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	Printed Name	Signature	Date
4. System Engineer	S. C. Khamamkar	<i>S. C. Khamamkar</i>	6/23/00
5. Checker	John D. Bigbee	<i>John D. Bigbee</i>	6/23/00
6. Responsible Manager	R. M. Dulin	<i>Robert M. Dulin</i>	6/23/2000

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**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SYSTEM DESCRIPTION DOCUMENT REVISION HISTORY**

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01 ICN 01	Added Section 2. Revised sections 1.2.2.1.2, 1.2.2.1.3, 1.2.2.1.4, 1.2.2.1.5, 1.2.2.1.6, 1.2.2.1.7, 1.2.2.1.10, and 1.2.2.1.11. Changed App. A Sections 1.2.2.1.5 and 1.2.2.1.6. Deleted 1.2.1.5. Deleted text and table in Section 1.4. Made minor changes to Summary and App. A 1.2.2.1.5 and 1.2.2.1.6. Added two new references. Deleted one reference. Made minor changes to references. Deleted TBV-402, TBV-460 and TBV-1196. Added TBV-4655.

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SUMMARY

The Waste Handling Building Electrical System performs the function of receiving, distributing, transforming, monitoring, and controlling AC and DC power to all waste handling building electrical loads. The system distributes normal electrical power to support all loads that are within the Waste Handling Building (WHB). The system also generates and distributes emergency power to support designated emergency loads within the WHB within specified time limits. The system provides the capability to transfer between normal and emergency power. The system provides emergency power via independent and physically separated distribution feeds from the normal supply. The designated emergency electrical equipment will be designed to operate during and after design basis events (DBEs). The system also provides lighting, grounding, and lightning protection for the Waste Handling Building.

The system is located in the Waste Handling Building System. The system consists of a diesel generator, power distribution cables, transformers, switch gear, motor controllers, power panel boards, lighting panel boards, lighting equipment, lightning protection equipment, control cabling, and grounding system. Emergency power is generated with a diesel generator located in a QL-2 structure and connected to the QL-2 bus. The Waste Handling Building Electrical System distributes and controls primary power to acceptable industry standards, and with a dependability compatible with waste handling building reliability objectives for non-safety electrical loads. It also generates and distributes emergency power to the designated emergency loads.

The Waste Handling Building Electrical System receives power from the Site Electrical Power System. The primary material handling power interfaces include the Carrier/Cask Handling System, Canister Transfer System, Assembly Transfer System, Waste Package Remediation System, and Disposal Container Handling Systems. The system interfaces with the MGR Operations Monitoring and Control System for supervisory monitoring and control signals. The system interfaces with all facility support loads such as heating, ventilation, and air conditioning, office, fire protection, monitoring and control, safeguards and security, and communications subsystems.

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 Handling Building Electrical System. The system architecture is provided in Appendix B.

1.1 SYSTEM FUNCTIONS

- 1.1.1 The system distributes electrical power.
- 1.1.2 The system receives normal electrical power from the Site Electrical Power System.
- 1.1.3 The system transfers loads between normal and emergency power.
- 1.1.4 The system monitors its own operating parameters.
- 1.1.5 The system provides for both local and remote monitoring and control of its operations.
- 1.1.6 The system transforms power for electrical loads.
- 1.1.7 The system performs the QL-2 functions of emergency power generation and distribution.
- 1.1.8 The system provides lighting, grounding, and lightning protection.
- 1.1.9 The system operates within expected environmental conditions.

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 Regulation, it will be referred to as "10 CFR 63" in this system description document. For the applicable version of the codes, standards, and regulatory documents, refer to Appendix E.

1.2.1 System Performance Criteria

1.2.1.1 The system shall have a minimum operational life of 40 years.

[F 1.1.1][MGR RD 3.2.C]

1.2.1.2 The system shall include provisions to support a deferral of closure for up to 300 years.

[F 1.1.1][MGR RD 3.2.H]

1.2.1.3 The system shall transform and distribute normal electrical power to the systems defined in Table 1.

Table 1. Systems Supplied with Normal Electrical Power

System
Cask/Carrier Handling System
Assembly Transfer System
Canister Transfer System
Disposal Container Handling System
Waste Package Remediation System
Waste Handling Building System
Health Safety System**
Maintenance & Supply System
Pool Water Treatment and Cooling System
Safeguards and Security System*
Waste Handling Building Electrical System**
Waste Handling Building Fire Protection System
Waste Handling Building Ventilation System
Site Radiological Monitoring System*
Surface Environmental Monitoring System*
Surface Operations Monitoring and Control System*
Site Operations System*

* The electrical loads for these systems are only for the portions that reside within the Waste Handling Building.

** These are the internal loads associated with this system (e.g., lighting).

[F 1.1.6][MGR RD 3.2.C]

1.2.1.4 The system shall transform and distribute emergency electrical power to the following system loads, as a minimum, defined in Tables 2 and 3.

Table 2. Emergency AC Electrical Power Loads

System Loads
Confinement Supply Fans
Confinement Exhaust Fans
CCC Air Conditioning Unit
CCC Air Handling Unit
Radiological Monitoring Equipment within WHB
Fire Protection Equipment within WHB
Emergency Lighting within WHB
(TBD-0400)

Table 3. Emergency DC Electrical Power Loads

System Loads
(TBD-0401)

[F 1.1.6][MGR RD 3.1.C][10 CFR 63.112(e)(11)]

1.2.1.5 Reserved

1.2.1.6 The system shall regulate the utilization voltage to +10/-5 percent.

[F 1.1.6][MGR RD 3.3.A]

1.2.1.7 The system shall keep all electrical wiring and fixtures physically separate from data and communication wiring.

[F 1.1.1][MGR RD 3.3.A]

1.2.2 Safety Criteria

1.2.2.1 Nuclear Safety Criteria

1.2.2.1.1 The system shall be designed to include means to protect the Emergency Power Source and Distribution structures systems and components (SSCs) against the adverse effects of either the operation or failure of the fire suppression systems.

[F 1.1.7][MGR RD 3.1.C][10 CFR 63.112(e)(9)]

1.2.2.1.2 The system design shall separate designated emergency loads into two (AC and DC) load groups.

[F 1.1.7][MGR RD 3.1.C, 3.1.G, 3.3.A][10 CFR 63.112(e)(12)]

1.2.2.1.3 The system shall provide a connection to the normal power source and to the emergency power source for each emergency AC load group.

[F 1.1.7][MGR RD 3.1.C, 3.1.G][10 CFR 63.112(e)(11)]

1.2.2.1.4 The system shall supply QL-2 AC emergency power to a load group without the possibility of automatic connection to the other load group.

[F 1.1.7][MGR RD 3.1.C, 3.1.G][10 CFR 63.112(e)(12)]

1.2.2.1.5 The system shall provide an uninterruptible power supply (UPS) in the form of a battery and battery charger to the designated emergency DC loads..

[F 1.1.7][MGR RD 3.1.C, 3.1.G][10 CFR 63.112(e)(11)]

1.2.2.1.6 The system shall supply QL-2 uninterruptible power to designated emergency instruments.

[F 1.1.7][MGR RD 3.1.C, 3.1.G][10 CFR 63.112(e)(11)]

1.2.2.1.7 The emergency diesel generator shall be capable of starting and accepting loads, in the required sequence, to supply power to the designated emergency loads upon loss of normal power.

[F 1.1.4, 1.1.7][MGR RD 3.1.C, 3.1.G][10 CFR 63.112(e)(11)]

1.2.2.1.8 The system QL-2 (SSCs) that are used to produce and distribute emergency electrical power shall be designed to withstand a design basis earthquake of Frequency Category 1 (TBV-1246).

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

1.2.2.1.9 The system shall provide central and local control for the manual initiation of each of its own QL-2 SSCs.

[F 1.1.7][MGR RD 3.1.G, 3.3.A]

1.2.2.1.10 The system shall ensure that all actions required for the delivery of either normal or emergency electrical power to its designated emergency SSCs performed by automatic means have the capacity to be safely performed by manual means.

[F 1.1.7][MGR RD 3.3.A]

1.2.2.1.11 The system shall be designed to ensure that failure of a non-emergency SSC under normal and DBE conditions would not inhibit the designated emergency SSCs from performing their intended functions.

[F 1.1.7, 1.1.8][MGR RD 3.1.C, 3.1.G][10 CFR 63.112(e)(12)]

- 1.2.2.1.12** 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-0406) 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, Rev. 3).

[MGR RD 3.1.B, 3.1.C, 3.1.G][10 CFR 63.111(a)(1), 63.112(e)(2), 63.112(e)(3)]

- 1.2.2.1.13** The external QL-2 portions of the system shall withstand the maximum Tornado wind speed of 189 mph with a corresponding pressure drop of 0.81 psi and rate of pressure drop of 0.3 psi/sec.

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

- 1.2.2.1.14** Tornado generated missiles that must be considered for the system are either the Spectrum I or Spectrum II missiles identified in "MGR Design Basis Extreme Wind/Tornado Analysis," Section 6.3.

[F 1.1.9][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.111(b)(2), 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.

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 4 for the areas of the Waste Handling Building in which the system components are located.

Table 4. Temperature Environment

Location of System Component	Normal Environment	Off-Normal Environment
Normally Occupied Areas (e.g., Offices, Maintenance Areas, Access Control)	78 - 70°F	(TBD-0395) °F for (TBD-0395) Hours
Normally Unoccupied Areas (e.g., Mechanical & Electrical Equipment Rooms, Cask Receiving & Handling Areas, Pool Areas)	92 - 63°F	(TBD-0395) °F for (TBD-0395) Hours
Unoccupied Areas (e.g., Assembly Cells, Canister Transfer Cells, DC Handling Cells, Emergency Generator Room)	106 - 63°F	(TBD-0395) °F for (TBD-0395) 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. For these components, cooling would be provided for the electronic components, but not necessarily the entire area.

[F 1.1.9][MGR RD 3.1.G, 3.3.A]

1.2.3.2 The system components shall be designed to withstand and operate in the humidity environment defined in Table 5 for the areas of the Waste Handling Building in which the components are located.

Table 5. Humidity Environment

Location of System Component	Normal Environment	Off-Normal Environment
Normally Occupied Areas (e.g., Offices, Maintenance Areas, Access Control)	30% - 60%	Humidity Control Not Required
Normally Unoccupied Areas (e.g., Mechanical & Electrical Equipment Rooms, Cask Receiving & Handling Areas, Pool Areas)	Humidity Not Controlled (TBD-0409), Note 1	Humidity Control Not Required
Unoccupied Areas (e.g., Assembly Cells, Canister Transfer Cells, DC Handling Cells, Emergency Generator Room)	Humidity Not Controlled (TBD-0409), Note 1	Humidity Control Not Required
Electronics Equipment Areas (e.g., Control Rooms, Computer Rooms, Communications Equipment Rooms, Data Processing and Recording Equipment Rooms)	40% - 50%	Humidity Control Not Required

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 1.1.9][MGR RD 3.1.G, 3.3.A]

- 1.2.3.3** The system shall be designed such that components susceptible to radiation can withstand and operate in the radiation environment (TBD-0405) in which the component is located.

[F 1.1.9][MGR RD 3.1.G, 3.3.A]

1.2.4 System Interfacing Criteria

- 1.2.4.1** The system shall receive normal and standby power from the Site Electrical Power System.

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

- 1.2.4.2** The system shall respond to the control signals from the Monitored Geologic Repository Operations Monitoring and Control System defined in Table 6.

Table 6. Control Signal Groups

Control Signal Groups
Control Diesel Generator
Control Switchgear
Control Motors
Control Lighting Off/On (Several by area)

[F 1.1.5][MGR RD 3.2.C]

- 1.2.4.3** The system shall provide the monitoring signals defined in Table 7 to the Monitored Geologic Repository Operations Monitoring and Control System.

Table 7. Monitoring Signal Groups

Monitoring Signal Groups
Monitor Incoming Site Power
Monitor System Buss Voltages
Monitor System Feeder Currents
Monitor Power Factor
Monitor System Demand
Monitor Diesel Generator Status
Monitor Diesel Generator Operating Parameters
Monitor UPS Status
Monitor UPS Operating Parameters
Monitor Equipment Alarm Status
Monitor Equipment Maintenance Status

[F 1.1.4, 1.1.5][MGR RD 3.2.C]

1.2.4.4 The system shall provide the space and location requirements of all electrical equipment to the Waste Handling Building System.

[F 1.1.6][MGR RD 3.2.C]

1.2.4.5 The system shall seal cable penetrations throughout the Waste Handling Building System with an approved sealing material that contains a rating commensurate with the fire rating of the barrier.

[F 1.1.6][MGR RD 3.2.C]

1.2.5 Operational Criteria

1.2.5.1 The inherent availability for the Waste Handling Building Electrical System shall be greater than 0.9883.

[F 1.1.1, 1.1.6][MGR RD 3.3.A]

1.2.5.2 The diesel generator shall have the capability to be tested under load in either a parallel or isochronous mode during operation of the facility or while the facility is shut down.

[F 1.1.7][MGR RD 3.1.C, 3.1.G, 3.3.A][10 CFR 63.112(e)(13)]

1.2.5.3 The system's QL-2 SSCs shall be designed to permit periodic inspection, testing, and maintenance to ensure their continued functioning and readiness.

[F 1.1.7][MGR RD 3.1.C][10 CFR 63.112(e)(13)]

1.2.5.4 The system shall provide an uninterruptible power supply for critical instrumentation and computers located within the WHB.

[F 1.1.3, 1.1.4, 1.1.7]

1.2.6 Codes and Standards Criteria

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

[MGR RD 3.1.E]

1.2.6.2 The system shall be designed in accordance with the applicable sections of "Fire Prevention Code" (NFPA 1).

[MGR RD 3.3.A]

- 1.2.6.3** The system shall be designed in accordance with the applicable sections of “National Electrical Code” (NFPA 70).
[MGR RD 3.3.A]
- 1.2.6.4** The system shall be designed in accordance with the applicable sections of “Life Safety Code” (NFPA 101).
[MGR RD 3.3.A]
- 1.2.6.5** The system shall be designed in accordance with the applicable sections of “Standard for the Installation of Lightning Protection Systems” (NFPA 780).
[MGR RD 3.3.A]
- 1.2.6.6** The system shall be designed in accordance with the applicable sections of IEEE C2-1997, “National Electrical Safety Code.”
[MGR RD 3.3.A]
- 1.2.6.7** The system shall be designed in accordance with the applicable sections of ANSI C84.1-1995, “Electric Power Systems and Equipment-Voltage Ratings (60 Hertz).”
[MGR RD 3.3.A]
- 1.2.6.8** The system shall be designed in accordance with the applicable sections of ANSI/IES RP-7-1991, “American National Standard Practice for Industrial Lighting.”
[MGR RD 3.3.A]
- 1.2.6.9** The system shall be designed in accordance with the applicable sections of IEEE 141-1993, “IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants.”
[MGR RD 3.3.A]
- 1.2.6.10** The system shall be designed in accordance with the applicable sections of IEEE 142-1991, “IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems.”
[MGR RD 3.3.A]

- 1.2.6.11** The system shall be designed in accordance with the applicable sections of IEEE 242-1986, "IEEE Recommended Practice for Protection & Coordination of Industrial and Commercial Power Systems."
[MGR RD 3.3.A]
- 1.2.6.12** The system shall be designed in accordance with the applicable portions of IEEE 308-1991, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," with the exception of Sections 5.10, 5.11, 6.2.4(2), 6.2.4(6), all of Section 8, and the single-failure criterion.
[MGR RD 3.3.A]
- 1.2.6.13** The system shall be designed in accordance with the applicable portions of IEEE 323-1983, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," with the exception of the single-failure criterion.
[MGR RD 3.3.A]
- 1.2.6.14** The system shall be designed in accordance with the applicable portions of IEEE 384-1992, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," with the exception of the single-failure criterion.
[MGR RD 3.3.A]
- 1.2.6.15** The system shall be designed in accordance with the applicable sections of IEEE 399-1997, "IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis."
[MGR RD 3.3.A]
- 1.2.6.16** The system shall be designed in accordance with the applicable sections of IEEE 493-1997, "IEEE Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems."
[MGR RD 3.3.A]
- 1.2.6.17** The system shall be designed in accordance with the applicable sections of IEEE 446-1995, "IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications."
[MGR RD 3.3.A]
- 1.2.6.18** The system shall be designed in accordance with the applicable portions of IEEE 603-1998, "IEEE Standard Criteria for Safety Systems for Nuclear Power

Generating Stations,” with the exception of Sections 3, 5.1, 5.6.3.3, 5.6.4, 5.13, 6.3.1, 6.3.2, 6.6, 6.7, 7.4, 7.5, and the single-failure criterion.

[MGR RD 3.3.A]

1.2.6.19 The system shall be designed in accordance with the applicable portions of IEEE 741-1997, “IEEE Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations,” with the exception of Sections 5.4, 5.5, and the single-failure criterion.

[MGR RD 3.3.A]

1.2.6.20 The system shall be designed in accordance with the applicable sections of IEEE 739-1995, “IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities.”

[MGR RD 3.3.A]

1.2.6.21 The system shall be designed in accordance with the applicable portions of IEEE 7-4.3.2-1993, “IEEE Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations,” with the exception of Sections 2, 5.1, 5.13, and the single-failure criterion.

[MGR RD 3.3.A]

1.2.6.22 The system shall be designed in accordance with the applicable portions of ANSI/ANS 59.51-1997, “Fuel Oil Systems for Safety-Related Emergency Diesel Generators,” for developing the appropriate interface between the mechanical portions of the diesel generator and the Waste Handling Building Electrical System.

[MGR RD 3.3.A]

1.2.6.23 Design, selection, and integration of system equipment shall incorporate human factors engineering (HFE) practices and criteria so that the system is maintainable. HFE shall include the applicable sections of UCRL-15673 (1985), “Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities.”

[MGR RD 3.3.A]

1.2.6.24 Design of safety related labels, signs, placards, and warnings (both surface and on-site laboratory) shall incorporate HFE practices and criteria in accordance with standards American National Standards Institute (ANSI) Z535.1-1998 “Safety Color Code”; ANSI Z535.2-1998, “Environmental and Facility Safety Signs”; ANSI Z535.3-1998, “Criteria for Safety Symbols”; ANSI Z535.4-1998, “Product

Safety Signs and Labels”; and ANSI Z535.5-1998, “Accident Prevention Tags (for Temporary Hazards).” (In those cases where this criterion and "Occupational Safety and Health Standards," 29 CFR 1910 overlap or conflict, 29 CFR 1910 takes precedence.)

[MGR RD 3.1.B, 3.3.A]

1.2.6.25 The design, selection, and integration of computer display terminals, equipment, and workspaces shall incorporate HFE practices and criteria in accordance with applicable industry standards. Standards ANSI/HFS 100-1988, “American National Standard for Human Factors Engineering of Visual Display Terminal Workstations”; ISO 9241-3 (1992), “Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 3: Visual Display Requirements”; and ISO 9241-8 (1997), “Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 8: Requirements for Displayed Colours” are recognized as U.S. Department of Energy’s (DOE's) preferred guidance for the design of the Monitored Geologic Repository (MGR) SSCs, but application of specific requirements to the MGR has not yet been determined. Future engineering analyses will determine those applicable areas.

[MGR RD 3.3.A]

1.2.6.26 The design, selection, and integration of computer user interface software shall incorporate HFE practices and criteria in accordance with applicable industry standards. Standards ESD-TR-86-278 (1986), “Guidelines for Designing User Interface Software”; and ISO 9241-10 (1996), “Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 10: Dialogue Principles”; ISO 9241-14 (1997), “Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 14: Menu Dialogues”; and ISO 9241-15 (1997), “Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 15: Command Dialogues” are recognized as DOE's preferred guidance for the design of the MGR SSCs, but application of specific requirements to the MGR has not yet been determined. Future engineering analyses will determine those applicable areas.

[MGR RD 3.3.A]

1.2.6.27 The design, selection, and integration of SSCs shall incorporate HFE practices and criteria in accordance with applicable sections of MIL-STD-1472E, “Department of Defense Design Criteria Standard, Human Engineering.”

[MGR RD 3.3.A]

1.2.6.28 The system shall comply with the applicable assumptions contained in the “Monitored Geologic Repository Project Description Document.”

- 1.2.6.29** The system shall be designed in accordance with the applicable portions of IEEE Std. 690-1984, "IEEE Standard for the Design and Installation of Cable Systems for Class 1E Circuits in Nuclear Power Generating Stations."

[MGR RD 3.3.A]

1.3 SUBSYSTEM DESIGN CRITERIA

There are no subsystem design criteria for this system.

1.4 CONFORMANCE VERIFICATION

This section will be completed in a later revision.

2. DESIGN DESCRIPTION

Section 2 of this SDD summarizes the 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 the design development, the information contained in this section will continue to change as the system matures.

2.1 SYSTEM DESIGN SUMMARY

This system description is based upon information contained in Attachment II Section 1.1.10 of the "Engineering Files for Sit Recommendation".

The WHB electrical system performs the function of receiving, distributing, transforming, monitoring, and controlling AC and DC power to all WHB electrical loads. The system generates emergency power for designated emergency loads. The designated emergency loads consist of components of the Primary Confinement Area Ventilation System. The system also distributes standby power for essential loads from the site electrical power system. (The essential loads and standby power requirements will be defined in a later revision.) The system provides the capability to transfer between site and emergency power. The designated emergency electrical equipment will be designed to operate during and after design basic events. The system also provides lighting, grounding, and lightning protection for the WHB.

During normal operations, power for the WHB initiates from switchgear circuit breakers located in the North Portal switchgear building, which is capable of distributing normal power to all loads.

Whenever off-site power is lost, the system generates and distributes emergency power to designated emergency loads using a dedicated diesel generator located within the WHB. This system is designed to distribute emergency power, via two physically separated distribution systems, to designated emergency process loads. The emergency power distribution system is configured with the capability of switching to emergency power if loss of offsite power occurs.

The control and instrumentation power for the designated emergency loads is provided by an uninterruptible power supply (UPS) or a battery system located within the WHB. A similar UPS for the normal loads has not been designed at this time. It will be included in this document at a later date after the design of the normal UPS is completed.

The WHB electrical system design is depicted in the WHB Electrical System One-Line Diagrams (Figures 1 and 2).

The WHB electrical system is completely bounded and housed by the WHB System. The front-end interface of the electrical system is bounded by the Site Electrical Power System. The WHB electrical system interfaces with facility

systems and subsystems maintaining loads in areas such as: process; heating, ventilation, and air conditioning; office; fire protection; monitoring and control; safeguards and security; and communications. The system and subsystem interfaces are as follows:

- Canister Transfer System
- Pool Water Treatment and Cooling System
- Assembly Transfer System
- Waste Package Remediation System
- Disposal Container Handling System
- Carrier/Cask Handling System
- Waste Handling Building Fire Protection System
- Waste Handling Building Ventilation System
- Safeguards and Security System
- Site Radiological Monitoring System
- Surface Environmental Monitoring System
- Operations Monitoring and Control System

2.2 DESIGN ASSUMPTIONS

In the development of this design concept, no design assumptions were required to supplement the design criteria given in Section 1 of this document.

2.3 DETAILED DESIGN DESCRIPTION

The basis for the following descriptions can be found in Attachment II, Section 1.1.10.3 and 1.1.10.4 of "Engineering Files for Site Recommendation." The WHB emergency power source and associated power distribution system is classified as Quality Level 2 and the normal power source and associated distribution system is classified as conventional quality. The electrical system consists of a diesel generator, power distribution cables, transformers, switch gear, motor controllers, power panel boards, lighting panel boards, lighting equipment, lightning protection equipment, control cabling, and grounding system.

Emergency power is generated with a diesel generator. The WHB electrical system distributes and controls primary power to acceptable industry standards, and with dependability compatible with WHB reliability objectives for non-safety electrical loads.

All major electrical equipment, including the power panel boards, lighting panel boards, and motors, is connected to the building ground. A separate instrument ground is provided for the control system equipment, which is tied to the building ground mat.

Lightning protection, including lightning arrestors, static wires, and grounding systems, will be provided for the WHB. Interior lighting for office areas consists

of commercial-type fluorescent luminaries with high power factor and energy efficient ballast. High intensity discharge luminaries are used in high bay areas.

2.3.1 System Arrangement

The system is arranged to separate designated emergency loads into two load groups. The WHB normal electrical supply will be fed from an off-site source that will provide power to all the WHB electrical loads. The power to the designated emergency loads will be separated from the non-safety electrical loads. These designated emergency electrical loads will have an emergency power supply provided by a single diesel generator, an uninterruptible power supply, or battery system with sufficient capacity to supply the designated emergency electrical loads when the normal electrical supply is not available. A grounding grid is provided around the WHB, as appropriate for the site soil resistivity. The building ground system will be interconnected to the switchyard substation ground.

2.3.2 Other System Features Or Characteristics

The emergency power diesel generator has the capability to be tested during operation of the facility. The inherent availability for the WHB electrical system to meet the throughput requirements will be greater than 0.9883. ("Bounded Minimum Inherent Availability Requirement for the System Description Documents"). The system design will separate designated emergency loads into two load groups.

The system will provide a connection to the normal power source and to the emergency power source for each designated emergency AC load group.

Supporting analyses to obtain sufficient information is not available at this time. Further design work is required to address topics such as:

- Safety and control considerations
- Surveillance and monitoring
- Communications
- Remote operations support
- As low as reasonably achievable design goals
- Recovery capability
- Mitigation of off normal and design basis events
- End-of-life decontamination and decommissioning

This section will be updated in future revisions of this system description document as the design of the system matures.

2.4 COMPONENT DESCRIPTION

This information will be provided in a future revision.

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.

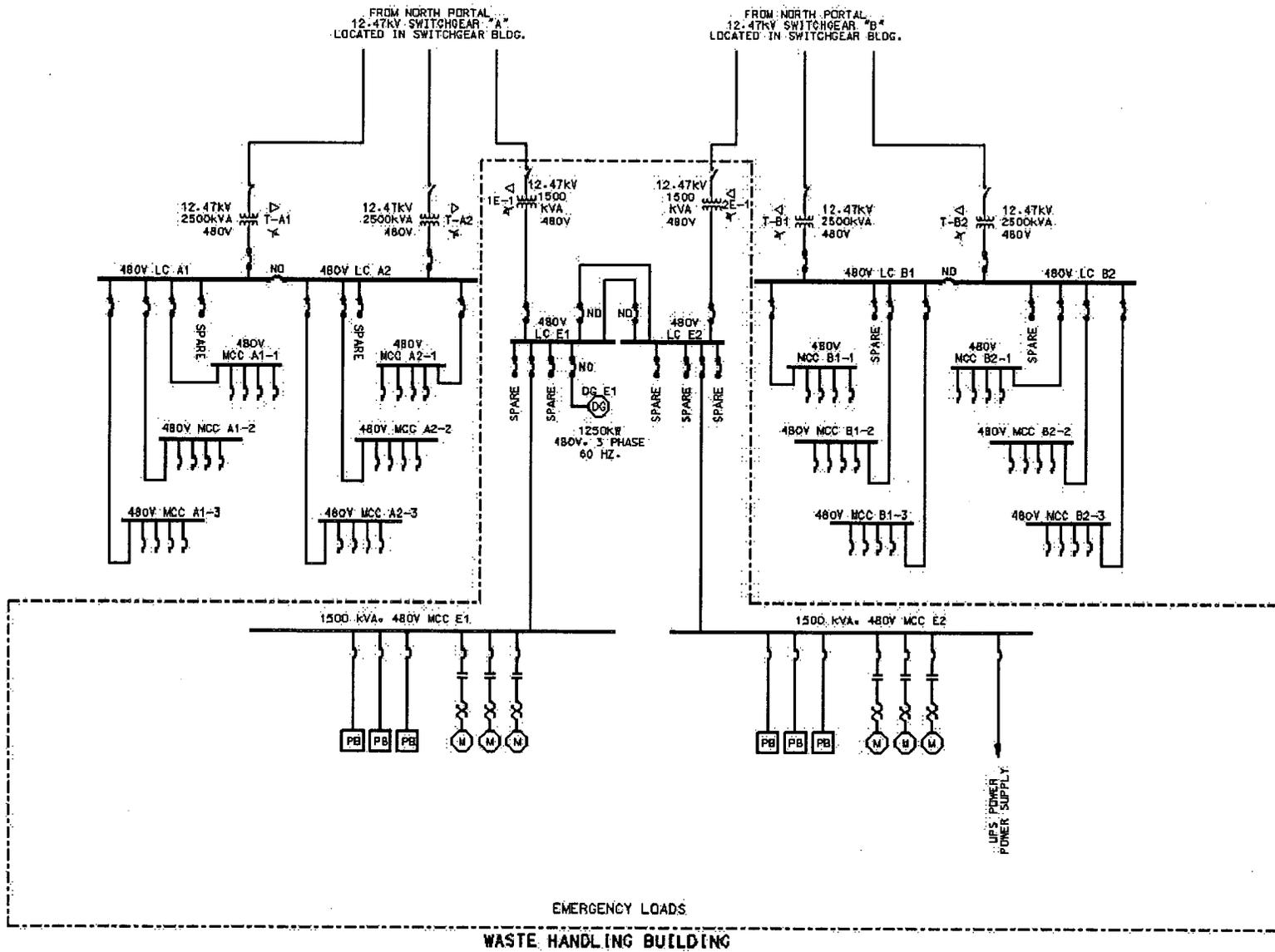


Figure 1. WHB Electrical Power Distribution One-Line Diagram

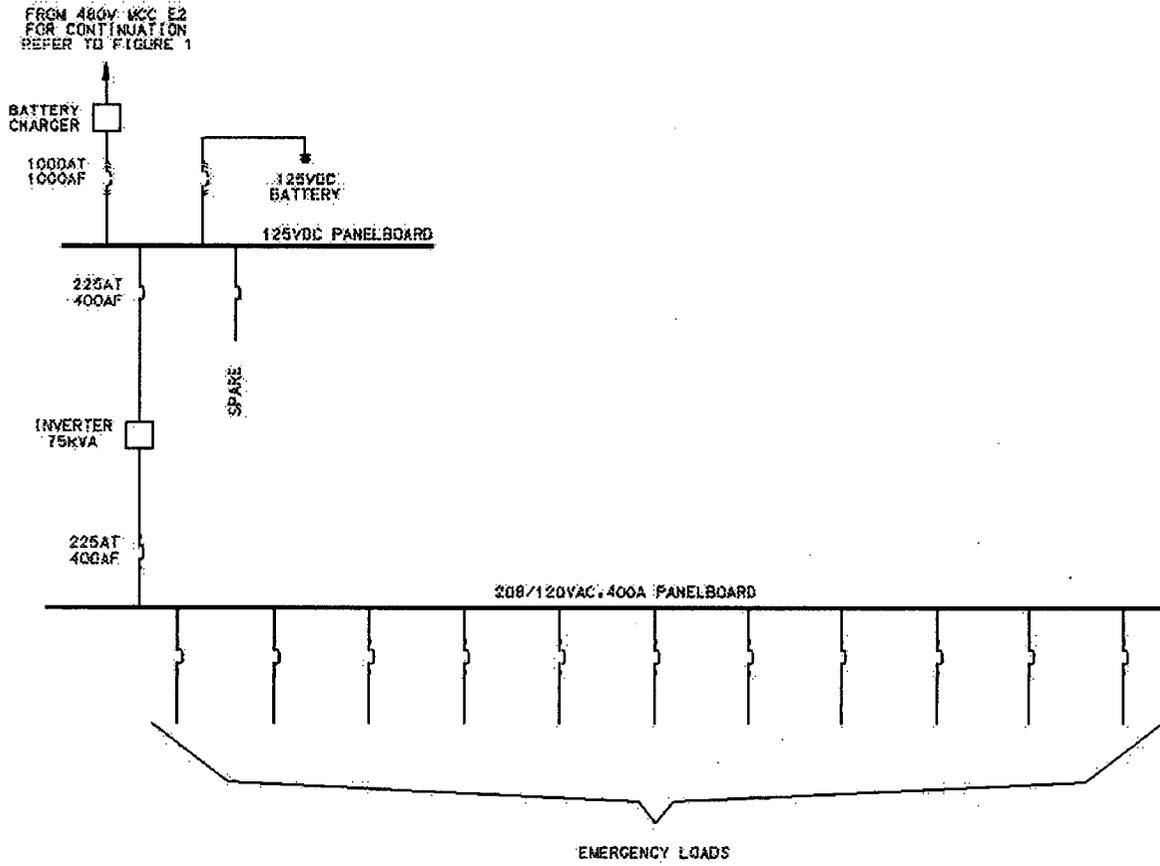


Figure 2. WHB Uninterruptible Power Supply One-Line Diagram

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 the "Monitored Geologic Repository Requirements Document" 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 and is required because the system supports 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

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

1.2.1.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.2.H. This criterion establishes the additional length of time the system may be asked to operate to allow future generations to continue monitoring the repository.

II. Criterion Performance Parameter Basis

The maximum life of 300 years after the initiation of MGR emplacement is taken directly from MGR RD 3.2.H.

1.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to establish the Waste Handling Building (WHB) electrical loads under normal conditions. The table only defines the loads for the operational phase. This criterion supports MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

N/A

1.2.1.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to establish the WHB electrical needs under emergency conditions. This criterion supports MGR RD 3.1.C and 3.2.C, and 10 CFR 63.112(e)(11).

To minimize the potential of occupational doses this criterion requires that the system have the capability to provide emergency AC electrical power to the loads that are directly related to air handling in the WHB. Therefore the system will transform and distribute emergency electrical AC power to; confinement supply fans, confinement exhaust fans, CCC air conditioning units, and the CCC air handling unit, as a minimum.

In addition, portions of other systems will be supplied with emergency power in order to continue to perform their safety functions within the WHB. Although TBD, the following loads have been identified; Radiological Monitoring Equipment within the WHB, Fire Protection Equipment within the WHB, and Emergency Lighting within the WHB.

The system will also provide emergency DC electrical power to a TBD set of loads in the WHB.

II. Criterion Performance Parameter Basis

N/A

1.2.1.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to define the utilization voltage limits for the end item equipment. This criterion supports MGR RD 3.3.A for engineering principles and practices for voltage regulation.

II. Criterion Performance Parameter Basis

NFPA 70, "National Electrical Code," Article 210, Section 19, branch circuit ratings, states that the circuit for service entrance conductors can have only a 5 percent drop in voltage from the point of service to the farthest load. This voltage drop limit is for normal operations because a momentary voltage drop will occur for the starting of large motors. The IEEE 141-1993, "IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants" identifies a range of +/-10 percent although the more restrictive lower bound of 5 percent for the National Electrical Code will be used. The voltage range is +10/-5 percent.

1.2.1.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A. This criterion is needed to maintain a margin of safety between high voltage wiring and fixtures and low voltage data/communications wiring. Separation of these two types of wiring will help to minimize the effect of induced electrical interference on data communications. General guidance can be obtained from IEEE Std. 141-1993, "IEEE Recommended Practice for Electric Power Distribution for Industrial Plants." Specific guidance can be found in Article 800 of NFPA-70, "National Electric Code," in Section 22 of IEEE C2-1997, "National Electrical Safety Code," and in Sections 5 and 6 of IEEE Std. 690-1984, "Cable Systems for Class 1E Circuits in Nuclear Power Generating Stations."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C and the implementation of 10 CFR 63.112(e)(9) as it relates to appropriate fire suppression systems. This criterion identifies the need for the system to protect the Emergency Power Source and Distribution SSCs against the operation or failure of the fire suppression system.

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion implements applicable Regulatory Guidance from MGR RD 3.1.C and the implementation of 10 CFR 63.112(e)(12). This criterion requires the safety loads to be

separated into redundant load groups such that loss of any one will not prevent the minimum safety functions from being performed.

This criterion supports MGR RD 3.1.G by considering guidance obtained from Guidance Statement 6.1g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.1g1 presents the applicability of Regulatory Guide 1.6 "Independence Between Redundant Standby (Onsite) Power Sources and Their Distribution System."

This criterion also supports MGR RD 3.3.A. Additional specific guidance is obtained from Chapter 2 of IEEE Std. 141-1993, "Recommended Practice for Electric Power Distribution for Industrial Plants."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C and the implementation of 10 CFR 63.112(e)(11). This criterion requires the safety loads to be powered by both the normal and emergency power sources to maintain the ability to perform the safety functions after loss of normal power.

This criterion supports MGR RD 3.1.G by considering guidance obtained from Guidance Statements 6.1g1 and 6.14g2 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.1g1 presents the applicability of Section C.1.4 of Regulatory Guide 1.6, "Independence Between Redundant Standby (Onsite) Power Sources and Their Distribution System." Guidance Statement 6.14g2 presents the applicability of Chapter 3.11 NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C and the implementation of 10 CFR 63.112(e)(12), which requires that the means to provide redundant systems necessary to maintain, with adequate capacity, the ability of utility services Important to Safety be considered in the design of the MGR.

This criterion requires the safety loads to be powered by a dedicated emergency power source that does not have the possibility for automatic connection to any other non-QL-2 loads.

This criterion supports MGR RD 3.1.G by considering guidance obtained from Guidance Statement 6.1g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System" which presents the applicability of Section D of Regulatory Guide 1.6 "Independence Between Redundant Standby (Onsite) Power Sources and Their Distribution System."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion implements applicable Regulatory Guidance from MGR RD 3.1.C and 3.1.G, and 10 CFR 63.112(e)(11). This criterion requires the DC safety loads to be powered only by a battery and battery charger configuration to retain the ability to perform the safety functions after a design basis event.

This criterion supports MGR RD 3.1.G by considering guidance obtained from Guidance Statements 6.1g2 and 6.14g2 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.1g2 presents the applicability of Regulatory Guide 1.6 "Independence Between Redundant Standby (Onsite) Power Sources and Their Distribution System." Guidance Statement 6.14g2 presents the applicability of Chapter 3.11 NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion requires the DC safety loads to be powered by a dedicated emergency power source that does not have connections to any other loads.

This criterion supports MGR RD 3.1.C and the implementation of 10 CFR 63.112(e)(12) and MGR RD 3.1.G by considering guidance obtained from Guidance Statement 6.1g2 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.1g2 presents the applicability of Regulatory Guide 1.6 "Independence Between Redundant Standby (Onsite) Power Sources and Their Distribution System."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C and the implementation of 10 CFR 63.112(e)(11). This criterion requires the diesel generator to meet its performance parameters to supply power for all of the needed engineered safety features and emergency shutdown loads when commanded to do so.

This criterion supports MGR RD 3.1.G by considering guidance obtained from Guidance Statement 6.2g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.2g1 presents the applicability of Regulatory Guide 1.9 "Selection, Design, and Qualification of Diesel-Generator Units Used as Onsite Electrical Power Systems at Nuclear Power Plants."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion implements applicable Regulatory Guidance from MGR RD 3.1.C and 3.1.G, and 10 CFR 63.112(e)(8). This criterion requires the QL-2 SSCs to withstand the WHB response spectra of a design basis event (DBE) earthquake. Frequency Category 1 applies because the system supplies electrical power to QL-1 systems (HEPA filters) in the WHB.

This criterion supports MGR RD 3.1.G by considering guidance obtained from Guidance Statements 6.3g1 and 7.3g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.3g1 presents the applicability of Regulatory Guide 1.29 "Seismic Design Classification."

II. Criterion Performance Parameter Basis

The Waste Handling Building floor response spectra have not been determined.

1.2.2.1.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion requires the capability to be able to perform manual initiation of system QL-2 SSCs at the central and local levels.

This criterion supports MGR RD 3.1.G and MGR RD 3.3.A by considering guidance obtained from Guidance Statement 6.7g1, 6.7g2, and 6.7g3 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.7g1, 6.7g2, and 6.7g3 present the applicability of Regulatory Guide 1.89 "Environmental Qualification of Certain Electrical Equipment Important to Safety for Nuclear Power Plants" and IEEE Std. 323-1983, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Plants."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.10 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A. This criterion requires that all automatic actions needed to provide normal or emergency electrical power to the system's QL-2 SSCs have the capability to be performed by manual means.

General guidance is provided in Sections 6.2 and 7.2 of IEEE Std. 603-1998, "Standard Criteria for Safety Systems for Nuclear Power Generating Stations."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.11 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C and the implementation of 10 CFR 63.112(e)(12). This criterion requires the safety loads be separated groups such that failure of non-QL-2 SSCs will not prevent the minimum safety functions from being performed.

This criterion supports MGR RD 3.1.G by considering guidance obtained from Guidance Statement 6.14g2 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.14g2 presents the applicability of NUREG-0800 "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.12 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.C, which requires compliance with 10 CFR 63. This criterion also supports MGR RD 3.1.B and 10 CFR 63.111(a)(1), which 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)." This criterion also supports MGR RD 3.1.G.

The requirement for compliance with ALARA principles is also based on 10 CFR 63.112(e)(2) and 63.112(e)(3), which require the performance analysis of the SSCs that are important to safety to include consideration of the means to limit the time required to perform work in the vicinity of radioactive materials, and consideration of suitable shielding.

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. Regulatory Guide 8.8 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."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.13 Criterion Basis Statement

I. Criterion Need Basis

MGR RD 3.1.C requires compliance with 10 CFR 63. This criterion establishes the requirement for the system to have the capability to perform its QL-2 functions during and after design basis events, as required. This criterion is based on 10 CFR 63.112(e)(8) which requires the performance analysis of SSCs (that are external to the WHB) that are QL-2 to include consideration of the "Ability of structures, systems, and components to perform their intended safety functions, assuming the occurrence of design basis events." The specific Design Basis Event is the Tornado winds. This system provides electrical power to QL-1 systems (HEPA filters) in the WHB.

II. Criterion Performance Parameter Basis

The maximum Tornado wind speed, pressure drop, and pressure drop rate were obtained from "MGR Design Basis Extreme Wind/Tornado Analysis," Section 7.

1.2.2.1.14 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.C. The criterion establishes the requirement for the Waste Handling Building Ventilation System to withstand the dynamic effects from external missiles. This criterion is based on 10 CFR 63.112(e)(8), which requires the performance analysis of the SSCs that are QL-2 to include consideration of the "Ability of structures, systems, and components to perform their intended safety functions, assuming the occurrence of design basis events." The system provides electrical power to QL-1 systems (HEPA filters) located in the WHB.

The specific design basis event is either a Spectrum I or Spectrum II tornado-generated missile.

This requirement is also intended to help meet the overall geologic operations area performance objectives in 10 CFR 63.111(a)(2) and 10 CFR 63.111(b)(2).

II. Criterion Performance Parameter Basis

The tornado generated missile parameters are obtained from "MGR Design Basis Extreme Wind/Tornado Analysis," Section 7, which recommends the use of the missile spectra specified in Section 6.3 of the analysis.

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.

This criterion supports MGR RD 3.1.G by considering guidance obtained from Guidance Statement 6.7g2 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.7g2 presents the applicability of Section C.1 of Regulatory Guide 1.89, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants."

II. Criterion Performance Parameter Basis

Temperature values are based on "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

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.

This criterion supports MGR RD 3.1.G by considering guidance obtained from Guidance Statement 6.7g2 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.7g2 presents the applicability of Section C.1 of Regulatory Guide 1.89, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants."

II. Criterion Performance Parameter Basis

Humidity values for occupied areas and electronics equipment areas are based on "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 requirement to use applicable industry codes and standards of MGR RD 3.3.A. This criterion addresses radiation exposure for normal conditions.

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, and 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 3.1.G by considering guidance obtained from Guidance Statement 6.7g3 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System." Guidance Statement 6.7g3 presents the applicability of Section C.2.c of Regulatory Guide 1.89, "Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants."

II. Criterion Performance Parameter Basis

The radiation environment is not defined.

1.2.4.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion defines the input power characteristics with the Site Electrical Power System. This criterion supports the waste handling needs of MGR RD 3.2.C. This criterion also supports MGR RD 3.3.A, which requires compliance with industry codes and standards.

II. Criterion Performance Parameter Basis

Future interface analysis will be performed to establish the maximum power needed for this interface criteria. The current distribution voltage is 12.5 kV and the voltage range comes from ANSI C84.1-1995, "Electric Power Systems and Equipment--Voltage Ratings (60 Hertz)," Table 1. The frequency is 60 Hz, 3 phase which is the standard for the U.S.

1.2.4.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion defines the control signal interface with the Surface Operations Monitoring and Control System. This criterion supports the waste handling needs of MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

Future interface analysis will be performed to establish bounding design parameters for this interface criterion.

1.2.4.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion defines the monitor interface with the Monitored Geologic Repository Operations Monitoring and Control System. This criterion supports the waste handling needs of MGR RD 3.2.C.

Monitoring of these signals will ensure that the Central Control Center (CCC), which is the part of the Monitored Geologic Repository Operations Monitoring and Control system, can make informed control decisions.

Monitoring the incoming site power, system bus voltages, system feeder currents power factor, and system demand will keep the CCC operations personnel informed as to the stability and availability of electrical power in the WHB.

Monitoring the status and operating parameters of the diesel generator are required in the event it is necessary to switch from normal to emergency electrical power or vice versa.

Monitoring the status and operating parameters of the UPS are required in the event it is necessary to switch from normal to emergency electrical power.

Monitoring the system equipment alarm and maintenance status will keep the CCC operations personnel informed as to the operability and reliability of the electrical system in the WHB.

II. Criterion Performance Parameter Basis

Future interface analysis will be performed to establish bounding design parameters for this interface criterion.

1.2.4.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion defines the physical interface with the Waste Handling Building System and the Waste Handling Building Electrical System. This criterion supports the waste emplacement needs of MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

Future interface analysis will be performed to establish bounding design parameters for this interface criterion.

1.2.4.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion defines the physical interface with the Waste Handling Building System and the Waste Handling Building Electrical System for cable penetrations through fire barriers. This criterion supports the waste emplacement needs of MGR RD 3.2.C.

II. Criterion Performance Parameter Basis

Future interface analysis will be performed to establish bounding design parameters for this interface criterion.

1.2.5.1 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

The value for the availability is from the "Bounded Minimum Inherent Availability Requirement for the System Description Documents," Table 7.2-1, p. 9. This value is from an uncontrolled source and is, therefore, TBV.

1.2.5.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C and the implementation of 10 CFR 63.112(e)(13). This criterion requires the diesel generator to be testable during operation of the facility as well as while the facility is shut down.

This criterion supports MGR 3.3.A, which requires compliance with industry codes and standards and MGR RD 3.1.G, which requires compliance to regulatory requirements. This criterion is supported by the following Guidance Statements in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System" which presents the applicability of several applicable industrial standards and practices:

Guidance Statement 6.2g2 - Regulatory Guide 1.9, "Selection, Design, and Qualification of Diesel-Generator Units Used as Onsite Electrical Power Systems at Nuclear Power Plants."

Guidance Statement 7.5g1 - IEEE Std. 450-1995, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications."

Guidance Statement 7.6g1 - IEEE Std. 484-1996, "IEEE Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications."

Guidance Statement 7.7g1 - IEEE Std. 485-1997, "IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications."

Guidance Statement 7.8g1 - IEEE Std. 535-1986, "IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations."

Guidance Statement 7.10g1 - IEEE Std. 650-1990, "IEEE Standard for Qualification of Static Battery Chargers and Inverters for Nuclear Power Generating Stations."

Guidance Statement 7.12g1 - IEEE Std. 946-1992, "IEEE Recommended Practice for the Design of DC Auxiliary Power Systems for Generating Stations."

II. Criterion Performance Parameter Basis

N/A

1.2.5.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion identifies the need for the QL-2 SSCs to be designed to permit inspection, testing, and maintenance. This criterion supports MGR RD 3.1.C and 10 CFR 63.112(e)(13).

II. Criterion Performance Parameter Basis

N/A

1.2.5.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to ensure devices such as radiological monitoring instruments or fire protection devices that receive electrical power from the system remain functional for the time period from when normal electrical power is lost until emergency power is available.

The above reasoning is also applied to specific computers and programmable logic controllers that monitor/control critical operations within the WHB

II. Criterion Performance Parameter Basis

N/A

1.2.6.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is derived from the regulatory precedent cited in MGR RD 3.1.E. This criterion is needed to ensure that the Waste Handling Building Electrical System complies with 29 CFR 1910, "Occupational Safety and Health Standards."

II. Criterion Performance Parameter Basis

N/A

1.2.6.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion is needed to ensure that the Waste Handling Building Electrical System complies with "Fire Prevention Code" (NFPA 1).

II. Criterion Performance Parameter Basis

N/A

1.2.6.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion is needed to ensure that the Waste Handling Building Electrical System complies with "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion addresses the emergency lighting criteria which results from the fire hazards analysis from "Life Safety Code" (NFPA 101).

II. Criterion Performance Parameter Basis

N/A

1.2.6.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of "Standard for the Installation of Lightning Protection Systems" (NFPA 780).

II. Criterion Performance Parameter Basis

N/A

1.2.6.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry federal regulations. This criterion specifically dictates that the system shall be designed considering applicable provisions of IEEE C2-97, "National Electrical Safety Code."

The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with other applicable federal regulations. This criterion specifically dictates that the system shall be designed considering applicable provisions of ANSI C84.1-1995, "Electric Power Systems and Equipment - Voltage Ratings (60 Hertz)." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of ANSI/IES RP-7, "American National Standard Practice for Industrial Lighting." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of IEEE 141-1993, "IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.10 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of IEEE 142-1991, "IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.11 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of IEEE 242-1986, "IEEE Recommended Practice for Protection & Coordination of Industrial and Commercial Power Systems." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.12 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR 3.3.A, which requires compliance with industry codes and standards. This criterion is supported by Guidance Statement 7.3g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System."

Because the IEEE nuclear standards were developed for commercial nuclear power plant applications, they specify two safety (redundant) systems and two off-site power sources. However, the MGR, by design, will not pose a similar risk to the health and safety of the general public as would a nuclear power plant. The need for redundancy within the electrical design and the ability of the electrical equipment to withstand the postulated

DBEs will be required as part of the MGR electrical design. The nuclear IEEE standards contain excellent design guidance regarding redundancy and durability for electrical systems and components. Consequently, the MGR design of the electrical system for the Waste Handling Building will incorporate portions of specific IEEE standards on a case by case basis, but will not incorporate the single failure criteria.

This criterion identifies the need to design the system in accordance with the applicable sections of IEEE 308-1991, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," with exceptions as documented in this criterion and referenced guidance package. It is expected that some sections, in addition to the exceptions noted, may only have partial or limited applicability. Therefore, the specific portions of Class 1E nuclear standards that apply to this system will be documented as part of the design description in Section 2 of the SDD.

II. Criterion Performance Parameter Basis

N/A

1.2.6.13 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR 3.3.A, which requires compliance with industry codes and standards. This criterion is supported by Guidance Statement 7.5g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System."

Because the IEEE nuclear standards were developed for commercial nuclear power plant applications, they specify two safety (redundant) systems and two off-site power sources. However, the MGR, by design, will not pose a similar risk to the health and safety of the general public as would a nuclear power plant. The need for redundancy within the electrical design and the ability of the electrical equipment to withstand the postulated DBEs will be required as part of the MGR electrical design. The nuclear IEEE standards contain excellent design guidance regarding redundancy and durability for electrical systems and components. Consequently, the MGR design of the electrical system for the Waste Handling Building will incorporate portions of specific IEEE standards on a case by case basis, but will not incorporate the single failure criteria.

This criterion identifies the need to design the system in accordance with the applicable sections of IEEE 323-1983, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Plants," with exceptions as documented in the guidance package. It is expected that some sections, in addition to the exceptions noted, may only have partial or limited applicability. Therefore, the specific portions of Class 1E nuclear standards that apply to this system will be documented as part of the design description in Section 2 of the SDD.

II. Criterion Performance Parameter Basis

N/A

1.2.6.14 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR 3.3.A, which requires compliance with industry codes and standards. This criterion is supported by Guidance Statement 7.7g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System."

Because the IEEE nuclear standards were developed for commercial nuclear power plant applications, they specify two safety (redundant) systems and two off-site power sources. However, the MGR, by design, will not pose a similar risk to the health and safety of the general public as would a nuclear power plant. The need for redundancy within the electrical design and the ability of the electrical equipment to withstand the postulated DBEs will be required as part of the MGR electrical design. The nuclear IEEE standards contain excellent design guidance regarding redundancy and durability for electrical systems and components. Consequently, the MGR design of the electrical system for the Waste Handling Building will incorporate portions of specific IEEE standards on a case by case basis, but will not incorporate the single failure criteria.

This criterion identifies the need to design the system in accordance with the applicable sections of IEEE 384-1992, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," with exceptions as documented in the guidance package. It is expected that some sections, in addition to the exceptions noted, may only have partial or limited applicability. Therefore, the specific portions of Class 1E nuclear standards that apply to this system will be documented as part of the design description in Section 2 of the SDD.

II. Criterion Performance Parameter Basis

N/A

1.2.6.15 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of IEEE 399-1997, "IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.16 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of IEEE 493-1997, "IEEE Recommended Practice for Design of Reliable Industrial and Commercial Power Systems." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.17 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of IEEE 446-1995, "IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.18 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR 3.3.A, which requires compliance with industry codes and standards. This criterion is supported by Guidance Statement 7.8g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System."

Because the IEEE nuclear standards were developed for commercial nuclear power plant applications, they specify two safety (redundant) systems and two off-site power sources. However, the MGR, by design, will not pose a similar risk to the health and safety of the general public as would a nuclear power plant. The need for redundancy within the electrical design and the ability of the electrical equipment to withstand the postulated

DBEs will be required as part of the MGR electrical design. The nuclear IEEE standards contain excellent design guidance regarding redundancy and durability for electrical systems and components. Consequently, the MGR design of the electrical system for the Waste Handling Building will incorporate portions of specific IEEE standards on a case by case basis, but will not incorporate the single failure criteria.

This criterion identifies the need to design the system in accordance with the applicable sections of IEEE 603-1998, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," with exceptions as documented in the guidance package. It is expected that some sections, in addition to the exceptions noted, may only have partial or limited applicability. Therefore, the specific portions of Class 1E nuclear standards that apply to this system will be documented as part of the design description in Section 2 of the SDD.

II. Criterion Performance Parameter Basis

N/A

1.2.6.19 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR 3.3.A, which requires compliance with industry codes and standards. This criterion is supported by Guidance Statement 7.9g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System."

Because the IEEE nuclear standards were developed for commercial nuclear power plant applications, they specify two safety (redundant) systems and two off-site power sources. However, the MGR, by design, will not pose a similar risk to the health and safety of the general public as would a nuclear power plant. The need for redundancy within the electrical design and the ability of the electrical equipment to withstand the postulated DBEs will be required as part of the MGR electrical design. The nuclear IEEE standards contain excellent design guidance regarding redundancy and durability for electrical systems and components. Consequently, the MGR design of the electrical system for the Waste Handling Building will incorporate portions of specific IEEE standards on a case by case basis, but will not incorporate the single failure criteria.

This criterion identifies the need to design the system in accordance with the applicable sections of IEEE 741-1997, "IEEE Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations," with exceptions as documented in the guidance package. It is expected that some sections, in addition to the exceptions noted, may only have partial or limited applicability. Therefore, the specific portions of Class 1E nuclear standards that apply to this system will be documented as part of the design description in Section 2 of the SDD.

II. Criterion Performance Parameter Basis

N/A

1.2.6.20 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of IEEE 739-1995, "IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

1.2.6.21 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR 3.3.A, which requires compliance with industry codes and standards. This criterion is supported by Guidance Statement 7.2g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System."

Because the IEEE nuclear standards were developed for commercial nuclear power plant applications, they specify two safety (redundant) systems and two off-site power sources. However, the MGR, by design, will not pose a similar risk to the health and safety of the general public as would a nuclear power plant. The need for redundancy within the electrical design and the ability of the electrical equipment to withstand the postulated DBEs will be required as part of the MGR electrical design. The nuclear IEEE standards contain excellent design guidance regarding redundancy and durability for electrical systems and components. Consequently, the MGR design of the electrical system for the Waste Handling Building will incorporate portions of specific IEEE standards on a case by case basis, but will not incorporate the single failure criteria.

This criterion identifies the need to design the system in accordance with the applicable sections of IEEE 7-4.3.2-1993, "IEEE Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations," with exceptions as documented in the guidance package. It is expected that some sections, in addition to the exceptions noted, may only have partial or limited applicability. Therefore, the specific portions of Class 1E nuclear standards that apply to this system will be documented as part of the design description in Section 2 of the SDD.

II. Criterion Performance Parameter Basis

N/A

1.2.6.22 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR 3.3.A, which requires compliance with industry codes and standards. This criterion is supported by Guidance Statement 7.1g1 in the "MGR Compliance Program Guidance Package for the Waste Handling Building Electrical System."

Because the IEEE nuclear standards were developed for commercial nuclear power plant applications, they specify two safety (redundant) systems and two off-site power sources. However, the MGR, by design, will not pose a similar risk to the health and safety of the general public as would a nuclear power plant. The need for redundancy within the electrical design and the ability of the electrical equipment to withstand the postulated DBEs will be required as part of the MGR electrical design. The nuclear IEEE standards contain excellent design guidance regarding redundancy and durability for electrical systems and components. Consequently, the MGR design of the electrical system for the Waste Handling Building will incorporate portions of specific IEEE standards on a case by case basis, but will not incorporate the single failure criteria.

This criterion identifies the need to design the system in accordance with the applicable sections of ANSI/ANS 59.51-1997, "Fuel Oil Systems for Safety-Related Emergency Diesel Generators" for developing the appropriate interface between the mechanical portions of the diesel generator and the Waste Handling Building Electrical System. It is expected that some sections may only have partial or limited applicability. Therefore, the specific portions of Class 1E nuclear standards that apply to this system will be documented as part of the design description in Section 2 of the SDD.

II. Criterion Performance Parameter Basis

N/A

1.2.6.23 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.G and 3.3.A. 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. 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

1.2.6.24 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 3.1.B and 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

1.2.6.25 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

1.2.6.26 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, paragraph 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

1.2.6.27 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3A. 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.

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 the earlier version of MIL-STD-1472).

II. Criterion Performance Parameter Basis

N/A

1.2.6.28 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

1.2.6.29 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable provisions of IEEE Std. 690-1984, "IEEE Standard for the Design and Installation of Cable Systems for Class 1E Circuits in Nuclear Power Generating Stations." The application of this standard is for good engineering practice in providing either information not covered in or in addition to "National Electrical Code" (NFPA 70).

II. Criterion Performance Parameter Basis

N/A

APPENDIX B ARCHITECTURE AND CLASSIFICATION

The QA Classification is established in "Classification of the MGR Waste Handling Building Electrical System" The overall system is classified as QL-2. The QA classification and next assumed level of system architecture are identified in Table 8.

Table 8. System Architecture and QA Classification

Waste Handling Building Electrical System	QL-1	QL-2	QL-3	CQ
Waste Handling Building Electrical System (HBE)		X		
Normal Power Source				X
Emergency Power Source		X		
Normal Power Distribution				X
Emergency Power Distribution		X		
Lightning Protection				X

APPENDIX C ACRONYMS, SYMBOLS, AND UNITS

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

C.1 ACRONYMS

AC	alternating current
ALARA	as low as is reasonably achievable
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
CCC	Central Control Center
CFR	Code of Federal Regulations
CQ	Commercial Quality
DBE	Design Basis Event
DC	direct current
DOE	U.S. Department of Energy
EMI	electromagnetic interference
F	function
HFE	Human Factors Engineering
HLW	High Level Waste
IEEE	Institute of Electrical and Electronics Engineers
MGR	Monitored Geologic Repository
MGR RD	Monitored Geologic Repository Requirements Document
N/A	Not Applicable
NFPA	National Fire Protection Association
NRC	U.S. Nuclear Regulatory Commission
QA	Quality Assurance
QL	Quality Level
SDD	System Description Document
SSCs	Structures, Systems, and Components
TBD	to be determined
TBV	to be verified
UPS	Uninterruptible Power Supply
WHB	Waste Handling Building

C.2 SYMBOLS AND UNITS

AC	Alternating Current
DC	Direct Current
°F	degrees Fahrenheit
Hz	Hertz
kV	kilovolts
psi	pounds per square inch
sec	seconds
%	percent
+/-	plus/minus
°	degrees

APPENDIX D FUTURE REVISION RECOMMENDATIONS AND ISSUES

This appendix identifies issues and actions that require further evaluation. The disposition of these issues and actions could alter the functions and design criteria that are allocated to this system in future revisions to this document. However, the issues and actions identified in this appendix do not require TBDs or TBVs beyond those already identified.

- Issue 1** Use of Design Solution Constraints as Design Criteria
- Issue 2** Resolve TBD and TBV parameters in the criteria.
- Issue 3** The electrical loads supplied by this system need to be refined. As part of this refinement, the equipment voltages and special needs should also be identified. This can only be accomplished as the interface equipment design matures. The identification and refinement of electrical loads will be an iterative process.
- Issue 4** The performance criteria for equipment manual start-up, automatic start-up, power switching, system shutdown, and emergency off needs to be addressed.
- Issue 5** Address maintenance criteria.
- Issue 6** Address Surveillance, In-Service Inspections, and Testing criteria.
- Issue 7** Address EMI criteria.
- Issue 8** In addition to the electrical loads refinement of 2.2 above, the requirement to provide DC power needs to be identified and defined. Other related DC parameters also need to be addressed such as voltage regulation and potential backup times if DC power is required.
- Issue 9** Address DBE driven equipment environments for temperature, humidity, and radiation.
- Issue 10** Address the refinement of Human Factor Engineering criteria.
- Issue 11** Address applicability of NFPA fire codes for diesel generator fuel systems.
- Issue 12** Address the refinement of interface criteria.

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 Practice for Industrial Lighting.” IES Committee on Industrial Lighting. ANSI/IES-RP-7-1991. 1991. New York, New York: Illuminating Engineering Society of North America. TIC: 242936.

“Bounded Minimum Inherent Availability Requirements for the System Description Documents.” CRWMS M&O. B00000000-01717-0200-00147, Rev. 00. March 13, 1998. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980416.0791.

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“Environmental and Facility Safety Signs.” National Electrical Manufacturers Association. ANSI Z535.2-1998. 1998. Rosslyn, Virginia.: National Electrical Manufacturers Association. TIC: 242942.

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“Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 10: Dialogue Principles.” International Organization for Standardization. ISO 9241-10, First Edition. May 1, 1996. Geneva, Switzerland: International Organization for Standardization. TIC: 239287.

“Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 14: Menu Dialogues.” International Organization for Standardization. ISO 9241-14, First Edition. June 1, 1997. Geneva, Switzerland: International Organization for Standardization. TIC: 239290.

“Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 15: Command Dialogues.” International Organization for Standardization. ISO 9241-15, First Edition. December 15, 1997. Geneva, Switzerland: International Organization for Standardization. TIC: 239291.

“Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 3: Visual Display Requirements.” International Organization for Standardization. ISO 9241-3, First Edition. July 15, 1992. Geneva, Switzerland: International Organization for Standardization. TIC: 239283.

“Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 8: Requirements for Displayed Colours.” International Organization for Standardization. ISO 9241-8, First Edition. October 1, 1997. Geneva, Switzerland: International Organization for Standardization. TIC: 239285.

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