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System Description Document
Volume I Cover Sheet

Complete only applicable items

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Page 1

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11. Remarks

The following TBDs/TBVs are used in this document.

TBD-386, TBD-388, TBD-390, TBD-403, TBD-404,
TBV-228, TBV-631

Use additional sheets if necessary.

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System Description Document Revision Record

Complete only applicable items

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Use additional sheets if necessary.

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TABLES

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SUMMARY

The Site Electrical Power System receives and distributes utility power to all North Portal site users. The major North Portal users are the Protected Area including the subsurface facility and Balance of Plant areas. The system is remotely monitored and controlled from the Surface Operations Monitoring and Control System. The system monitors power quality and provides the capability to transfer between Off-Site Utility and standby power (including dedicated safeguards and security power). Standby power is only distributed to selected loads for personnel safety and essential operations. Security power is only distributed to essential security operations. The standby safeguards and security power is independent from all other site power. The system also provides surface lighting, grounding grid, and lightning protection for the North Portal. The system distributes power during construction, operation, caretaker, and closure phases of the repository.

The system consists of substation equipment (disconnect switches, breakers, transformers and grounding equipment) and power distribution cabling from substation to the north portal switch gear building. Additionally, the system includes subsurface facility substation (located on surface), switch-gear, standby diesel generators, underground duct banks, power cables and conduits, switch-gear building and associated distribution equipment for power distribution. Each area substation distributes power to the electrical loads and includes the site grounding, site lighting and lightning protection equipment. The site electrical power system distributes power of sufficient quantity and quality to meet users demands.

The Site Electrical Power System interfaces with the North Portal surface systems requiring electrical power. The system interfaces with the Subsurface Electrical Distribution System which will supply power to the underground facilities from the North Portal. Power required for the South Portal and development side activities of the subsurface facility will be provided at the South Portal by the Subsurface Electrical Distribution System. The Site Electrical Power System interfaces with the Off-Site Utility System for the receipt of power. The System interfaces with the Surface Operations Monitoring and Control System for monitoring and control. The System interfaces with MGR Site Layout System for the physical location of equipment and power distribution.

QUALITY ASSURANCE

The Quality Assurance (QA) program applies to this document. The "Classification of Permanent Items," QAP-2-3, evaluation entitled "Classification of the Preliminary MGDS Repository Design" (TBV-228) has identified the Site Electrical Power System as an MGR item that is not important to safety; however, the system is subject to the QA program because it contains items required for physical protection. The MGR Requirements Manager has evaluated this activity in accordance with QAP-2-0, "Conduct of Activities." The "SDD Development/Maintenance (Q SDDs) (WP# 16012310M2 & 16012023M2)" activity evaluation has determined the preparation, checking, and review of this document are subject to "Quality Assurance Requirements and Description" requirements. Unverified and undetermined criteria and engineering data are identified and tracked in accordance with NLP-3-15, "To Be Verified (TBV) and To Be Determined (TBD) Monitoring System." This document was prepared in accordance with NLP-3-33, "System Description Documents."

1. FUNCTIONS AND DESIGN CRITERIA

The functions and design criteria for the system are identified in the following sections. Throughout this document the term "system" shall be used to indicate the Site Electrical Power System. The system architecture is provided in Appendix D.

1.1 SYSTEM FUNCTIONS

1.1.1 The system distributes electrical power during construction, operation, caretaker, and closure phases of the repository.

1.1.2 The system receives electrical power from the Off-Site Utilities System.

1.1.3 The system monitors incoming power quality, system operating parameters, and equipment status.

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

1.1.5 The system provides normal and standby (including dedicated safeguards and security) power.

1.1.6 The system distributes and transforms electrical power for the Protected Area facilities (includes Subsurface Facility System), Balance of Plant facilities, and site support equipment and substations.

1.1.7 The system provides lighting, grounding, and lightning protection at the North Portal for the surface facilities.

1.1.8 The system operates within the expected environmental conditions.

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

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

1.1.11 The system provides features that facilitate decommissioning at repository closure.

1.2 SYSTEM DESIGN CRITERIA

This section presents the design criteria for the Site Electrical Power System. Each criteria in this section has a corresponding Criteria Basis Statement in Volume II (see Section 5) that describes the need for the criteria as well as a basis for the performance parameters imposed by the criteria. Each criterion in this section also contains bracketed traces indicating traceability to the functions (F) in Section 1.1, the "Mined Geologic Disposal System Requirements Document" (MGDS RD).

1.2.1 System Performance Criteria

1.2.1.1 The system shall have a minimum operational life of 150 years.

[F 1.1.1][MGDS RD 3.2.B, 3.2.H]

1.2.1.2 The system shall transform and distribute electrical power to the normal system loads defined in Table 1-1.

Table 1-1. Electrical Power Normal Loads

System	Operational Phase*				Power kV
	CO	OP	CA	CL	
Waste Handling Bldg.	X	X			8526 (TBV-631)
Waste Treatment Bldg.	X	X			1331 (TBV-631)
Carrier Prep. Bldg.	X	X			292 (TBV-631)
Transporter Maint. Bldg.	X	X			105 (TBV-631)
Change House	X	X	X	X	130 (TBV-631)
Switchgear Bldg**.	X	X	X	X	78 (TBV-631)
Shop Bldg.	X	X	X	X	197 (TBV-631)
Office/Adm. Bldg.	X	X	X	X	482 (TBV-631)
Food, training, Medical, Fire Station, Comp Center	X	X	X	X	916 (TBV-631)
Central Warehouse, Central shop	X	X	X	X	1195 (TBV-631)
Motor pool, Service, Mockup bldg. Utility Bldg. Visitor Center	X	X	X	X	342 (TBV-631)
General Parking, Balance of Plant	X	X	X	X	156 (TBV-631)
Subsurface***	X	X	X	X	5850 (TBV-631)
Safeguards and Security Loads	X	X	X	X	240 (TBV-631)

* Operational Phases in which power will be supplied: CO-Construction, OP-Operation, CA-Caretaker, CL-Closure
** These are the internal loads associated with this system (e.g., lighting)
*** The subsurface load is the aggregate sum of all of the subsurface loads.

[F 1.1.5, 1.1.6][MGDS RD 3.2.B, 3.2.H]

1.2.1.3 The system shall transform and distribute electrical power to the standby loads defined in Table 1-2.

Table 1-2. Electrical Power Standby Loads

System	Operational Phase*				Power kVA
	CO	OP	CA	CL	
(TBD-404)					(TBD-404)

* Operational Phases in which power will be supplied: CO-Construction, OP-Operation, CA-Caretaker, CL-Closure

[F 1.1.5][MGDS RD 3.2.B]

1.2.1.4 The system shall transform and distribute electrical power to the safeguards and security system loads defined in Table 1-3.

Table 1-3. Electrical Power Standby Safeguards and Security Loads

System	Operational Phase*				Power kVA
	CO	OP	CA	CL	
Security Stations		X	X	X	180 (TBV-631)
Protected Area Security Lighting	X	X	X	X	65 (TBV-631)

* Operational Phases in which power will be supplied: CO-Construction, OP-Operation, CA-Caretaker, CL-Closure

[F 1.1.5, 1.1.6][MGDS RD 3.1.D, 3.2.B, 3.3.K]

1.2.1.5 The system shall maintain the power factor at the utility interface at a level greater than 0.85.

[F 1.1.2][MGDS RD 3.1.G]

1.2.1.6 The system shall automatically generate standby electrical power with the performance characteristics defined in Tables 1-4, 1-5, 1-6, and 1-7.

Table 1-4. Site Standby Power Characteristics for Diesel Generators

Performance Characteristics	Value
Voltage	(TBD-386) V
Frequency	(TBD-386) Hz
Power	(TBD-386) kVA
Phase	(TBD-386) phase
Maximum Time to "on-line"	(TBD-386) seconds
Minimum Run time at full load	(TBD-386) hours

Table 1-5. Security Standby Power Characteristics for Diesel Generators

Performance Characteristics	Value
Voltage	(TBD-386) V
Frequency	(TBD-386) Hz
Power	(TBD-386) kVA
Phase	(TBD-386) phase
Maximum Time to "on-line"	(TBD-386) seconds
Minimum Run time at full load	(TBD-386) hours

Table 1-6. Site Standby Power Characteristics for Uninterruptible Power Supplies

Performance Characteristics	Value
Voltage	(TBD-386) V
Frequency	(TBD-386) Hz
Power	(TBD-386) kVA
Phase	(TBD-386) Phase
Minimum Battery Back-up Time	(TBD-386) Hours
Total Harmonic Distortion	(TBD-386) THD

Table 1-7. Security Standby Power Characteristics for Uninterruptible Power Supplies

Performance Characteristics	Value
Voltage	(TBD-386) V
Frequency	(TBD-386) Hz
Power	(TBD-386) kVA
Phase	(TBD-386) Phase
Minimum Battery Back-up Time	(TBD-386) Hours
Total Harmonic Distortion	(TBD-386) THD

[F 1.1.5][MGDS RD 3.3.K]

1.2.1.7 The system shall provide the minimum surface lighting for the areas defined in Table 1-8.

Table 1-8. Surface Area Lighting

Surface Areas	Illumination Levels
Parking lots	(TBD-403) ft candles
General purpose	(TBD-403) ft candles
Roadways	(TBD-403) ft candles
Facility perimeters	(TBD-403) ft candles

[F 1.1.7][MGDS RD 3.2.B, 3.3.A]

1.2.1.8 The system design shall provide a 10 percent margin to accommodate future load growth.

[F 1.1.1][MGDS RD 3.3.A]

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

[F 1.1.6][MGDS RD 3.3.A]

1.2.2 Safety Criteria

1.2.2.1 Nuclear Safety Criteria

This system contains no Nuclear Safety Criteria.

1.2.2.2 Non-Nuclear Safety Criteria

1.2.2.2.1 The system shall provide ground-fault detection and relaying to automatically de-energize any high voltage system component that has developed a ground fault for circuits that are 1,000 volts or higher.

[F 1.1.7, 1.1.9][MGDS RD 3.1.E]

1.2.2.2.2 The system shall provide a grounding grid for the surface that is physically separated from the Subsurface Electrical Distribution System grounding grid by a minimum of 20 feet.

[F 1.1.7][MGDS RD 3.1.E]

1.2.3 System Environment Criteria

1.2.3.1 The system shall be designed to withstand and operate in the extreme surface temperature environment of 5 degrees F to 117 degrees F (-15 degrees C to 47 degrees C).

[F 1.1.8][MGDS RD 3.1.G]

1.2.3.2 The system non-safety related buildings and structures shall be designed for a basic wind speed of 122 MPH (54 meters per second).

[F 1.1.8][MGDS RD 3.1.G]

1.2.3.3 The system shall be designed to withstand a frost line depth of (TBD-390).

[F 1.1.8][MGDS RD 3.1.G]

1.2.3.4 The system shall be designed to operate at the elevations defined in Table 1-9.

Table 1-9. Elevations

Area	Elevation
North and South Portals	3750 ft (1143 m)
Ventilation shafts	4850 ft (1478 m)

[F 1.1.8][MGDS RD 3.1.G]

1.2.3.5 The system shall be designed to withstand and operate in the snowfalls described in Table 1-10.

Table 1-10. Snowfall Environment

Parameter	Maximum
Maximum Daily Snowfall	10 in (25 cm)
Maximum Snowfall Accumulation	17 in (43 cm)

[F 1.1.8][MGDS RD 3.1.G]

1.2.3.6 The system shall be designed to withstand and operate in the surface external relative humidity environment described in Table 1-11.

Table 1-11. Surface External Relative Humidity Environment

Parameter	Value
Annual mean value	28%
Minimum summer mean value (June)	13%
Maximum winter mean value (December)	46%

[F 1.1.8][MGDS RD 3.1.G]

1.2.3.7 The system shall be designed to withstand and operate in the precipitation environment described in Table 1-12.

Table 1-12. Precipitation (Rainfall)

Parameter	Range/Maximum
Maximum annual precipitation	10 in./yr (25 cm)
Maximum daily precipitation	5 in./day (13 cm)

[F 1.1.8][MGDS RD 3.1.G]

1.2.3.8 The system mounting and structural items shall be designed to withstand a (TBD-388) seismic event.

[F 1.1.8][MGDS RD 3.1.G]

1.2.4 System Interfacing Criteria

1.2.4.1 The system shall receive power, with the input power characteristics defined in Table 1-13, from the Off-Site Utility System for the North Portal.

Table 1-13. Off-Site Utility System Input Power Characteristics

Input Parameter	Range
Voltage	138 kV nominal (145 kV max)
Frequency	60 +/- 0.2 Hz
Phase	3

[F 1.1.2][MGDS RD 3.2.B]

1.2.4.2 The system shall provide power, with the power characteristics defined in Table 1-14, to the Subsurface Electrical Distribution System for the subsurface facility and emplacement ventilation shaft at the North Portal.

Table 1-14. Subsurface Electrical Distribution System Power Characteristics

Input Parameter	Range
Voltage	12.5 kV nominal (12.16 kV min to 13.09 kV max)
Frequency	60 +/- 0.2 Hz
Phase	3

[F 1.1.6][MGDS RD 3.2.B]

1.2.4.3 The system shall respond to the control signals from the Surface Operations Monitoring and Control System, defined in Table 1-15.

Table 1-15. Control Signal Groups

Control Signals
Control Diesel Generator
Control Switch-gear
Control Motors
Control Load Shed
Control Lighting Off/On (Several by area)

[F 1.1.4][MGDS RD 3.2.B]

1.2.4.4 The system shall provide the monitoring signals, defined in Table 1-16, to the Surface Operations Monitoring and Control System.

Table 1-16. Monitoring Signal Groups

Monitoring Signals
Monitor Incoming Off-Site Utilities
Monitor System Buss Voltages
Monitor System Feeder Currents
Monitor Power Factor
Monitor System Demand
Monitor Ground-Check Relay Status
Monitor Load Shed Status
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 1.1.3, 1.1.4][MGDS RD 3.2.B]

1.2.4.5 The system shall provide the space and location requirements of all surface equipment to the MGR Site Layout System.

[F 1.1.6][MGDS RD 3.2.B]

1.2.4.6 The system shall provide an automatic, independent source of standby power for the Safeguards and Security system.

[F 1.1.5][MGDS RD 3.1.D, 3.3.K]

1.2.5 Operational Criteria

1.2.5.1 The inherent availability for the Site Electrical Power System shall be greater than 0.9883.

[F 1.1.5, 1.1.6][MGDS RD 3.3.A]

1.2.5.2 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, "Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities."

[F 1.1.9, 1.1.10][MGDS RD 3.3.A]

1.2.5.3 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.)

[F 1.1.9, 1.1.10][MGDS RD 3.3.A]

1.2.5.4 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, "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 3: Visual Display Requirements;" and ISO 9241-8, "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 8: Requirements for Displayed Colours" are recognized as DOE's preferred guidance for the design of the Monitored Geologic Repository (MGR) SSC, but application of specific requirements to the MGR has not yet been determined. Future engineering analyses will determine those applicable areas.

[F 1.1.9, 1.1.10][MGDS RD 3.3.A]

1.2.5.5 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, "Guidelines for Designing User Interface Software;" and ISO 9241-10, "Ergonomic Requirements for Office Work with

Visual Display Terminals (VDTs) - Part 10: Dialogue Principles;" ISO 9241-14, "Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) - Part 14: Menu Dialogues;" and ISO 9241-15, "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 SSC, but application of specific requirements to the MGR has not yet been determined. Future engineering analyses will determine those applicable areas.

[F 1.1.9, 1.1.10][MGDS RD 3.3.A]

1.2.5.6 The design, selection, and integration of SSC shall incorporate HFE practices and criteria in accordance with applicable industry standards. MIL-STD-1472D, "Human Engineering Design Criteria for Military Systems, Equipment, and Facilities," is recognized as DOE's preferred guidance for the design of the MGR SSC, but application of specific requirements to the MGR has not yet been determined. Future engineering analyses will determine those applicable areas.

[F 1.1.9, 1.1.10][MGDS RD 3.3.A]

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."

[F 1.1.9][MGDS RD 3.1.E]

1.2.6.2 The system shall be designed and constructed in accordance with the applicable sections of 29 CFR 1926, "Safety and Health Regulations for Construction."

[F 1.1.9][MGDS RD 3.1.F]

1.2.6.3 The system shall be designed in accordance with the applicable sections of DOE Order 6430.1A, "General Design Criteria," Division 16, Electrical.

[F 1.1.6, 1.1.9, 1.1.11][MGDS RD 3.1.G]

1.2.6.4 The system shall be designed in accordance with the applicable sections of NFPA 1, "Fire Prevention Code," 1997.

[F 1.1.9][MGDS RD 3.3.A]

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

[F 1.1.9][MGDS RD 3.3.A]

1.2.6.6 The system shall be designed in accordance with the applicable sections of NFPA 780, "Standards for the Installation of Lightning Protection Systems," 1997.

[F 1.1.7, 1.1.9][MGDS RD 3.3.A]

1.2.6.7 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."

[F 1.1.6, 1.1.9][MGDS RD 3.3.A]

1.2.6.8 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."

[F 1.1.7, 1.1.9][MGDS RD 3.3.A]

1.2.6.9 The system shall be designed in accordance with the applicable sections of IEEE 242-1986, "IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems."

[F 1.1.6][MGDS RD 3.3.A]

1.2.6.10 The system shall be designed in accordance with the applicable sections of IEEE Std 446-1995, "IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications."

[F 1.1.5][MGDS RD 3.3.A]

1.2.6.11 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."

[F 1.1.6][MGDS RD 3.3.A]

1.2.6.12 The system shall be designed in accordance with the applicable sections of ANSI C2-97, "National Electrical Safety Code."

[F 1.1.9][MGDS RD 3.3.A]

1.2.6.13 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)."

[F 1.1.6][MGDS RD 3.3.A]

1.2.6.14 The system shall be designed in accordance with the applicable sections of ANSI/IES-RP-7-1991, "Industrial Lighting."

[F 1.1.7][MGDS RD 3.3.A]

1.3 SUBSYSTEM DESIGN CRITERIA

There are no subsystem design criteria for this system.

1.4 CONFORMANCE VERIFICATION

This section outlines the methods to be used to verify the conformance of the system with its design criteria.

1.4.1 The methods of conformance verification to be used are:

Analysis. Analysis is the process of accumulating results and conclusions intended to verify that a requirement has been satisfied. Analytical verification of compliance may include compilation and interpretation of results of tests, demonstrations, and examinations of lower-level components of the system. Analysis may also include logical arguments, modeling, calculations, tradeoff studies, reports (design and/or tradeoff), and other relevant information to verify compliance with a requirement, when physical testing of a system is impracticable.

Examination. Examination is the process of conducting careful observation and inspection, without use of special laboratory appliances and procedures, to verify compliance with specified requirements. Examination is a relatively direct method, involving, at most, simple physical manipulation or measurement. It is generally non-destructive and does not necessarily involve operation of the system being evaluated.

Demonstration. Demonstration is the qualitative process of displaying or operating a system or item in or near its operational environment to verify compliance with requirements. It differs from testing in that it is generally a qualitative and direct determination of the performance of a function and is performed without special instrumentation or other special equipment.

Test. Test is the quantitative process whereby data are collected, under controlled conditions, to document the performance of a product with respect to a standard. Manipulation and analysis of data derived from testing is an integral part of the method. Special instrumentation and scientific procedures are commonly employed. A test may be conducted in a laboratory or in the field (in situ).

1.4.2 Table 1-17 correlates the criteria with the method to be used to verify compliance with the criteria. In the following table, items marked "N/A" (not applicable) have no verification required. These items are titles or contain explanatory materials. The other columns "Analysis," "Demo," "Exam," and "Test" refer to the verification methods identified in Section 1.4.1.

Table 1-17. Conformance Verification

Criterion		Verification Method Code				
Number	**Title**	**N/A**	**Analysis**	**Exam**	**Demo**	**Test**
1.2	System Design Criteria	X				
1.2.1	System Performance Criteria	X				
1.2.1.1			X			
1.2.1.2			X			X
1.2.1.3			X			X
1.2.1.4			X			X
1.2.1.5			X			X
1.2.1.6			X			X
1.2.1.7			X			X
1.2.1.8			X			
1.2.1.9			X			X
1.2.2	Safety Criteria	X				
1.2.2.1	Nuclear Safety Criteria	X				
1.2.2.2	Non-Nuclear Safety Criteria	X				
1.2.2.2.1			X			X
1.2.2.2.2			X			X
1.2.3	System Environment Criteria	X				
1.2.3.1			X			
1.2.3.2			X			
1.2.3.3			X			
1.2.3.4			X			
1.2.3.5			X			
1.2.3.6			X			
1.2.3.7			X			
1.2.3.8			X			
1.2.4	System Interfacing Criteria	X				
1.2.4.1			X			X
1.2.4.2			X			X
1.2.4.3			X			X
1.2.4.4			X			X
1.2.4.5			X			
1.2.4.6			X			
1.2.5	Operational Criteria	X				
1.2.5.1			X			
1.2.5.2			X	X		
1.2.5.3			X			
1.2.5.4			X			
1.2.5.5			X			
1.2.5.6			X			
1.2.6	Codes and Standards Criteria	X				
1.2.6.1			X			
1.2.6.2			X	X		
1.2.6.3			X			
1.2.6.4			X			
1.2.6.5			X			
1.2.6.6			X			
1.2.6.7			X			
1.2.6.8			X			
1.2.6.9			X			
1.2.6.10			X			

Table 1-17. Conformance Verification (Continued)

Criterion		Verification Method Code				
Number	**Title**	**N/A**	**Analysis**	**Exam**	**Demo**	**Test**
1.2.6.11			X			
1.2.6.12			X			
1.2.6.13			X			
1.2.6.14			X			

2. DESIGN DESCRIPTION

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

3. SYSTEM OPERATIONS

An operations section for this system will be provided in a future revision.

4. SYSTEM MAINTENANCE

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

APPENDIX A REFERENCES

This section provides a listing of references used in Volume I.

"Accident Prevention Tags (for Temporary Hazards)." National Electrical Manufacturers Association. ANSI Z535.5-1998. 1998. Washington, D.C.: American National Standards Institute, National Electrical Manufacturers Association. TIC: 238773.

"American National Standard for Human Factors Engineering of Visual Display Terminal Workstations." American National Standard Institute. ANSI/HFS 100-1988. February 4, 1988. Santa Monica, California: The Human Factors Society, Inc. TIC: 211186.

"Classification of the Preliminary MGDS Repository Design." Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O). B00000000-01717-0200-00134, Rev. 01. November 1998. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19981103.0546.

"Criteria for Safety Symbols." National Electrical Manufacturers Association. ANSI Z535.3-1998. 1998. Washington D.C.: American National Standards Institute, National Electrical Manufacturers Association. TIC: 238774.

"Electric Power Systems and Equipment - Voltage Ratings (60 Hertz)." National Electrical Manufacturers Association. ANSI C84.1-1995. 1995. Rosslyn, Virginia: National Electrical Manufacturers Association. TIC: 242358.

"Environmental and Facility Safety Signs." National Electrical Manufacturers Association. ANSI Z535.2-1998. 1998. Washington, D.C.: American National Standards Institute, National Electrical Manufacturers Association. TIC: 238776.

"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: 239286.

"Fire Prevention Code." National Fire Protection Association. NFPA 1, 1997 Edition. February 21, 1997. Quincy, Massachusetts: National Fire Protection Association. TIC: 238744.

"General Design Criteria." U.S. Department of Energy. DOE Order 6430.1A. April 6, 1989. Washington, D.C.: U.S. Department of Energy. TIC: 225261.

"Guidelines for Designing User Interface Software." Smith, Sidney L., Mosier, Jane N. ESD-TR-86-278. August 1986. Bedford, Massachusetts: The MITRE Corporation. TIC: 210805.

"Human Engineering Design Criteria for Military Systems, Equipment, and Facilities." Department of Defense. MIL-STD-1472D. March 14, 1989. U.S Department of Defense. TIC: 206191.

"Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities." Bongarra, Jr., James P., VanCott, Harold P., Pain, Richard F., Peterson L. Rolf, Wallace, Ronald I.. UCRL-15673. June 18, 1985. Falls Church, Virginia: Lawrence Livermore National Laboratory Nuclear Systems Safety Program, Bio Technology, Inc. TIC: 206097.

"IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants." Institute of Electrical and Electronics Engineers, Inc. IEEE 141-1993. December 2, 1993. New York, New York: Institute of Electrical and Electronics Engineers, Inc. TIC: 240362.

"IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications." Institute of Electrical and Electronics Engineers, Inc. IEEE 446. 1995. New York, New York: American National Standards Institute. TIC: 242952.

"IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities." The Institute of Electrical and Electronics Engineers, Inc. IEEE 739-1995. New York, New York: The Institute of Electrical and Electronics Engineers, Inc. TIC: 231563.

"IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems." Institute of Electrical and Electronics Engineers, Inc. IEEE 142-1991. 1991. New York, New York: Institute of Electrical and Electronics Engineers, Inc. TIC: 235220.

"IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems." The Institute of Electrical and Electronics Engineers, Inc. IEEE 242. 1986. New York, New York: The Institute of Electrical and Electronics Engineers, Inc. TIC: 8003.

"Industrial Lighting." IES Committee on Industrial Lighting. ANSI/IES-RP-7. January 22, 1991. New York, New York: Illuminating Engineering Society of North America. TIC: 242936.

"Mined Geologic Disposal System Requirements Document." U.S. Department of Energy. YMP/CM-0025, Rev. 3. February 1998. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.19980520.1022.

"National Electrical Code." National Fire Protection Association. NFPA 70. 1999 Edition. 1998. Quincy, Massachusetts: National Fire Protection Association. TIC: 240528.

"National Electrical Safety Code." Institute of Electrical and Electronics Engineers. ANSI C2-1997. 1997. New York, New York: American National Standards Institute. TIC: 240358.

"Occupational Safety and Health Standards." Occupational Safety and Health Administration, Department of Labor. 29 CFR 1910. July 1, 1998. Washington, D.C.: U.S. Government Printing Office. TIC: 239378.

"Product Safety Signs and Labels." National Electrical Manufacturers Association. ANSI Z535.4-1998. 1998. Washington, D.C.: American National Standards Institute, National Electrical Manufacturers Association. TIC: 242945.

"Quality Assurance Requirements and Description." U.S. Department of Energy, Office of Civilian Radioactive Waste Management. DOE/RW-0333P, Rev. 8. June 5, 1998. Washington, D.C.: U.S. Government Printing Office. ACC: MOL.19980601.0022.

"Safety and Health Regulations for Construction." Occupational Safety and Health Administration, Department of Labor. 29 CFR 1926. July 1, 1998. Washington, D.C.: U.S. Government Printing Office. TIC: 242940.

"Safety Color Code." National Electrical Manufactuters Association. ANSI Z535.1-1998. 1998. Washington, D.C.: American National Standards Institute, National Electrical Manufacturers Association. TIC: 238777.

"SDD Development/Maintenance (Q SDDs) (WP# 16012310M2 & 16012023M2)." CRWMS M&O. January 22, 1999. Las Vegas, Nevada: CRWMS M&O. ACC: MOL. 19990225.0080.

"Standards for the Installation of Lightning Protection Systems." National Fire Protection Association. NFPA 780, 1997 Edition. 1997. Quincy, Massachusetts: National Fire Protection Association. TIC: 240298.

APPENDIX B ACRONYMS

This section provides a listing of acronyms used in Volume I.

10 CFR 60	Title 10, Part 60 of the Code of Federal Regulations
ANSI	American National Standards Institute
DOE	Department of Energy
F	Function
HFE	Human Factors Engineering
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society Of North America
MGDS RD	Mined Geologic Disposal System Requirements Document
MGR	Monitored Geologic Repository
NFPA	National Fire Protection Association
QA	Quality Assurance
TBD	To Be Determined
TBV	To Be Verified

APPENDIX C SYMBOLS AND UNITS

C	Celsius
cm	centimeters
F	Fahrenheit
ft	feet
Hz	Hertz
in./day	inches per day
in./yr	inches per year
kVA	kilovolts/amp
m	meters
MPH	miles per hour
%	percent
+/-	plus/minus

APPENDIX D SYSTEM ARCHITECTURE

The system architecture is presented below.

Site Electrical Power System
- Switchyard
- Power Transmission
- Switch-gear Building
- Power Distribution System
- Standby Power Source
- Security Power Source
- Substations
- Lighting
- Grounding
- Lightning Protection

CRWMS/M&O

System Description Document Volume II Cover Sheet

Complete only applicable items

1. SDD Title		
Site Electrical Power System Description Document		
2. Document Identifier (Including Rev. No.)	3. ICN No.	4. Total Pages (Volume II)
BCB000000-01717-1705-00021 REV00	N/A	31

5. Remarks

Use additional sheets if necessary.

CONTENTS

5. SDD CRITERION BASIS STATEMENTS

This section presents the criterion basis statements for criteria in Sections 1.2 and 1.3 of Volume I. Descriptions of the traces to the "Mined Geologic Disposal System Requirements Document" (MGDS RD).

1.2.1.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to establish how long the Site Electrical Power System must be designed to operate. This criterion supports MGDS RD 3.2.B and 3.2.H which define the operational periods for the repository. It should be noted that the waste receipt, handling, and emplacement periods of paragraph 3.2.B are enveloped by 3.2.H.

Note: Due to the nature of this system, it is anticipated that the design will go through several iterations of repair and replacement to meet the total extent of this requirement.

II. Criterion Performance Parameter Basis

The system operates during construction, emplacement, retrieval (if required), and closure. The total number of years the system must operate is the sum of each of these periods. From the parent requirement 3.2.H, the total = 6 + 100 + 34 + 10 = 150 years.

1.2.1.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to establish the Site Electrical Power System loads under normal conditions. The table defines the loads as a function of the operational phase since individual loads may change or not be present during the different periods. This criterion supports waste handling needs of MGDS RD 3.2.B and 3.2.H. It should be noted that the waste receipt, handling, and emplacement periods of paragraph 3.2.B are enveloped by 3.2.H.

II. Criterion Performance Parameter Basis

The electrical power normal loads are summarized from the "Site Electrical System Technical Report," Table 7-1. The normal electrical loads are very preliminary and therefore are identified with TBV-631.

1.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to establish the Site Electrical Power System loads for the safeguards and security system standby source. The table defines the loads as a function of the operational phase since individual loads may change or not be present during the different periods. This criterion supports waste handling needs of MGDS RD 3.2.B.

II. Criterion Performance Parameter Basis

The site standby power electrical loads are not known. They are identified with TBD-404.

1.2.1.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to establish the Site Electrical Power System loads for the standby security source. The table defines the loads as a function of the operational phase since individual loads may change or not be present during the different periods. This criterion supports waste handling needs of MGDS RD 3.1.D, 3.2.B, and 3.3.K.

II. Criterion Performance Parameter Basis

The electrical power safeguards and security system loads are summarized from the "Site Electrical System Technical Report," Table 7-1, North Portal Electrical Loads. The value for the security stations is the summation of stations 1 through 3, (104 + 39 + 36= 179) rounded up to 180 kVA from p. 29. The lighting is directly from the Protected Area lighting line item from p. 30. The standby security loads are very preliminary and therefore are identified with TBD-631.

1.2.1.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to define the minimum power factor at the utility interface. There is an economic penalty associated with low power factors driven by the utility. This criterion supports MGDS RD 3.1.G by incorporating use of U.S. Department of Energy (DOE) standards.

II. Criterion Performance Parameter Basis

The value for the minimum power factor at the utility interface is defined in DOE Order 6430.1A, "General Design Criteria," paragraph 1630-1.2.

1.2.1.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to define the standby power generation (including uninterruptible power supplies) characteristics for the site and safeguards and security needs. The need for an automatic standby power for the safeguards and security system is defined in "Perimeter Intrusion Alarm Systems," (Regulatory Guide 5.44) paragraph 1.3. This criterion supports waste handling needs of MGDS RD 3.3.K.

II. Criterion Performance Parameter Basis

The characteristics and amount of power required for the site and security needs have not been defined. The values are identified with TBD-386.

1.2.1.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to define the lighting requirements for the North Portal area to support the conduct of operations. This criterion supports waste handling needs of MGDS RD 3.2.B, 3.3.A.

II. Criterion Performance Parameter Basis

The lighting levels have not been identified. They are identified with TBD-403.

1.2.1.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to ensure that the electrical system is designed with sufficient margin for the future. This criterion supports MGDS RD 3.3.A for engineering principles and practices for system margins and future load growth.

II. Criterion Performance Parameter Basis

The value of 10 percent is based on engineering judgement derived from standard engineering practice regarding system margins. The 10 percent value is applied in addition to the system loads defined during the final design.

1.2.1.9 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 MGDS 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 NEC will be used. The voltage range is +10/-5 percent.

1.2.2.2.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to address ground-fault relaying and circuit de-energizing. This criterion supports "Occupational Safety and Health Standards," 29 CFR 1910.304(f)(7)(ii)(C) through MGDS RD 3.1.E for electrical safety.

II. Criterion Performance Parameter Basis

N/A

1.2.2.2.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to define physical separation between ground grids. This criterion supports "Occupational Safety and Health Standards," 29 CFR 1910 through MGDS RD 3.1.E for electrical safety.

II. Criterion Performance Parameter Basis

The minimum physical separation distance between ground grids was obtained from "Occupational Safety and Health Standards," 29 CFR 1910.304(f)(7)(ii)(D).

1.2.3.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the outdoor temperature environment in which structures, systems, and components are expected to operate. This criterion is supported by industry codes and standards of MGDS RD 3.1.G by defining the environmental conditions.

Temperature is considered to be one of the primary environmental parameters that can affect component performance or result in advanced degradation. To ensure proper performance, many equipment manufacturers specify the temperature environment in which the component must operate.

II. Criterion Performance Parameter Basis

The extreme outside temperature range of -15 degree C to 47 degree C is based on the annual extreme minimum and maximum temperatures for the nine meteorological monitoring sites located in the Yucca Mountain area. The location of the nine sites are shown in Figure 2-1 of the "Engineering Design Climatology and Regional Meteorological Conditions Report." Extreme temperatures (and other data) are in Tables A-1 through A-9 of this report.

The collected temperature data in Tables A-1 through A-9 are based on 11 years of monitoring at Sites 1-5 and four years of monitoring at Sites 6-9. Site 1 data is typically more representative of the nine sites because it is closest to the repository. However, due to the limited number of years that data was collected, the lowest and highest recorded temperatures for all nine sites are used to bound the extreme temperature range. Site 5 has the lowest recorded temperature of -13.1degree C and Site 9 has the highest of 45.1 degree C. This temperature range was conservatively expanded to -15 degree C to 47 degree C (5 degree F to 117 degree F).

1.2.3.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion establishes the wind environment for the non-safety related buildings and structures at the repository. This criterion is supported by industry codes and standards of MGDS RD 3.1.G by defining the environmental conditions.

Wind is one of the primary external environmental parameters that can affect buildings and structures located outside. Proper consideration of wind is required to ensure that buildings and structures can withstand the wind forces, or are adequately protected from the wind.

According to Section 6.5 of the standard for "Minimum Design Loads for Buildings and Other Structures," (ANSI/ASCE 7-95), the basic wind speed is to be used in the determination of the design wind loads for all buildings and structures. A similar discussion is provided in Sections 1615, 1616, and 1618 of the 1997 "Uniform Building Code, Volume 2, Structural Engineering Design Provisions." The basic wind speed is defined as the three-second gust speeds at 10 m-agl with an annual probability of 0.02.

II. Criterion Performance Parameter Basis

Basic Wind Speed: Based on the basic wind speed maps provided in Figure 6-1 of ANSI/ASCE 7-95 and Figure 16-1 of the 1997 "Uniform Building Code, Volume 2, Structural Engineering Design Provisions," the Yucca Mountain region is located near an area designated as a special wind region. Section 6.5.2.1 of ANSI/ASCE 7-95 and Section 1618 of the 1997 "Uniform Building Code, Volume 2, Structural Engineering Design Provisions" require that for areas designated as special wind regions, and where local records indicate higher 50-year wind speeds than the basic wind speeds, the higher values shall be used. Review of the 50-year wind speed data for the nine meteorological sites (Site 1 through Site 9) indicates that the Yucca Mountain region qualifies as a special wind region.

Table 4-6 of the "Engineering Design Climatology and Regional Meteorological Conditions Report" provides the projections of maximum one-second gust wind speeds at 10 m-agl for the nine meteorological sites for 50-year, 100-year, and 200-year return periods. Projections at Site 1 are based on only one year of data. The projections for other sites are based on four years of data. To bound the basic wind speed for the entire Yucca Mountain facility (including the North and South Portals, and the ventilation shafts), Site 4 one-second 50-year return wind speed estimate of 54 meters per second, which is the highest of all nine sites, is used in this criterion. The one-second estimate also bounds the three-second basic wind speed definition in ANSI/ASCE 7-95.

1.2.3.3 Criterion Basis Statement

I. Criterion Need Basis

Frost line is one of the external environmental parameters that can affect the foundation and footing design for the structures that must be embedded in the ground. This criterion is supported by industry codes and standards of MGDS RD 3.1.G by defining the environmental conditions.

II. Criterion Performance Parameter Basis

The frost line depth will be based on the conditions at the Nevada Test Site. The frost line conditions have not be identified and therefore are identified with TBD-390.

1.2.3.4 Criterion Basis Statement

I. Criterion Need Basis

The elevation in which equipment operate can effect performance as a result of reduced pressure and available oxygen. The performance of non-turbo charged diesel generators are especially susceptible to operating elevations and must typically be derated. This criterion is supported by industry codes and standards of MGDS RD 3.1.G by defining the environmental conditions.

II. Criterion Performance Parameter Basis

The elevation values are taken from the "Engineering Design Climatology and Regional Meteorological Conditions Report," Table 2-1. The value for the North and South Portals is 3750 ft taken from Site 1 NTS-60. The value for the ventilation shafts is 4850 taken from Site 2, Yucca Mountain.

1.2.3.5 Criterion Basis Statement

I. Criterion Need Basis

Snowfall is one of the primary design parameters needed for exposed structures to ensure external loadings are accounted for. This criterion is supported by industry codes and standards of MGDS RD 3.1.G by defining the environmental conditions.

II. Criterion Performance Parameter Basis

The snowfall environment for the Yucca Mountain site was determined from the following information. The nine meteorological monitoring sites operated by the Radiological and Environmental Field Programs Department (R/EFPD), as defined in "Meteorological Monitoring Program 1996 Summary Report," pp. 1-1 to 1-5, do not monitor snowfall because it is an infrequent occurrence. "Engineering Design Climatology and Regional Meteorological Conditions Report" includes snowfall information for some other sites in the general area that were examined to bound the snowfall environment that could occur at the Yucca Mountain site. The closest of these sites is Desert Rock Airport south of Mercury, about 45 km east-southeast of Yucca Mountain. Snowfall data were also included for Tonopah, which is about 150 km north-northwest of the repository and at a higher elevation. Tables A-12 and A-14 of "Engineering Design Climatology and Regional Meteorological Conditions Report" provide climatological summaries for those locations that include daily maximum, monthly maximum, and annual totals for snowfall. The snowfall data for Tonopah is considered to provide a conservative estimate of snowfall at the repository site for the following reasons: The elevation at R/EFPD Site 1 (which is closest to the proposed repository surface facilities) is 3,750 ft, Desert Rock is 3,300 ft, and Tonopah is 5,430 ft (altitudes are listed in "Regional and Local Wind Patterns Near Yucca Mountain," in meters). While Desert Rock is closer to Yucca Mountain, it is at a lower altitude.

Average yearly total precipitation for Site 1, Desert Rock, and Tonopah are 4.97, 5.5, and 5.53, inches respectively from the "Engineering Design Climatology and Regional Meteorological Conditions Report," Tables A-1, A-12 and A-14). Annual average snowfall depths are 2.86 inches at Desert Rock, and 13.53 inches at Tonopah. Tonopah is further north, receives slightly more total precipitation, and is at a higher altitude; therefore, use of snow data from Tonopah is considered to be the conservative bounding area for Yucca Mountain. The maximum daily snowfall for Tonopah is 10 inches (rounded up from 9.7 inches) and occurs in the month of February from Table A-14.

The monthly snowfall is used to establish and bound the maximum snowfall accumulation. This is based on the conservative nature of the maximum monthly snowfall and the consideration that all of the monthly snowfall occurs in a short period of time with no reduction for melting. The maximum monthly snowfall for Tonopah is 17 inches and occurs in the month of December from Table A-14.

The snowfall data for Tonopah were not collected under an Office of Civilian Radioactive Waste Management approved QA program. The data were collected by the National Weather Service at its Tonopah station and are accepted by the scientific community as an accurate measurement of the actual snowfall at the station. The data are suitable for use in the analysis, as discussed above, to provide conservative estimates of the possible maximum snowfall at the Yucca Mountain site for use in design criteria.

1.2.3.6 Criterion Basis Statement

I. Criterion Need Basis

Humidity is considered to be a primary environmental parameter that can affect structure, systems, and components performance and anticipated life expectancy. This criterion establishes the external humidity environment at the site. This criterion is supported by industry codes and standards of MGDS RD 3.1.G by defining the environmental conditions.

II. Criterion Performance Parameter Basis

The humidity values are taken from the "Engineering Design Climatology and Regional Meteorological Conditions Report," Table A-1, Site 1 (NTS-60). Using Site 1 data is appropriate because the site is the closest and most representative of the North Portal, South Portal, and ventilation shafts. The annual mean humidity for Site 1 is 28 percent which is the average of the yearly averages for each of the time periods (Hour 0400, 1000, 1600, 2200) from Table A-1. The minimum summer mean humidity for Site 1 is 13 percent which occurred in the month of June at hour 1600 from Table A-1. The maximum winter mean humidity for Site 1 is 46 percent (rounded up from 45.9) which occurred in the month of December at hour 0400 from Table A-1.

1.2.3.7 Criterion Basis Statement

I. Criterion Need Basis

Daily precipitation is an environmental parameter that can affect site drainage and erosion, buried utilities, outdoor equipment seals, and roof drain system sizing. This criterion establishes the rainfall rates through which the affected systems must be able to endure and function. This criterion is supported by industry codes and standards of MGDS RD 3.1.G by defining the environmental conditions.

II. Criterion Performance Parameter Basis

The maximum annual precipitation is derived from the "Engineering Design Climatology and Regional Meteorological Conditions Report," p. 4-10 and Figure 4-3. The report identifies a maximum annual precipitation that ranges from 1 to 10 inches for the period of 1949 to 1995. The bounding maximum annual precipitation of 10 inches is taken from the Amargosa Farms site. The Amargosa Farms site is deemed appropriate in the report based on its proximity to Yucca Mountain, p. 2-5, second paragraph.

The maximum daily precipitation is derived from the "Engineering Design Climatology and Regional Meteorological Conditions Report," p. 4-21, fourth paragraph. The reference paragraph states, "The conclusion from the statistical analyses of observed and estimated precipitation data performed for this report indicate that the maximum daily precipitation within 50 km of Yucca Mountain is not expected to exceed five inches."

1.2.3.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to establish the seismic environments in which the mounting and structural items of the system must be designed to operate. This criterion is supported by industry codes and standards of MGDS RD 3.1.G by defining the environmental conditions.

II. Criterion Performance Parameter Basis

This criterion contains TBD-388.

1.2.4.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion defines the input power characteristics interface with the Off-Site Utility System. This criterion supports the waste handling needs of MGDS RD 3.2.B.

II. Criterion Performance Parameter Basis

The current transmission voltage is 138 kV and the voltage range comes from ANSI C84.1-1995, "Electric Power Systems and Equipment--Voltage Ratings (60 Hertz)," Table 1, where, for transmission voltages over 100 kV, the standard only specifies the nominal and the maximum voltage, because these lines are normally unregulated. 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 input power characteristics interface with the Subsurface Electrical Distribution System. This criterion supports the waste handling needs of MGDS RD 3.2.B.

II. Criterion Performance Parameter Basis

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.

1.2.4.3 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 MGDS RD 3.2.B.

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 monitor interface with the Surface Operations Monitoring and Control System. This criterion supports the waste handling needs of MGDS RD 3.2.B.

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 MGR Site layout and the Site Electrical Power System. This criterion will specifically define the layout and location of electrical right-a-ways, buildings, and equipment. This criterion supports the waste emplacement needs of MGDS RD 3.2.B.

II. Criterion Performance Parameter Basis

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

1.2.4.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to establish the standby power requirements for safeguards and security system. Specifically, this criterion requires power to be automatically generated upon loss of normal power and to be independent from all other standby power. This criterion supports safeguards and security power needs of MGDS RD 3.1.D and 3.3.K, and 10 CFR 73.46(e)(6).

II. Criterion Performance Parameter Basis

N/A

1.2.5.1 Criterion Basis Statement

I. Criterion Need Basis

The subject requirement addresses and quantifies the parent requirement for availability. This criterion supports the MGDS 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. 12.

1.2.5.2 Criterion Basis Statement

I. Criterion Need Basis

The subject criterion addresses maintainability of the system in accordance with applicable industry standards in support of MGDS RD 3.3.A. Maintainability of system equipment involves many factors including the human-machine interface, since humans must conduct maintenance on the equipment. This interface must necessarily incorporate human factors engineering (HFE) practices and criteria, which is also specified in MGDS RD 3.3.A, into the design, selection, and integration of the system. Although HFE and maintainability have been dictated for the design of the system, specific HFE design criteria or guidelines have not been mandated. DOE has not published its own HFE design criteria document, nor have they mandated that specific HFE guidelines be used on the MGR project. The DOE "Human Factors Engineering" (GPG-FM-027), Good Practices Guide provides reference to several guidelines or criteria that should be used.

GPG-FM-027 states in paragraph 2.3.1 "Other sources for human engineering design criteria include UCRL 15673, 'Human Factors Design Guidelines for Maintainability of DOE Nuclear Facilities,'..." UCRL-15673 specifically addresses HFE maintainability design criteria for DOE nuclear facilities. Technical credibility for the HFE guidelines in UCRL-15673 are provided by the authors, which include an HFE professional for the NRC, a safety coordinator for the National Academy of Sciences, and three members of the Human Factors and Ergonomics Society; including the president.

Additionally, GPG-FM-027 states in paragraph 2.3.1 "The Department of Defense (DOD) has been at the forefront of HFE data generation and collection, and many applied HFE practitioners consider its 'Human Factors Engineering Design Criteria for Military Systems, Equipment, and Facilities', MIL-STD-1472D, the premier aggregation of general human engineering design criteria..." Although MIL-STD-1472D, "Human Engineering Design Criteria for Military Systems, Equipment, and Facilities," includes specific Human Factors Engineering design guidelines for maintainability, it is not included here but is included in a separate criterion in this section.

The criteria and basis were obtained from "Criteria and Backup Statements for the Site Electrical Power System and Subsurface Electrical Distribution System."

II. Criterion Performance Parameter Basis

N/A

1.2.5.3 Criterion Basis Statement

I. Criterion Need Basis

The subject criterion supports the MGDS RD 3.3.A for safety-related labels, signs, placards, and warnings. Although the design of labels, signs, placards, and warnings is based on many factors, if the human can not read or understand the information being presented the risk of injury, death, or equipment damage is increased; thus, the design must incorporate HFE practices and criteria.

The ANSI standards for safety colors, signs, symbols, labels, and tags are used in many industries throughout the United States, including the nuclear industry. The MGR cannot justify not using anything other than these standards. These standards provide an approach for implementing a uniform safety design program. When used in conjunction with other standards and guidelines, such as MIL-STD-1472D, the ANSI standards will ensure a consistent and meaningful design. "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) provide specific design guidelines for the use of colors, signage, symbology, labeling, and tagging for safety.

Additionally, "Human Factors Engineering" (GPG-FM-027) states in paragraph 2.3.1 "The Department of Defense (DOD) has been at the forefront of HFE data generation and collection, and many applied HFE practitioners consider its 'Human Factors Engineering Design Criteria for Military Systems, Equipment, and Facilities,' MIL-STD-1472D, the premier aggregation of general human engineering design criteria..." Although MIL-STD-1472D provides specific HFE design guidelines for safety-related labeling, it is not included here but is included in a separate criterion in this section.

The criteria and basis were obtained from "Criteria and Backup Statements for the Site Electrical Power System and Subsurface Electrical Distribution System."

II. Criterion Performance Parameter Basis

N/A

1.2.5.4 Criterion Basis Statement

I. Criterion Need Basis

The subject criterion addresses computer display terminals, equipment, and workspaces in accordance with applicable industry standards in support of the MGDS RD 3.3.A. Development of computer display terminals, equipment, and workspaces involves many factors including the human-machine interface, since humans must monitor, operate, and maintain the equipment. This interface must necessarily incorporate HFE practices and criteria, which is also specified in MGDS RD 3.3.A, into the design, selection, and integration of the system. Although the use of HFE and maintainability have been dictated for the design of the system, specific HFE design criteria or guidelines have not been mandated. DOE has not published its own HFE design criteria document, nor have they mandated that specific HFE guidelines be used on the MGR project. The DOE "Human Factors Engineering" (GPG-FM-027), Good Practices Guide provides reference to several guidelines or criteria that should be used.

GPG-FM-027 states in paragraph 2.3.1.3 "A newer resource for software issues is ISO 9241." The ISO 9241 series of standards on visual display terminal and workstation hardware and software characteristics will have an impact on user performance, comfort, and safety. ISO 9241 is one of the newest HFE guidelines for the design and selection of visual display terminals, workstations, and interfaces, and as such not all of the volumes have been published. "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) provide specific HFE guidelines for the design of the human-computer interface.

Additionally, GPG-FM-027 states in paragraph 2.3.1 "The Department of Defense (DOD) has been at the forefront of HFE data generation and collection, and many applied HFE practitioners consider its 'Human Factors Engineering Design Criteria for Military Systems, Equipment, and Facilities,' MIL-STD-1472D, the premier aggregation of general human engineering design criteria..." Although MIL-STD-1472D provides specific HFE design guidelines for the human-computer interface, it is not included here but is included in a separate criterion in this section.

Although not specifically mentioned in GPG-FM-027, "American National Standard for Human Factors Engineering of Visual Display Terminal Workstations" (ANSI/HFS 100-1988) provides HFE criteria for the design of visual display terminals, associated furniture, and the working environment. As an American National Standard, ANSI/HFS 100-1988 is widely used and should not be disregarded. When used in conjunction with other HFE standards and guidelines, such as MIL-STD-1472D, this ANSI standard will ensure a consistent and meaningful design of human-computer interface equipment and facilities.

The application of specific requirements contained in ANSI/HFS 100-1988 and ISO 9241 to the design, selection, and integration of system equipment will be determined in future engineering analyses.

The criteria and basis were obtained from "Criteria and Backup Statements for the Site Electrical Power System and Subsurface Electrical Distribution System."

II. Criterion Performance Parameter Basis

N/A

1.2.5.5 Criterion Basis Statement

I. Criterion Need Basis

The subject criterion addresses the design of the human-computer interface in accordance with applicable industry standards in support of the MGDS RD 3.3.A. The human-computer interface design must necessarily incorporate HFE practices and criteria, which are also specified in MGDS RD 3.3.A, since it is through this interface that humans will monitor, operate, and maintain the system. Although HFE practices and criteria have been dictated for the design of the system, specific HFE design criteria or guidelines have not been mandated. DOE has not published its own HFE design criteria document, nor have they mandated that specific HFE guidelines be used on the MGR project. The DOE "Human Factors Engineering" (GPG-FM-027), Good Practices Guide provides reference to several guidelines or criteria that should be used.

GPG-FM-027 refers in paragraph 2.3.1.8 to "Guidelines for Designing User Interface Software," ESD-TR-86-278 as an additional source of guidelines for the human-computer interface software. ESD-TR-86-278, 1986 contains extensive HFE guidance for human-computer interface design.

GPG-FM-027 states in paragraph 2.3.1.3 "A newer resource for software issues is ISO 9241." The ISO 9241 series of standards on visual display terminal and workstation hardware and software characteristics will have an impact on user performance, comfort, and safety. ISO 9241 is one of the newest HFE guidelines for the design and selection of visual display terminals, workstations, and interfaces, and as such not all of the volumes have been published. "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) provide specific HFE guidelines for the design of the human-computer software interface.

Additionally, GPG-FM-027 states in paragraph 2.3.1 "The Department of Defense (DOD) has been at the forefront of HFE data generation and collection, and many applied HFE practitioners consider its 'Human Factors Engineering Design Criteria for Military Systems, Equipment, and Facilities,' MIL-STD-1472D, the premier aggregation of general human engineering design criteria..." Although MIL-STD-1472D provides specific HFE design guidelines for the human-computer interface, it is not included here but is included in a separate criterion in this section.

The application of specific requirements contained in ESD-TR-86-278 and ISO 9241 to the design, selection, and integration of system equipment will be determined in future engineering analyses.

The criteria and basis were obtained from "Criteria and Backup Statements for the Site Electrical Power System and Subsurface Electrical Distribution System."

II. Criterion Performance Parameter Basis

N/A

1.2.5.6 Criterion Basis Statement

I. Criterion Need Basis

The subject criterion addresses the design of the human-computer interface in accordance with applicable industry standards in support of the MGDS RD 3.3.A. The human-computer interface design must necessarily incorporate HFE practices and criteria, which are also specified in MGDS RD 3.3.A, since it is through this interface that humans will monitor, operate, and maintain the system. Although HFE practices and criteria have been dictated for the design of the system, specific HFE design criteria or guidelines have not been mandated. DOE has not published its own HFE design criteria document, nor have they mandated that specific HFE guidelines be used on the MGR project. The DOE "Human Factors Engineering" (GPG-FM-027), Good Practices Guide provides reference to several guidelines or criteria that should be used.

GPG-FM-027 refers in paragraph 2.3.1.8 to "Guidelines for Designing User Interface Software," ESD-TR-86-278 as an additional source of guidelines for the human-computer interface software. ESD-TR-86-278, 1986 contains extensive HFE guidance for human-computer interface design.

GPG-FM-027 states in paragraph 2.3.1.3 "A newer resource for software issues is ISO 9241." The ISO 9241 series of standards on visual display terminal and workstation hardware and software characteristics will have an impact on user performance, comfort, and safety. ISO 9241 is one of the newest HFE guidelines for the design and selection of visual display terminals, workstations, and interfaces, and as such not all of the volumes have been published. "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) provide specific HFE guidelines for the design of the human-computer software interface.

Additionally, GPG-FM-027 states in paragraph 2.3.1 "The Department of Defense (DOD) has been at the forefront of HFE data generation and collection, and many applied HFE practitioners consider its 'Human Factors Engineering Design Criteria for Military Systems, Equipment, and Facilities,' MIL-STD-1472D, the premier aggregation of general human engineering design criteria..." Although MIL-STD-1472D provides specific HFE design guidelines for the human-computer interface, it is not included here but is included in a separate criterion in this section.

The application of specific requirements contained in ESD-TR-86-278 and ISO 9241 to the design, selection, and integration of system equipment will be determined in future engineering analyses.

The criteria and basis were obtained from "Criteria and Backup Statements for the Site Electrical Power System and Subsurface Electrical Distribution System."

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 MGDS RD 3.1.E. This criterion is needed to ensure that the Site Electrical Power 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 is derived from the regulatory precedent cited in MGDS RD 3.1.F. This criterion is needed to ensure that the Site Electrical Power System complies with 29 CFR 1926, "Safety and Health Regulations for Construction."

II. Criterion Performance Parameter Basis

N/A

1.2.6.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS RD 3.1.G, which requires compliance with applicable DOE Orders. This criterion specifically dictates that the system shall be designed considering applicable provisions of DOE Order 6430.1A, "General Design Criteria," Division 16, Electrical.

Additionally, the function of decommissioning is also addressed by section 1300-11.2.

II. Criterion Performance Parameter Basis

N/A

1.2.6.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGDS RD 3.3.A, which requires compliance with industry codes and standards. This criterion is needed to ensure that the Site Electrical Power System complies with NFPA 1, "Fire Prevention Code."

II. Criterion Performance Parameter Basis

N/A

1.2.6.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion responds to MGDS RD 3.3.A, which requires compliance with industry codes and standards. This criterion is needed to ensure that the Site Electrical Power System complies with NFPA 70, "National Electrical Code," 1999."

II. Criterion Performance Parameter Basis

N/A

1.2.6.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS 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 NFPA 780, " Standards for the Installation of Lightning Protection Systems."

II. Criterion Performance Parameter Basis

N/A

1.2.6.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS 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 NFPA 70, "National Electrical Code," 1999.

II. Criterion Performance Parameter Basis

N/A

1.2.6.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS 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 NFPA 70, "National Electrical Code," 1999.

II. Criterion Performance Parameter Basis

N/A

1.2.6.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS 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, "IEEE Recommended Practice for Protection and 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 NFPA 70, "National Electrical Code," 1999.

II. Criterion Performance Parameter Basis

N/A

1.2.6.10 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS 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 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 NFPA 70, "National Electrical Code," 1999.

II. Criterion Performance Parameter Basis

N/A

1.2.6.11 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS 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, "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 NFPA 70, "National Electrical Code," 1999.

II. Criterion Performance Parameter Basis

N/A

1.2.6.12 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS 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 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 NFPA 70, "National Electrical Code," 1999.

II. Criterion Performance Parameter Basis

N/A

1.2.6.13 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS 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 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 NFPA 70, "National Electrical Code," 1999.

II. Criterion Performance Parameter Basis

N/A

1.2.6.14 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGDS RD 3.3.A, which requires compliance with industry codes and standards. This criterion specifically dictates that the system shall be designed considering applicable guidance of ANSI/IES-RP-7-1991, "Industrial Lighting." The application of this standard is for good engineering practice in providing either information not covered in or in addition to NFPA 70, "National Electrical Code," 1999.

II. Criterion Performance Parameter Basis

N/A

6. COMPLIANCE PROGRAM

A compliance program guidance package is not necessary for this system, since it is classified as Non-Q (see the Quality Assurance section of Volume I).

APPENDIX A REFERENCES

This section provides a listing of references used in Volume II.

"Accident Prevention Tags (for Temporary Hazards)." National Electrical Manufacturers Association. ANSI Z535.5-1998. December 17, 1997. Rosslyn, Virginia: American National Standards Institute, 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. February 4, 1988. Santa Monica, California: The Human Factors Society, Inc. TIC: 211186.

"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.

"Criteria and Backup Statements for the Site Electrical Power System and Subsurface Electrical Distribution System SDDs." CRWMS M&O. LV.SA.LRE.02/99-013. February 12, 1999. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990316.0182.

"Criteria for Safety Symbols." National Electrical Manufacturers Association. ANSI Z535.3-1998. April 9, 1998. Rosslyn, Virginia.: American National Standards Institute, National Electrical Manufacturers Association. TIC: 242943.

"Electric Power Systems and Equipment - Voltage Ratings (60 Hertz)." National Electrical Manufacturers Association. ANSI C84.1-1995. 1995. Rosslyn, Virginia: National Electrical Manufacturers Association. TIC: 242358.

"Engineering Design Climatology and Regional Meteorological Conditions Report." CRWMS M&O. B00000000-01717-5707-00066, Rev. 00. October 2, 1997. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19971210.0773.

"Environmental and Facility Safety Signs." National Electrical Manufacturers Association. ANSI Z535.2-1998. 1998. Washington, D.C.: American National Standards Institute, National Electrical Manufacturers Association. TIC: 242942.

"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: 239286.

"Fire Prevention Code." National Fire Protection Association. NFPA 1, 1997 Edition. February 21, 1997. Quincy, Massachusetts: National Fire Protection Association. TIC: 238744.

"General Design Criteria." U.S. Department of Energy. DOE Order 6430.1A. April 6, 1989. Washington, D.C.: U.S. Department of Energy. TIC: 225261.

"Guidelines for Designing User Interface Software." Smith, Sidney L., Mosier, Jane N. ESD-TR-86-278. August 1986. Bedford, Massachusetts: The MITRE Corporation. TIC: 210805.

"Human Engineering Design Criteria for Military Systems, Equipment, and Facilities." Department of Defense. MIL-STD-1472D. March 14, 1989. Washington, D.C.: U.S. Department of Defense. TIC: 206191.

"Human Factors Design Guidelines for Maintainability of Department of Energy Nuclear Facilities." Bongarra, Jr., James P., VanCott, Harold P., Pain, Richard F., Peterson L. Rolf, Wallace, Ronald I. UCRL-15673. June 18, 1985. Falls Church, Virginia: Lawrence Livermore National Laboratory Nuclear Systems Safety Program, Bio Technology, Inc. TIC: 206097.

"Human Factors Engineering." Office of Project and Fixed Asset Management. GPG-FM-027. March 1996. Washington, D.C.: U.S. Department of Energy, Office of Field Management, Office of Project and Fixed Asset Management. TIC: 240421.

"IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants." Institute of Electrical and Electronics Engineers, Inc. IEEE 141-1993. December 2, 1993 & July 23, 1997 Correction Sheet. New York, New York: Institute of Electrical and Electronics Engineers, Inc. TIC: 240362.

"IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications." Institute of Electrical and Electronics Engineers, Inc. IEEE 446-1995. 1995. New York, New York: American National Standards Institute. TIC: 242952.

"IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities." The Institute of Electrical and Electronics Engineers, Inc. IEEE 739-1995. 1995. New York, New York: The Institute of Electrical and Electronics Engineers, Inc. TIC: 231563.

"IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems." Institute of Electrical and Electronics Engineers, Inc. IEEE 142-1991. December 9, 1991. New York, New York: Institute of Electrical and Electronics Engineers, Inc. TIC: 235220.

"IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems." The Institute of Electrical and Electronics Engineers, Inc. IEEE 242-1986. 1986. New York, New York: The Institute of Electrical and Electronics Engineers, Inc. TIC: 8003.

"Industrial Lighting." IES Committee on Industrial Lighting. ANSI/IES-RP-7. January 22, 1991. New York, New York: Illuminating Engineering Society of North America. TIC: 242936.

"Meteorological Monitoring Program 1996 Summary Report." CRWMS M&O. B00000000-01717-5705-00072, Rev. 00. October 28, 1997. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980210.0202.

"Mined Geologic Disposal System Requirements Document." U.S. Department of Energy. YMP/CM-0025, Rev. 3. February 1998. Las Vegas, Nevada: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.19980520.1022.

"Minimum Design Loads for Buildings and Other Structures." ANSI/ASCE 7-95. June 6, 1996. New York, New York: American Society of Civil Engineers. TIC: 236611.

"National Electrical Code." National Fire Protection Association. NFPA 70, 1999 Edition. 1998. Quincy, Massachusetts: National Fire Protection Association. TIC: 240528.

"National Electrical Safety Code." Institute of Electrical and Electronics Engineers. ANSI C2-1997, 1997 Edition. June 6, 1997. New York, New York: American National Standards Institute. TIC: 240358.

"Occupational Safety and Health Standards." Occupational Safety and Health Administration, Department of Labor. 29 CFR 1910. July 1, 1998. Washington, D.C.: U.S. Government Printing Office. TIC: 239378.

"Perimeter Intrusion Alarm Systems." U.S. Nuclear Regulatory Commission. Regulatory Guide 5.44, Rev. 3. October 1997. Washington, D.C.: U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation. TIC: 242395.

"Physical Protection of Plants and Materials." Nuclear Regulatory Commission. 10 CFR 73. January 1, 1998. Washington, D.C.: U.S. Government Printing Office. TIC: 238423.

"Product Safety Signs and Labels." National Electrical Manufacturers Association. ANSI Z535.4-1998. April 28, 1998. Rosslyn, Virginia.: American National Standards Institute, National Electrical Manufacturers Association. TIC: 242945.

"Regional and Local Wind Patterns Near Yucca Mountain." CRWMS M&O. B00000000-01717-5705-00081, Rev. 00. November 20, 1997. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980204.0319.

"Safety and Health Regulations for Construction." Occupational Safety and Health Administration, Department of Labor. 29 CFR 1926. July 1, 1998. Washington, D.C.: U.S. Government Printing Office. TIC: 238502.

"Safety Color Code." National Electrical Manufacturers Association. ANSI Z535.1-1998. February 23, 1998. Rosslyn, Virginia.: American National Standards Institute, National Electrical Manufacturers Association. TIC: 242940.

"Site Electrical System Technical Report." CRWMS M&O. BCBC00000-01717-5705-00003, Rev. 00. February 26, 1998. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980702.0372.

"Standard for the Installation of Lightning Protection Systems." National Fire Protection Association. NFPA 780, 1997 Edition. 1997. Quincy, Massachusetts: National Fire Protection Association. TIC: 240298.

"Uniform Building Code, Volume 2, Structural Engineering Design Provisions." International Conference of Building Officials. April 1997. Whittier, California: International Conference of Building Officials (ICBO). TIC: 233818.

APPENDIX B ACRONYMS

This section provides a listing of acronyms used in Volume II.

10 CFR 60	Title 10, Part 60 of the Code of Federal Regulations
ANSI	American National Standards Institute
DOE	Department of Energy
HFE	Human Factors Engineering
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society Of North America
MGDS RD	Mined Geologic Disposal System Requirements Document
MGR	Monitored Geologic Repository
NFPA	National Fire Protection Association
NTS	Nevada Test Site
R/EFPD	Radiological and Environmental Field Programs Department
SDD	System Description Document
TBD	To Be Determined
TBV	To Be Verified

APPENDIX C SYMBOLS AND UNITS

C	Celsius
ft	feet
Hz	Hertz
kVA	kilovolts/amp
m-agl	meters above ground level
+/-	plus/minus

APPENDIX D FUTURE REVISIONS, RECOMMENDATIONS, AND CONSIDERATIONS

1.0 Purpose

The purpose of this section is to document issues and actions that shall be considered in future revisions of the SDD. The use of this information will be used to further enhance the development of the SDD during the life cycle of this system. As the system criteria and design description matures, the usefulness of this section will become minimized. However, in the early phase of development of this SDD, this section will serve as a valuable tool.

2.0 Future Revision Recommendations & Considerations

2.1 Resolve TBD and TBV parameters in the criteria.

2.2 The non-Q seismic levels and the extent of the system which needs to survive a seismic event needs to be re-addressed from a program-wide perspective. Currently the criteria has been written for only the mounting and structural items to withstand the seismic event. This has been identified from a personnel safety perspective. It is the designers impression that the non-Q systems will need to be inspected and repaired, as necessary, to ensure continued and/or re-establish service.

2.3 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.

2.4 The performance criteria for equipment manual start-up, automatic startup, power switching, system shutdown, and emergency off needs to be addressed.

2.5 Address Maintenance criteria.

2.6 Address Surveillance, In-Service Inspections, and Testing criteria.

2.7 Evaluate the potential benefits of moving the dedicated security diesel generator to the Safeguards and Security SDD. This effort could help simplify the security sensitive aspects of the design by consolidating all security related criteria under one SDD.