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OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SYSTEM DESCRIPTION DOCUMENT REVISION HISTORY

1. SDD Title
Waste Handling Building Ventilation System Description Document

2. Document Identifier (Including Rev. No. and Change No., if applicable)
SDD-HBV-SE-000001 REV 01 ICN 01

3. Revision	4. Description of Revision
00	Initial Issue (issued using document identifier BCB000000-01717-1705-00031).
01	Issued Approved. This document is a complete rewrite of and supersedes the previous issuance. This document incorporates changes to the "Monitored Geologic Repository Requirements Document," including switching traceability to the "Revised Interim Guidance Pending Issuance of New U.S. Nuclear Regulatory Commission (NRC) Regulations (Revision 01, July 22, 1999), for Yucca Mountain, Nevada." This revision incorporates "Classification of the Waste Handling Building Ventilation System" and the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System." Changes have been included for the system to comply with management direction put into effect via the "Monitored Geologic Repository Project Description Document."
ICN 01	Issued Approved. This ICN adds Section 2, and updates Section 1 and Appendices A, B, C, and E for clarification of criteria, changes to references, and other editorial changes. All changes are indicated by revision bars.

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SUMMARY

The Waste Handling Building Ventilation System provides heating, ventilation, and air conditioning (HVAC) for the contaminated, potentially contaminated, and uncontaminated areas of the Monitored Geologic Repository's (MGR) Waste Handling Building (WHB). In the uncontaminated areas, the non-confinement area ventilation system maintains the proper environmental conditions for equipment operation and personnel comfort. In the contaminated and potentially contaminated areas, in addition to maintaining the proper environmental conditions for equipment operation and personnel comfort, the contamination confinement area ventilation system directs potentially contaminated air away from personnel in the WHB and confines the contamination within high-efficiency particulate air (HEPA) filtration units. The contamination confinement areas ventilation system creates airflow paths and pressure zones to minimize the potential for spreading contamination within the building. The contamination confinement ventilation system also protects the environment and the public by limiting airborne releases of radioactive or other hazardous contaminants from the WHB.

The Waste Handling Building Ventilation System is designed to perform its safety functions under accident conditions and other Design Basis Events (DBEs) (such as earthquakes, tornadoes, fires, and loss of the primary electric power). Additional system design features (such as compartmentalization with independent subsystems) limit the potential for cross-contamination within the WHB. The system provides status of important system parameters and equipment operation, and provides audible and/or visual indication of off-normal conditions and equipment failures.

The Waste Handling Building Ventilation System confines the radioactive and hazardous material within the building such that the release rates comply with regulatory limits. The system design, operations, and maintenance activities incorporate ALARA (as low as is reasonably achievable) principles to maintain personnel radiation doses to all occupational workers below regulatory limits and as low as is reasonably achievable.

The Waste Handling Building Ventilation System interfaces with the Waste Handling Building System by being located within the WHB and by maintaining specific pressures, temperatures, and humidity within the building. The system also depends on the WHB for water supply. The system interfaces with the Site Radiological Monitoring System for continuous monitoring of the exhaust air; the Waste Handling Building Fire Protection System for detection of fire and smoke; the Waste Handling Building Electrical System for normal, emergency, and standby power; and the Monitored Geologic Repository Operations Monitoring and Control System for monitoring and control of the system.

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 DOE/RW-0333P, "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 Waste Handling Building Ventilation System are identified in the following sections. Throughout this document, the term "system" is used to indicate the Waste Handling Building Ventilation System for both the contamination confinement and non-confinement ventilation systems. The system architecture and classification are provided in Appendix B.

1.1 SYSTEM FUNCTIONS

1.1.1 The system provides the proper environment for personnel comfort and equipment operation in the contaminated, potentially contaminated, and uncontaminated areas of the WHB to support the waste handling operations.

1.1.2 The system limits the spread of airborne contamination within the WHB.

1.1.3 The system limits the release of airborne radioactive contaminants to the accessible environment to maintain public and worker radiation exposures below regulatory limits.

1.1.4 The system provides status of system parameters and ventilation equipment operation.

1.1.5 In conjunction with other MGR systems, the Waste Handling Building Ventilation System operates to mitigate the consequences of DBEs.

1.1.6 The system provides active and passive features for the safety of personnel and for maintaining radiation doses ALARA during normal and off-normal conditions in the WHB.

1.1.7 The system permits periodic inspection, testing, and maintenance of system components.

1.1.8 The system performs its confinement and filtration functions following credible DBEs.

1.2 SYSTEM DESIGN CRITERIA

This section presents the design criteria for the system. Each criterion in this section has a corresponding Criterion Basis Statement in Appendix A that describes the need for the criterion as well as a basis for the performance parameters imposed by the criterion. Each criterion in this section also contains bracketed traces indicating traceability, as applicable, to the *functions (F) in* Section 1.1, the "Monitored Geologic Repository Requirements Document" (MGR RD), and "Revised Interim Guidance Pending Issuance of New U.S.

Nuclear Regulatory Commission (NRC) Regulations (Revision 01, July 22, 1999), for Yucca Mountain, Nevada." In anticipation of the interim guidance being promulgated as a Code of Federal Regulations, it will be referred to as "10 CFR 63" in this system description document. For the applicable version of the codes, standards, and regulatory documents, refer to Appendix E.

1.2.1 System Performance Criteria

1.2.1.1 The system shall be designed to maintain nominal temperatures during operations during normal and off-normal conditions in the areas within the WHB as defined in Table 1.

Table 1. Design Temperatures

Area	Summer/Winter Normal Conditions (Note 2)	Summer/Winter Off-Normal Conditions
Normally Occupied Areas (e.g., Offices, Maintenance Areas, Access Control)	76°F±2°F/72°F±2°F	Temperature Control Not Required Note 1
Normally Unoccupied Areas (e.g., Mechanical & Electrical Equipment Rooms, Cask Receiving & Handling Areas, Fuel Handling Areas)	90°F±2°F /65°F±2°F	Temperature Control Not Required Note 1
Unoccupied Areas (e.g., Assembly Cells, Canister Transfer Cells, Emergency [Diesel] Generator Room, Disposal Container Handling Cells)	104°F±2°F /65°F±2°F	Temperature Control Not Required Note 1
Electronics Equipment Areas (e.g., Control Rooms, Computer Rooms, Communications Equipment Rooms, Data Processing and Recording Equipment Rooms)	72°F±2°F /72°F±2°F	72°F±2°F/ 72°F±2°F Note 2

Note 1: Temperature control is not required during off-normal conditions such as loss of power or equipment failure. Further study is required to evaluate the impact of extreme low and high, off-normal temperatures in these areas.
Note 2: The design is to be based on the temperature values without consideration to the ± 2°F margin. This margin is provided for system performance variations.
For definition of acronyms, symbols, and units, see Appendix C.

[F 1.1.1][MGR RD 3.3.A]

1.2.1.2 The system shall be designed to maintain the nominal relative humidity values during operations during normal and off-normal conditions in the areas within the WHB as defined in Table 2.

Table 2. Design Relative Humidity

Area	Summer/Winter Normal Conditions	Summer/Winter Off-Normal Conditions
Normally Occupied Areas (e.g., Offices, Maintenance Areas, Access Control)	30%-60%/30%-60%	Humidity Control Not Required Note 2
Normally Unoccupied Areas (e.g., Mechanical & Electrical Equipment Rooms, Cask Receiving & Handling Areas, Fuel Handling Areas)	Humidity Control Not Required Note 1	Humidity Control Not Required Note 2
Unoccupied Areas (e.g., Assembly Cells, Canister Transfer Cells, Emergency [Diesel] Generator Room, Disposal Container Handling Cells)	Humidity Control Not Required Note 1	Humidity Control Not Required Note 2
Electronics Equipment Areas (e.g., Control Rooms, Computer Rooms, Communications Equipment Rooms, Data Processing and Recording Equipment Rooms)	40%-50%/40%-50%	Humidity Control Not Required Note 2

Note 1: Humidity control is not required in these areas. Special provisions may be provided to accommodate components with special humidity requirements.
Note 2: Humidity control is not required during off-normal conditions such as loss of power or equipment failure.
For definition of acronyms, symbols, and units, see Appendix C.

[F 1.1.1][MGR RD 3.3.A]

1.2.1.3 The system design shall be based on the outside design conditions as indicated in Table 3.

Table 3. Outside Design Conditions

Parameter	Design Data
Site: Mercury, Nevada	Latitude: 36° 37' 12" Longitude: 116° 01' 12" Elevation: 3310 ft
Heating Dry-Bulb	99.6%: 24° F (Note 1) 99%: 28° F (Note 2)
Cooling Dry-Bulb	0.4%: 102° F (Note 1) (Note 4) 1%: 100° F (Note 2)
Cooling Mean Coincident Wet-Bulb	0.4%: 65° F (Note 1) 1%: 64° F (Note 2)
Wet-Bulb	1%: 67° F (Note 3)
Dew-Point	0.4%: 64° F 1%: 60° F
Mean Coincident Dry-Bulb	0.4%: 72° F 1%: 77° F
Range of Dry-Bulb Temperature	25.9° F

Note 1: Use where close temperature and humidity control is required.
Note 2: Use for personnel comfort systems.
Note 3: Use for cooling towers.
Note 4: Use this value plus 5 °F for air-cooled condensers.
For definition of acronyms, symbols, and units, see Appendix C.

[F 1.1.1][MGR RD 3.3.A]

1.2.1.4 The system shall maintain the differential pressures between contamination confinement areas of the WHB during normal and off-normal operational modes in accordance with Table 4.

Table 4. Differential Pressures in Confinement and Non-Confinement Areas

Confinement Area	Definition	Pressure Requirement
Primary	Areas where radioactive materials or contamination is present during normal operations	-0.7 to -1.0 inwg relative to Secondary -0.8 to -1.15 inwg relative to Tertiary
Secondary	Areas where potential for contamination is high, or could become contaminated from an abnormal event	-0.1 to -0.15 inwg relative to Tertiary, and at least -0.25 inwg to the atmosphere
Tertiary	Areas where potential for contamination is low	-0.1 to -0.15 inwg to atmosphere
Non-Confinement Area	Areas with no potential for contamination	atmospheric to +0.15 inwg

Note: For definition of acronyms, symbols, and units, see Appendix C.

[F 1.1.2][MGR RD 3.1.C, 3.3.A][10 CFR 63.111(a)(1), 63.112(e)(1)]

1.2.1.5 The system shall provide no less than the minimum quantity of outside air required for the safety and health of the personnel in the normally occupied areas, in accordance with Table 2 of "Ventilation for Acceptable Indoor Air Quality" (ANSI/ASHRAE 62-1989).

[F 1.1.1][MGR RD 3.3.A]

1.2.1.6 The system shall provide once-through ventilation in primary and secondary confinement areas of the WHB, as defined in Table 4.

[F 1.1.2, 1.1.6][MGR RD 3.1.B, 3.1.C, 3.3.A][10 CFR 63.111(a)(1), 63.112(e)(1)]

1.2.1.7 The system shall be designed to provide an exhaust airflow pattern from areas of low potential for contamination to areas of higher potential for contamination.

[F 1.1.2, 1.1.6][MGR RD 3.1.B, 3.1.C, 3.3.A][10 CFR 63.111(a)(1), 63.112(e)(1)]

1.2.1.8 Reserved

1.2.1.9 The system shall be designed such that primary, secondary, tertiary, and non-confinement areas ventilation systems are separate and independent from each other.

[F 1.1.2, 1.1.6][MGR RD 3.1.B, 3.1.C, 3.3.A][10 CFR 63.111(a)(1), 63.112(e)(1)]

1.2.1.10 The system shall be designed to exhaust airflow from confinement areas through air cleaning units equipped with 90 percent American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) prefilters (minimum), and at least one stage of 99.97 percent HEPA filters in series for the secondary and tertiary confinement areas, and two stages of 99.97 percent HEPA filters for the primary confinement areas.

[F 1.1.3][MGR RD 3.3.A]

1.2.1.11 The system design shall include at least one stage of HEPA filtration in any contamination confinement area recirculation circuit.

[F 1.1.2, 1.1.3, 1.1.6][MGR RD 3.1.B, 3.1.C, 3.3.A][10 CFR 63.111(a)(1), 63.112(e)(1)]

1.2.1.12 The system shall prevent backflow, due to equipment failure, from areas of higher contamination potential to areas of lower contamination potential.

[F 1.1.2, 1.1.3, 1.1.6][MGR RD 3.1.B, 3.1.C, 3.3.A][10 CFR 63.111(a)(1), 63.112(e)(1)]

1.2.1.13 The system shall provide monitoring and alarms as required for the parameters identified in Table 5.

Table 5. System Parameters Monitoring

Parameter	Location / Characteristics
Space Temperature	All areas of the WHB
Air Flow Rate	All filter trains, stack
Differential Pressure	Filters, moisture eliminators, and all areas of the WHB which are required to be maintained at a specific pressure with respect to other areas/atmosphere
Radiation	Downstream of HEPA filtration units for each subsystem and at the stack discharge
Smoke/High Heat	Ventilation ductwork

[F 1.1.4][MGR RD 3.1.C, 3.3.A][10 CFR 63.112(e)(10), 63.112(e)(4)]

1.2.1.14 The system shall provide, as a minimum, equipment status for the items identified in Table 6.

Table 6. Equipment Status

Equipment	Status
All electrically powered or controlled equipment	On-Off
All motor and air operated valves and dampers	Open-Closed

[F 1.1.4][MGR RD 3.3.A]

1.2.1.15 The system shall be designed to detect and isolate system equipment failures.

[F 1.1.2, 1.1.3, 1.1.6][MGR RD 3.3.A]

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

[F 1.1.1, 1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.1.8][MGR RD 3.2.C]

1.2.2 Safety Criteria

1.2.2.1 Nuclear Safety Criteria

1.2.2.1.1 The confinement area ventilation system shall be designed to perform its confinement and filtration functions during a loss of primary electric power.

[F 1.1.8][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.111(b)(2), 63.112(e)(11)]

1.2.2.1.2 The confinement area ventilation system components required to provide confinement and filtration of airborne radioactivity shall be designed to function during and after a Frequency Category 1 (TBV-1246) design basis earthquake.

[F 1.1.8][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.111(b)(2), 63.112(e)(8)]

1.2.2.1.3 The confinement area ventilation system filter efficiency shall be a minimum of 99 percent for confinement areas exhaust airflow.

[F 1.1.8][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.112(e)(1), 63.112(e)(4)]

1.2.2.1.4 The confinement area ventilation system shall be designed to perform its confinement and filtration functions following a design basis tornado with a maximum wind speed of 189 miles per hour with a corresponding pressure drop of 0.81 psi and a rate of pressure drop of 0.3 psi/sec.

[F 1.1.8][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.111(b)(2), 63.112(e)(8)]

1.2.2.1.5 The confinement area ventilation system shall be designed to perform its confinement and filtration functions following a design basis tornado that generates Spectrum I or Spectrum II missiles identified in "MGR Design Basis Extreme Wind/Tornado Analysis," Section 6.3.

[F 1.1.8][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.111(b)(2), 63.112(e)(8)]

1.2.2.1.6 The confinement area ventilation system shall be designed in accordance with the project ALARA program goals (TBD-406) and the applicable guidelines in "Information Relevant to Ensuring that Occupational Radiation Exposures at

Nuclear Power Stations will be as Low as is Reasonably Achievable" (Regulatory Guide 8.8).

[F 1.1.6][MGR RD 3.1.B, 3.1.C, 3.3.A]
[10 CFR 63.111(a)(1), 63.112(e)(2), 63.112(e)(3)]

1.2.2.1.7 The confinement area ventilation system shall perform its confinement and filtration functions during the first 24-hour period following an event involving the release of radioactive materials with a failure rate less than 4.2×10^{-6} per hour (TBV-4455).

[F 1.1.8][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.112(e)(1), 63.112(e)(8)]

1.2.2.1.8 The confinement area ventilation system shall be designed to perform its confinement and filtration functions while exposed to the decay heat generated by the radioactive materials entrapped by the system filters.

[F 1.1.8][MGR RD 3.1.C][10 CFR 63.111(a)(2), 63.112(e)(1), 63.112(e)(4)]

1.2.2.2 Non-nuclear Safety Criteria

1.2.2.2.1 The system shall be designed to permit periodic inspection, testing, and maintenance, as necessary, to ensure continued functioning and readiness of the system.

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

1.2.2.2.2 The system shall be capable of filtering dust and toxic and noxious substances in the inlet air to the limits established in "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices."

[F 1.1.1, 1.1.2, 1.1.6][MGR RD 3.1.G, 3.3.A]

1.2.2.2.3 The system shall be designed with auditory and visual alarm systems to alert personnel to conditions that have the potential to affect personnel safety, result in equipment damage, and affect system performance.

[F 1.1.4, 1.1.6][MGR RD 3.3.A]

1.2.3 System Environment Criteria

1.2.3.1 The system components shall be designed to withstand and operate in the normal and off-normal temperature environments defined in Criterion 1.2.1.1 for the areas of the WHB in which the components are located. During off-normal conditions for normally occupies areas, normally unoccupied areas, and unoccupied areas, the temperature environment is (TBD-395).

[MGR RD 3.3.A]

1.2.3.2 The system components shall be designed to withstand and operate in the normal and off-normal humidity environments defined in Criterion 1.2.1.2 for the areas of the WHB in which the components are located. For normally unoccupied areas and unoccupied areas under normal conditions, the humidity environment is (TBD-409).

[MGR RD 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-405) in which the component is located.

[MGR RD 3.3.A]

1.2.3.4 The affected system components and outside structures shall be designed for a maximum wind speed of 121 miles per hour.

[MGR RD 3.3.A]

1.2.3.5 The system shall be designed for the outside temperature environment of 5 degrees F to 117 degrees F.

[MGR RD 3.3.A]

1.2.3.6 The system components located outside shall be designed for an external environment with a maximum daily snowfall of 10 inches and maximum snowfall accumulation of 17 inches.

[MGR RD 3.3.A]

1.2.3.7 The system components located outside shall be designed for the ambient relative humidity environment defined in Table 7.

Table 7. Ambient Relative Humidity Environment

Parameter	Value
Annual mean value	28%
Minimum summer mean value	13%
Maximum winter mean value	46%

Note: For definition of acronyms, symbols, and units, see Appendix C.

[MGR RD 3.3.A]

1.2.3.8 The system components located outside shall be designed for an external environment with a maximum annual precipitation of 10 inches and maximum daily precipitation of 5 inches.

[MGR RD 3.3.A]

1.2.3.9 The system components susceptible to blockage or damage by sand (e.g., air intake louvers, outdoor units) shall be protected from and designed to operate in sandstorms.

[MGR RD 3.3.A]

1.2.4 System Interfacing Criteria

1.2.4.1 The system shall interface with the Waste Handling Building System as required for housing and support of system components and ductwork; supply of water for heating, cooling, and humidification; and maintaining the required pressures, temperatures, and humidity environments.

[F 1.1.1, 1.1.2]

1.2.4.2 The system shall interface with the Site Radiological Monitoring System as required for continuous monitoring of exhaust air for radioactive contamination during normal and off-normal conditions.

[F 1.1.4, 1.1.5]

1.2.4.3 The system shall interface with the Waste Handling Building Fire Protection System for equipment installation and interlock requirements.

[F 1.1.5]

1.2.4.4 The system shall interface with the Waste Handling Building Electrical System as required for normal, emergency, and standby power.

[F 1.1.5]

1.2.4.5 The system shall interface with the Monitored Geologic Repository Operations Monitoring and Control System as required for remote control of the system.

[F 1.1.5]

1.2.5 Operational Criteria

1.2.5.1 The system shall be designed for an inherent availability of greater than 0.9825 (TBV-4655).

[MGR RD 3.3.A]

1.2.6 Codes and Standards Criteria

1.2.6.1 The system design shall comply with the applicable provisions of "Occupational Safety and Health Standards" (29 CFR 1910).

[MGR RD 3.1.E]

1.2.6.2 The system design shall comply with the applicable provisions of "Safety and Health Regulations for Construction" (29 CFR 1926).

[MGR RD 3.1.F]

1.2.6.3 The system shall comply with the applicable provisions of "Nuclear Power Plant Air-Cleaning Units and Components" (ASME N509-1989).

[MGR RD 3.3.A]

1.2.6.4 The system shall comply with the applicable provisions of "Testing of Nuclear Air Treatment Systems" (ASME N510-1989).

[MGR RD 3.3.A]

1.2.6.5 The system design shall comply with the applicable provisions of "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988), and "Design of an Independent Spent Fuel Storage Installation (Water-Basin Type)" (Regulatory Guide 3.49).

[MGR RD 3.3.A]

1.2.6.6 The system design shall comply with the applicable provisions of "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992).

[MGR RD 3.3.A]

1.2.6.7 The system design shall comply with the applicable provisions in the "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21).

[MGR RD 3.3.A]

1.2.6.8 The system design shall comply with the applicable requirements of ASHRAE "Fundamentals," "ASHRAE Handbook - Heating, Ventilating, and Air-Conditioning Systems and Equipment," "Heating, Ventilating, and Air-Conditioning Applications," and the ASHRAE handbook "Refrigeration."

[MGR RD 3.3.A]

1.2.6.9 The system ductwork shall be designed in accordance with applicable sections of "Standard for the Installation of Air Conditioning and Ventilating Systems" (NFPA 90A).

[MGR RD 3.3.A]

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

[MGR RD 3.3.A]

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

[MGR RD 3.3.A]

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

[MGR RD 3.3.A]

1.2.6.13 The system shall be designed in accordance with the applicable sections of "Code on Nuclear Air and Gas Treatment" (ASME AG-1-1997).

[MGR RD 3.3.A]

1.2.6.14 The system shall be designed in accordance with the applicable sections of "General Design Guide for Ventilation Systems for Fuel Reprocessing Plants" (Regulatory Guide 3.32).

[MGR RD 3.1.G]

1.2.6.15 The system shall be designed in accordance with the applicable sections of "Manual Initiation of Protective Actions" (Regulatory Guide 1.62).

[MGR RD 3.1.G]

1.2.6.16 The system shall be designed in accordance with the applicable provisions of Section 9.4.2 of "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (NUREG-0800).

[MGR RD 3.1.G]

1.2.6.17 The system shall be designed in accordance with the applicable sections of "Standards for Protection Against Radiation" (10 CFR 20).

[MGR RD 3.1.B]

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

1.2.6.19 The system shall be designed in accordance with the applicable sections of "Design, Testing, and Maintenance Criteria for Postaccident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants" (Regulatory Guide 1.52).

[MGR RD 3.1.G]

1.2.6.20 The system shall be designed to ensure emissions comply with the air quality standards of the "National Primary and Secondary Ambient Air Quality Standards" (40 CFR 50).

[MGR RD 3.1.G]

1.2.6.21 The system shall be designed in accordance with the applicable provisions of the "National Emission Standards for Hazardous Air Pollutants" (40 CFR 61), Subpart H.

[MGR RD 3.1.G]

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

[MGR RD 3.3.A]

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

[MGR RD 3.3.A]

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

[MGR RD 3.3.A]

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

[MGR RD 3.3.A]

1.3 SUBSYSTEM DESIGN CRITERIA

Subsystem design criteria for this system will be identified in a later revision, if necessary.

1.4 CONFORMANCE VERIFICATION

This section will be provided in a future revision.

2. DESIGN DESCRIPTION

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

The information contained in this section has been obtained from "Engineering Files for Site Recommendation" (Attachment II Section 1.1.7) and "WHB/WTB Space Program Analysis for Site Recommendation" (Section 6.2.5).

2.1 SYSTEM DESIGN SUMMARY

The WHB Ventilation System provides heating, ventilation, and air-conditioning to the contaminated, potentially contaminated, and uncontaminated areas of the WHB. The system maintains the proper environmental conditions for equipment operation as well as for the comfort, health, and safety of the operating personnel in this facility. The system provides protection to the public and the environment by limiting the release of radioactive or other airborne contaminants in the effluents from the facility. Additionally, the system minimizes the spread of airborne radioactive and hazardous contamination within the confines of the facility by maintaining pressure differential control in order to direct the flow of air successively from uncontaminated areas (non-confinement areas) to areas of greater potential for contamination (confinement areas).

The system is designed to remain operational, as required, to perform its safety functions during normal and off normal operating modes, and during and after credible DBEs. Where contamination confinement is required, the ventilation system, in conjunction with the building physical barriers, comprises the confinement system for the WHB. Effective confinement control is accomplished by compartmentalizing the facility into contamination confinement zones based on their potential for airborne radioactive contamination. The confinement areas are separated from non-confinement areas by physical barriers, backflow isolation, and airlocks or vestibules.

The system includes features to ensure that a single failure does not result in the loss of its capability to accomplish its required safety functions, and that it can withstand or mitigate consequences of internal and external missile impacts and seismic events. The system is completely enclosed and housed in the WHB that facilitates radiation protection and provides system reliability, utility, maintenance, and safety measures required for operation.

The system interfaces with other MGR systems as described in Section 1.2.4.

2.2 DESIGN ASSUMPTIONS

The principal supplementary assumptions that were used (in addition to the design criteria defined in Section 1) to develop the system design concept and/or design features are summarized below:

2.2.1 System maintenance will be conducted using a preventative maintenance approach. Since the system operates continually, the system will be provided with enough redundancy so that maintenance can be performed without shutting the system down.

2.2.2 Bare spent fuel assemblies handling and drying operations are always performed in confinement areas.

2.2.3 The pool water treatment and cooling system maintains proper water quality, temperature, and provides continual treatment of the pool water to remove radioactive constituents in order to minimize potential for airborne contamination due to open surface water evaporation.

2.3 DETAILED DESIGN DESCRIPTION

The WHB Ventilation System is comprised of two separate and independent subsystems. One is a nuclear grade quality subsystem that provides proper environmental conditions for equipment and for the health, comfort, and safety of the operating personnel in areas that may be normally contaminated or having potential for airborne radioactive or hazardous contamination (contamination confinement zones). The other is a conventional quality subsystem that provides proper environmental conditions for equipment and for the health, comfort, and safety of the operating personnel in uncontaminated areas (non-confinement zone). Both subsystems provide at least the minimum quantity of outside air to meet the ventilation requirements for acceptable indoor air quality.

The arrangement of the system and the subsystems serving the confinement and the non-confinement zones of the WHB are described in the following sections.

2.3.1 System Arrangement

The arrangement of the system is delineated in Figures 1 and 2. Figure 1 shows the confinement and non-confinement areas of the facility at grade level, and Figure 2 shows these areas at 30 feet above grade level. The confinement areas are further divided into three zones for effective confinement control as shown in the figures. The confinement areas are separated from non-confinement areas by physical barriers, backflow isolation, and airlocks or vestibules.

The system is completely enclosed and housed within the WHB. The system equipment is housed in designated equipment rooms and configured so that the supply air (outside air) equipment and the exhaust side equipment are at opposite ends of the building. Equipment for the Emergency Ventilation Subsystem is housed in a separate enclosure/room.

Benefits provided by the manner in which the system is arranged are discussed in Section 2.3.2.3.

2.3.2 Contamination Confinement Zone

Effective confinement control of the areas that are normally contaminated or have the potential for contamination is accomplished by compartmentalizing the area into contamination confinement zones based on their potential for airborne radioactive contamination. Three contamination confinement zones appear to suit the most restrictive hazard anticipated for the WHB.

- **Primary Confinement Ventilation Zone**. This zone is considered normally contaminated and comprises areas such as the Assembly Transfer System (ATS) and the waste package remediation cells where the special nuclear material is exposed or not protected by any qualified enclosure or pools. This zone is maintained at the lowest negative pressure differential relative to the secondary confinement zone.

- **Secondary Confinement Ventilation Zone**. This zone is considered to have high potential for contamination and comprises areas such as the disposal container (DC) decontamination cell, DC load cell, DC handling cell, and the canister transfer cell where special nuclear material is handled in approved but potentially unsealed enclosures. This zone is maintained at a negative pressure differential relative to the outside environment but higher than the primary confinement zone.

- **Tertiary Confinement Ventilation Zone**. This zone is considered to have low potential for contamination and comprises occupied areas such as operating galleries, corridors, HVAC equipment areas, and fuel storage pool areas that are usually free of contamination but which may be subject to unplanned low levels of airborne radioactive contamination. This zone is maintained at a lower negative pressure differential relative to the outside environment but higher than the secondary confinement zone.

The rationale for the compartmentalization defined above will be confirmed by future analysis that considers the type, quantity, physical and chemical form, and packaging of the material handled in the facility.

2.3.3 Confinement Zone Ventilation System

Each of the primary, secondary, and tertiary contamination confinement zones described in the previous section is provided with a separate, parallel, continuously operating ventilation subsystem. In addition, an emergency ventilation subsystem with emergency power and 100 percent redundancy is provided to satisfy the requirements of the primary contamination confinement zone. The ventilation system serving the three contamination confinement zones is classified as Quality-Level 2 (QL-2), as indicated in Appendix B, Table 8. Each subsystem is comprised of components for air moving, air conditioning, air cleanup, air distribution ductwork, and associated control and monitoring capabilities.

Ventilation for the primary and the secondary confinement zones (areas that are normally contaminated and areas with high potential for airborne radioactive or hazardous contamination) is provided by once-through ventilation subsystems. Ventilation for the tertiary confinement zone (occupied areas that are usually free of contamination but which may be subject to unplanned low levels of airborne radioactive contamination) is provided by a recirculation ventilation subsystem. The ventilation flow diagram for the contamination confinement zones is illustrated in Figure 3.

2.3.3.1 System Functional Description

Each of the ventilation subsystems is comprised of a supply air side that conditions the air for health, safety, and comfort; and an exhaust air side to clean the air before discharge to the outside environment. The supply air side of the system is comprised of air-handling units, fans, and associated air distribution ductwork. Each air-handling unit consists of pre-filter, final filters, heating coils, cooling coils, and a humidifier (where required). The outside air for each of the confinement zones subsystems is introduced through a wall intake structure with bird screen designed to withstand the effects of rain, snow, tornado, high winds, dust, sand, debris, and wind-generated missiles. The supply air intake structure is located away from the exhaust air side of the system to prevent contamination of the supply air.

The exhaust air side of the system is comprised of air-cleaning units with HEPA filters, exhaust fans, associated exhaust ductwork, and exhaust air stack. The air-cleaning units are equipped with 90 percent (minimum) prefilters/moisture separators and HEPA filters that are arranged in banks with adequate spacing for routine in-place testing, filter element replacement, and monitoring. The air-cleaning unit for the primary confinement area is equipped with two stages of 99.97 percent HEPA filters in series. The air-cleaning unit for the secondary and tertiary confinement areas must be equipped with at least one stage of 99.97 percent HEPA filters. However, the number of stages of HEPA filtration necessary for the removal of airborne radioactive contaminants, as required to meet the quantity and concentration that may be released to the environment, is to be determined by safety analysis. In the absence of such analysis, a *typical* two-stage HEPA filtration system is provided in the air-cleaning unit for all three contamination confinement zones. The air recirculation subsystem serving the tertiary contamination confinement zone has the capability to go to a once-through ventilation mode during an off-normal event by closing the normally open recirculation control dampers and opening the normally closed isolation dampers via controlled interlocks. Therefore, the air recirculation/air-cleaning unit for the occupied areas of the tertiary confinement zone is also provided with two stages of HEPA filtration.

The exhaust air from each of the confinement zones is picked up at strategic locations of the rooms/areas for efficient removal of heat and airborne contaminants. The exhaust fans from each confinement zone discharge the air to the outside environment through a common exhaust stack at least 12 feet higher than the highest point on the WHB or adjacent structures. The exhaust stack is designed to withstand maximum predicted wind loads and applicable DBEs. The air is continually discharged to the outside environment through the HEPA filters and the stack during normal and off normal conditions. The filtered exhaust air is continuously monitored for radioactive contamination by a stack Continuous Air Emission Monitoring (CAEM) System to ensure that the discharge air complies with the effluent control guidelines established by the project.

The supply air intakes and air exhaust penetrations are provided with tornado dampers and missile protection. The tornado dampers are designed to close automatically to prevent the reversal of contaminated airflow and to protect the WHB from dangerous negative pressures induced by the effect of the high winds.

The monitoring and control of the ventilation system operations is provided with audible and/or visual alarms for off normal conditions and equipment failures. The operation of the supply air fans and the exhaust air fans is interlocked to prevent pressurization of the confinement zones. The system interfaces with the Monitored Geologic Repository Operations Monitoring and Control System and with the Site Radiological Monitoring System.

2.3.3.2 Emergency Ventilation Subsystem

An emergency ventilation subsystem with emergency power and 100 percent redundancy is provided to satisfy the requirements of the primary contamination confinement zone. The subsystem is energized to provide once-through ventilation to maintain the safety function of the primary confinement zone during a power failure. The system is designed with the same components comprising the normal ventilation system. The subsystem is sized to provide some cooling of internal heat loads caused by decay of any present nuclear material and to maintain the facility at a negative pressure differential relative to the outside environment to ensure airflow direction from the lesser to the greater contaminated zone.

The supply air is introduced, firstly, to areas of the secondary confinement zone where high internal heat loads may occur. Next, the air is drawn along with any in-leakage to the primary confinement zone through exhaust ductwork by air-cleaning units with HEPA filtration and exhaust fans and discharged to the outside environment through the stack. This subsystem configuration, where the exhaust is equal to the sum of the supply air added to in-leakage, ensures continuous airflow direction toward the primary confinement zone and the discharge of air through the air-cleaning units and the stack.

2.3.3.3 Major System Features and Characteristics

The enclosure of the system in its entirety within the WHB facilitates radiation protection and provides utility, maintenance, and safety measures required for operation. The objectives of efficient maintainability are achieved by housing the system components in designated equipment rooms. The ventilation equipment rooms are sized to allow sufficient space for servicing and replacement operations, in-place testing, and space for miscellaneous associated or auxiliary systems. The equipment rooms/areas are configured so that the supply air (clean-air side) of the system is located away from the effluents discharge from potentially contaminated areas. This feature minimizes the potential for re-entrainment of contaminants by the outside air intakes of the system.

The contamination confinement subsystems are provided with all the accessories necessary for isolation, volume control, and pressure differential control to satisfy the requirements of each of the confinement zones. Pressure differential control is maintained in each of the contamination confinement zones to ensure an airflow pattern from areas of lesser potential for contamination to areas of greater potential for contamination by airborne radioactive or hazardous materials. Isolation of the contaminated or potentially contaminated areas of the WHB from the non-confinement areas is provided by ventilated airlocks or vestibules to prevent cross contamination within the facility.

The confinement ventilation SSCs essential to perform confinement functions are designed to ensure that a single failure does not result in the loss of its capability to accomplish its required safety functions. To protect against single failures, the system includes appropriate redundancy and diversity to minimize the possibility of concurrent common-mode failures. The system is also provided with features to withstand or mitigate the consequences of internal and external missile impacts, and to withstand the seismic events as assigned. The emergency ventilation system that serves the primary contamination confinement zone also ensures a continuous airflow direction during a loss of primary power from the least contaminated areas to the most contaminated areas and final air discharge to the outside environment through air-cleaning units and exhaust stack.

Each subsystem is comprised of several modular components for system diversity so that any one component can be completely isolated in case of failure, or shut down for maintenance. These features allow the remaining associated components to continue to maintain their required system functions. The resulting system configuration provides a high degree of system reliability.

2.3.4 Non-Confinement Zone Ventilation System

Ventilation of the non-confinement zone (uncontaminated areas) of the WHB is provided by a recirculation air system that is separate and independent from the ventilation system that serves the contamination confinement zones. The system is designed to have the capability for filtering any adverse elements in the air for protection of the health of the occupants. The system supplies at least the minimum quantity of outside air to meet the requirements for acceptable indoor air quality. The system is of Conventional Quality (CQ) as indicated in Appendix B, Table 8.

The non-confinement ventilation system is comprised of components for air moving, air conditioning, air distribution ductwork, and associated controls and monitoring capabilities. Supply air is introduced through outside air intake louvers and mixed with recirculated air. The air-handling unit filters, conditions, and supplies the mixed air to each room/area based on thermal considerations. Local thermostats control the thermal condition of the rooms/areas. Exhaust air from the system is discharged to the outside environment by exhaust fans and associated ductwork. The flow diagram for the non-confinement zone ventilation is illustrated in Figure 4.

Computer and control rooms are provided, with a separate and independent ventilation system with redundant components, to ensure continuous operation and close control of environmental conditions during normal as well as during off-normal conditions. Audible and visual alarms are provided to alert personnel to conditions that affect system performance. The non-confinement areas are maintained at a positive pressure differential relative to the confinement zones to prevent cross contamination.

2.3.5 Other System Features or Characteristics

The WHB Ventilation System incorporates several additional features related to areas of safety, surveillance, ALARA, off-normal event and DBE mitigation, decontamination, and decommissioning. This section will be updated in future revisions of this SDD as the design of the system progresses.

2.4 COMPONENT DESCRIPTION

This information will be provided in a future revision of this document.

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 mature.

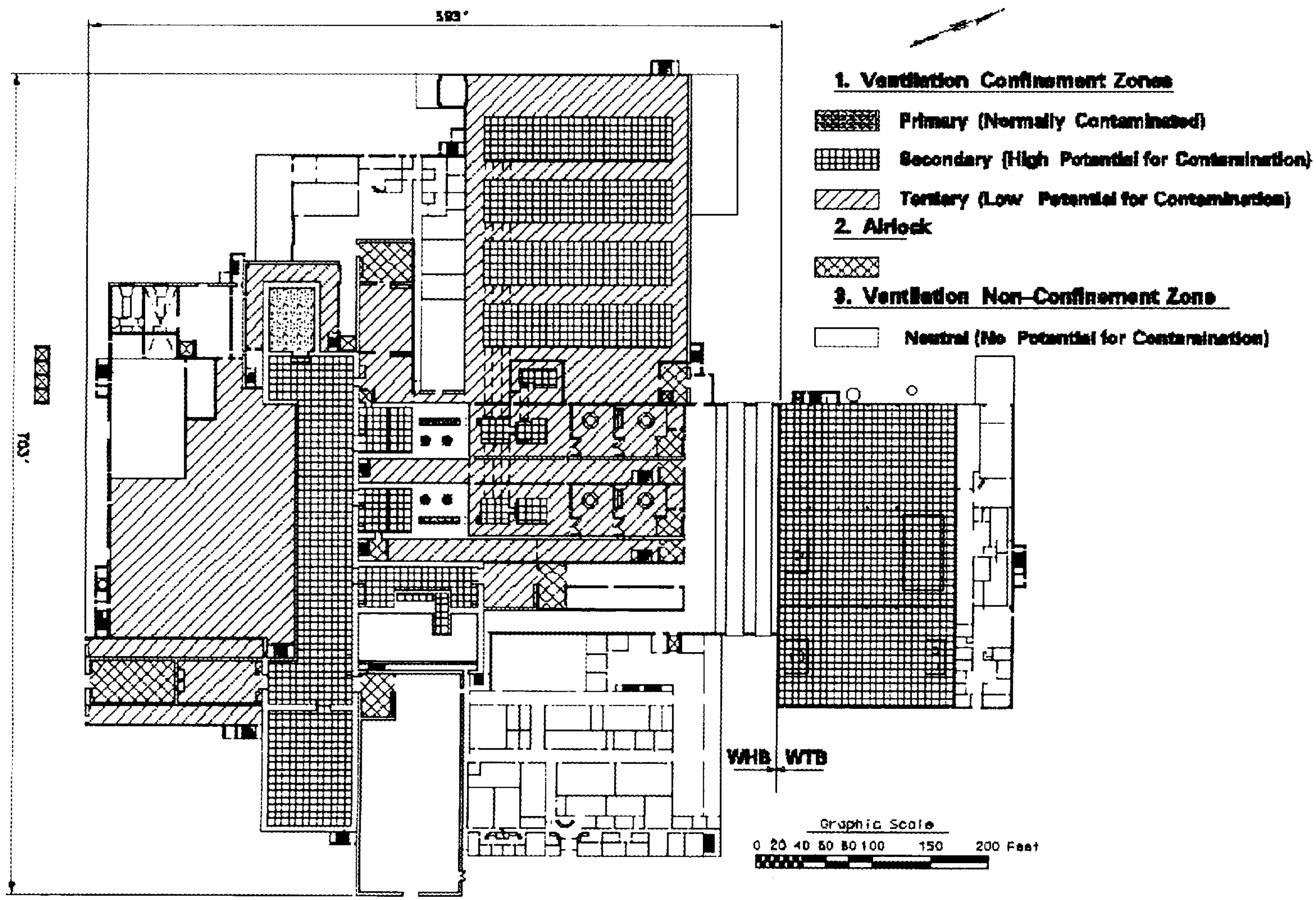

Figure 1. Waste Handling/Waste Treatment Building Confinement Zone Configuration –Grade Level

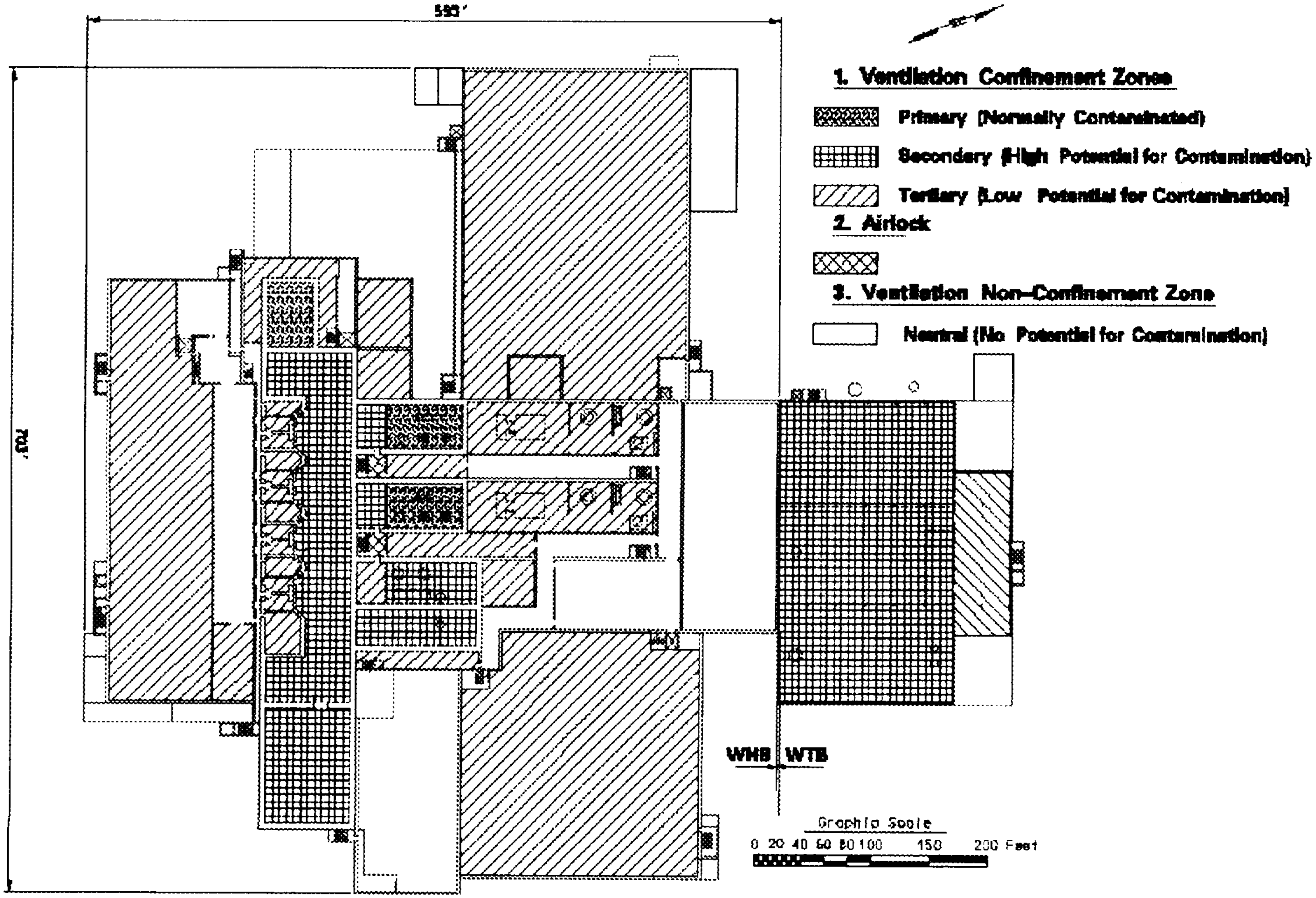

Figure 2. Waste Handling/Waste Treatment Building Confinement Zone Configuration –30' Above Grade Level

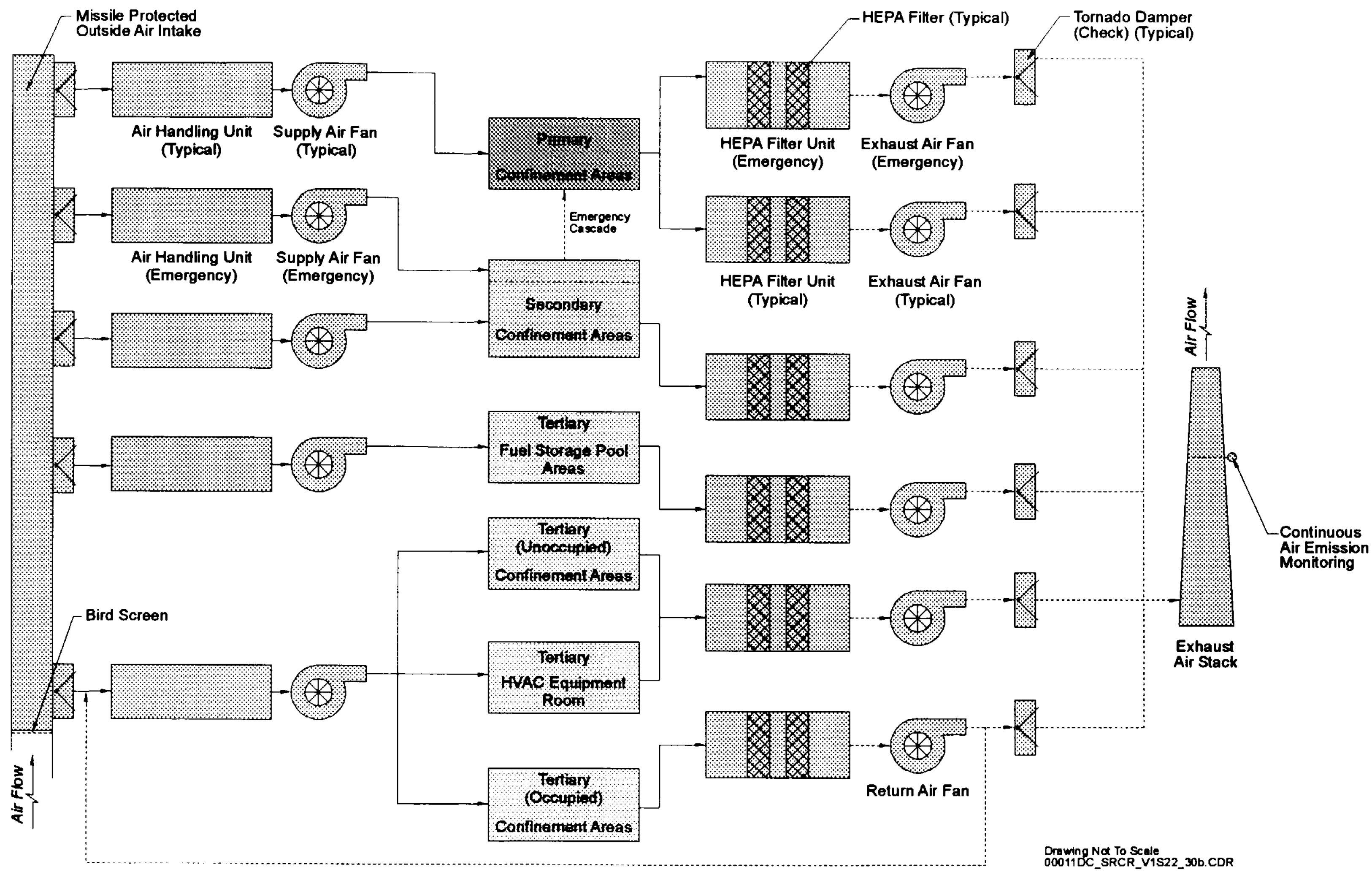

Figure 3. Waste Handling Building Confinement Areas HVAC Flow Diagram

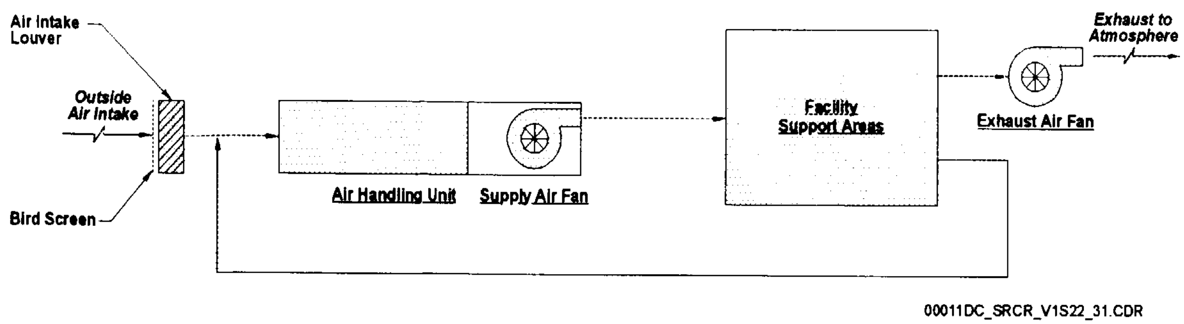

Figure 4. Waste Handling Building Non-Confinement Areas HVAC Flow Diagram

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 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 is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on the HVAC system design requirement in Section 6.6.2.1.5 of the "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988), which requires control of the interior ambient temperatures and humidity within limits defined by equipment and personnel requirements.

II. Criterion Performance Parameter Basis

Normally Occupied Areas (Normal Conditions): Design temperatures of 76 degrees F for summer and 72 degrees F for winter are from Appendix E of ANSI/ANS-57.7-1988. This appendix provides the typical normal temperatures for summer and winter for a spent fuel storage and handling facility similar to the MGR. The specified temperatures are within the ASHRAE recommended comfort zone shown in Figure 4 of Chapter 8 of the ASHRAE "Fundamentals" handbook.

Normally Occupied Areas (Off-Normal Conditions): Temperature control during off-normal conditions (e.g., loss of power, equipment failure) is not required.

Normally Unoccupied Areas (Normal Conditions): Design temperatures of 90 degrees F for summer and 65 degrees F for winter are taken from Appendix E of ANSI/ANS-57.7-1988. Appendix E provides the typical normal temperature ranges for summer and winter for a spent fuel storage and handling facility similar to the MGR. The specified temperatures apply to areas that are not expected to be occupied for a full shift, but in which occasional or intermittent occupation may be required. These temperatures are deemed appropriate for short-term occupancy and most mechanical and electrical components. Special cooling/heating provisions must be provided if temperature limits specified by an equipment manufacturer do not fall within the range specified in Table 1 of this document.

Normally Unoccupied Areas (Off-Normal Conditions): Temperature control during off-normal conditions (e.g., loss of power, equipment failure) is not required.

Unoccupied Areas (Normal Conditions): Occupancy in the unoccupied areas is not expected except under special circumstances. Therefore, the main purpose of temperature control in these areas is protection of the electric equipment. Experience indicates that 104 degrees F is the typical maximum design ambient temperature during normal operations for areas that are not occupied but house electrical equipment in facilities similar to the MGR, such as nuclear power plants. The minimum design temperature of 65 degrees F for winter is from Appendix E of ANSI/ANS-57.7-1988. Appendix E provides the typical normal temperatures for summer and winter for a spent fuel storage and handling facility similar to the MGR. A temperature of 65 degrees F is deemed appropriate for most mechanical and electrical components. Special cooling/heating provisions must be provided if temperature limits specified by an equipment manufacturer do not fall within the range specified in Table 1 of this document.

Unoccupied Areas (Off-Normal Conditions): Temperature control during off-normal conditions (e.g., loss of power, equipment failure) is not required.

Electronics Equipment Areas (Normal Conditions): Design summer and winter temperature of 72 degrees F is from Table 1, Chapter 16 of the "Heating, Ventilating and Air-Conditioning Applications." According to this reference, the specified temperature is typical of the temperature environment recommended by most computer equipment manufacturers. The specified temperature of 72 degrees F is within the limits of 18 to 27 degrees C (64 to 81 degrees F) provided in Table 1 of the "Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity" (ANSI/ISA-S71.01-1985), for Class A (Air Conditioned - Severity Level 1) locations. This standard establishes temperature and humidity conditions for industrial process measurement and control equipment. It should be noted that the provided range does not allow the control system to modulate in the specified range, as Note 'd' of Table 1 requires that the operating temperature be selected from the limits provided in the standard. The specified temperature of 72 degrees F is also within the temperature limits of 20 to 23 degrees C (68 to 73 degrees F) for Equipment Group (1)(a) provided in Table 10 of the "IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automatic Control" (IEEE C37.1-1994). Section 6 of this standard contains a definition of the environment in which control and data acquisition equipment are required to operate. Strict compliance with this IEEE standard is not required; however, the information contained in the standard is used as a guideline.

Electronics Equipment Areas (Off-Normal Conditions): Equipment located in these areas is generally more sensitive to high temperatures and has a more significant impact on the overall operations at the repository. Therefore, the ventilation system is required to make provisions to maintain a temperature of 72 degrees F during off-normal (e.g., loss of power, equipment failure) conditions also. This requirement is especially important in cases where the computer, communications, or data processing equipment is required to operate during a power outage.

The 2-degree F margins shown in Table 1 are provided for system performance variations.

1.2.1.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on the requirement in Section 6.6.2.1.5 of "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988), which requires the individual building areas to be thermostatically controlled to maintain temperature and humidity within limits defined by equipment and personnel requirements.

Humidity is not controlled in WHB areas that are not normally occupied or do not house electronics components. This is due to 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. Generally, prolonged exposure to low or high humidity environments is required before a component is damaged. If a component located in these areas (unoccupied areas) requires humidity control, as specified by the manufacturer, special provisions must be provided.

II. Criterion Performance Parameter Basis

Normally Occupied Areas (Normal Conditions): The design humidity range of 30 to 60 percent for summer and winter is based on the human comfort criteria available in various sources. In Table 1 of Chapter 3 of the "Heating, Ventilating and Air-Conditioning Applications," a humidity value of 20 to 30 percent for winter, and 50 to 60 percent for summer is specified for office buildings. Considering the indoor temperature requirement of 72 degrees F in winter and 76 degrees F in summer, a humidity range of 30 to 60 percent would place the normally occupied areas within the ASHRAE summer and winter comfort zone shown in Chapter 8, Figure 4 of the ASHRAE "Fundamentals" handbook.

Electronics Equipment Areas: The design humidity range of 40 to 50 percent for summer and winter is based on several sources. Table 1 of Chapter 16 of the "Heating, Ventilating and Air-Conditioning Applications" specifies a humidity value of 50 percent for typical computer room design conditions based on the recommended value by most computer equipment manufacturers. The specified humidity range of 40 to 50 percent is within the limits (35 to 75 percent) provided in Table 1 of the "Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity" (ANSI/ISA-S71.01-1985) for Class A (Air Conditioned Severity Level 1) locations. This standard establishes temperature and humidity conditions for industrial process measurement and control equipment. It should be noted that the provided range does not allow the control system to modulate in the specified range, as Note 'd' of Table 1 requires that the operating humidity environment be selected from the limits provided in the standard. The specified humidity range of 40 to 50 percent is also within the limits (40 to 60 percent for Equipment Group (1)(a)) provided in Table 10 of the "IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automatic Control" (IEEE C37.1-1994). Section 6 of this standard contains a definition of the environment in which control and data acquisition equipment are required to operate. Strict compliance with this IEEE standard is not required; however, the information contained in the standard is used as a guideline.

1.2.1.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion establishes the outside design requirements for the heating and cooling load calculations. Use of applicable and accurate environmental data (and other parameters) is essential in calculation of heating and cooling loads. The data provided in Table 3 of this document is not intended to be all-inclusive (the design organization may obtain additional data from qualified sources as required). However, deviations from the specific parameters that are provided in Table 3 must be documented.

II. Criterion Performance Parameter Basis

The outside design conditions are obtained from Tables 1A and 1B in Chapter 26 of the ASHRAE "Fundamentals" handbook. Selection of Mercury, Nevada as the representative site is appropriate because it is close to and representative of the conditions in the North Portal area.

1.2.1.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion establishes the requirement for maintaining pressure zones in the WHB. Pressure zones are required for controlling contamination within the facility. As required by various ventilation design standards, three confinement areas are defined for a facility: primary, secondary, and tertiary. The WHB will be analyzed by the design organization to determine the confinement requirements based on the level of hazard in each zone. Maintaining negative pressure for each confinement area is required during all normal and off-normal modes of system operation.

This criterion is based on the requirements, recommendations, and guidelines provided in Section 2.2.1 of the "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21); Sections 1 and 2 of the "Heating, Ventilating, and Air-Conditioning Design Guide for Department of Energy Nuclear Facilities" (ASHRAE DG-1-93), and Section 6.6 of "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988).

MGR RD 3.1.C requires compliance with 10 CFR 63. This criterion supports the general requirement in 10 CFR 63.112(e)(1), which requires the performance analysis of the SSCs that are important to safety to include consideration of a means to limit concentrations of radioactive materials in air. Maintaining the specified negative pressures in areas with contamination present, or with potential for contamination, will help limit concentration of radioactive materials in air. This requirement also supports 10 CFR 63.111(a)(1).

This criterion is supported by Guidance Statements 6.4g1, 6.6g1, 6.8g1, and 7.1g2 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The primary, secondary, and tertiary confinement pressure requirement values are from Section 2 of the "Heating, Ventilating, and Air-Conditioning Design Guide for Department of Energy Nuclear Facilities." Pressure requirements for primary areas relative to tertiary areas are derived by adding the pressure requirements for primary to secondary areas to the pressure requirements for secondary to tertiary areas.

The additional requirement for secondary confinement (0.25 inwg with respect to atmosphere) is from "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988), Section 6.6.2.2.3.2. Based on this requirement, the secondary confinement area is not only required to be maintained at a negative pressure of 0.1 to 0.15 inwg with respect to the tertiary confinement area, but also, it is required to be maintained at a minimum of 0.25 inwg with respect to the atmosphere.

Maintaining positive pressure in non-confinement areas is a common industry practice. The specified +0.15 inwg is of similar magnitude to required pressure differentials between confinement areas.

1.2.1.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion establishes the requirement for the minimum outside air to be supplied to the occupied areas. Adequate outside air is one of the factors in the design of a ventilation system that can affect employee safety, health, and comfort.

II. Criterion Performance Parameter Basis

The minimum requirements are obtained from Table 2 of "Ventilation for Acceptable Indoor Air Quality" (ANSI/ASHRAE 62-1989).

1.2.1.6 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. The criterion is based on the general requirement in 10 CFR 63.112(e)(1), which requires the performance analysis of the SSCs that are important to safety to include consideration of a means to limit concentrations of radioactive materials in air. This criterion also supports MGR RD 3.1.B and the performance objective in 10 CFR 63.111(a)(1), which requires the geologic repository operations area to provide protection against radiation exposures and release of radioactive material by meeting the requirements of "Standards for Protection Against Radiation" (10 CFR 20).

This criterion also supports MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is supported by the requirement in Section 6.6.2.2.3.1 of "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988), which requires that subsystems with high potential for contamination be designed for once-through flow.

II. Criterion Performance Parameter Basis

N/A

1.2.1.7 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. The criterion is based on the general requirement in 10 CFR 63.112(e)(1), which requires the performance analysis of the SSCs that are important to safety to include consideration of a means to limit concentrations of radioactive materials in air. This criterion supports MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. This criterion also supports MGR RD 3.1.B and the performance objective in 10 CFR 63.111(a)(1), which requires the geologic repository operations area to provide protection against radiation exposures and release of radioactive material by meeting the requirements of "Standards for Protection Against Radiation" (10 CFR 20).

This criterion establishes the requirement for exhaust airflow patterns to be from areas of low potential for contamination to areas of higher potential for contamination. This requirement helps reduce the potential for cross contamination within the facility. This criterion is based on Section 6.6.2.1.2 of "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988).

This criterion is supported by Guidance Statements 6.4g1, 6.6g1, 6.8g1, and 7.1g2 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.1.9 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; and MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on the general requirement of designing the ventilation subsystems based on the level of potential for airborne radioactive contamination. This requirement helps reduce the potential for cross contamination within the facility. This criterion is supported by the requirements in Section 6.6 and Section 6.6.3.1 of "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988).

This criterion also supports the general requirement in 10 CFR 63.112(e)(1), which requires the performance analysis of the SSCs that are important to safety to include consideration of means to limit concentrations of radioactive materials in air. Limiting physical interface between areas with contamination potential and areas with no contamination potential will help limit concentration of radioactive materials in air. This criterion also supports MGR RD 3.1.B and the performance objective in 10 CFR 63.111(a)(1), which requires the geologic repository operations area to provide protection against radiation exposures and release of radioactive material by meeting the requirements of "Standards for Protection Against Radiation" (10 CFR 20).

This criterion is supported by Guidance Statement 6.4g1 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.1.10 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.3.A. This requirement is supported by the general performance requirement in Section 5.6.3 of "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988), which requires the ventilation system be designed and installed with the capability to collect airborne particulate radioactive materials during normal operations of the facility.

This criterion is supported by Guidance Statements 6.2g6 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The specific requirement for the use of 90 percent prefilters, and 99.97 percent HEPA filter banks for all confinement areas, is based on Sections 6.6.2.2.2.1 and 6.6.2.2.3.1 of ANSI/ANS-57.7-1988, which require the exhaust air from areas with potential for contamination be filtered through 90 percent ASHRAE prefilters and 99.97 percent HEPA filters in series.

The requirement for two stages of HEPA filters for the primary confinement area is based on Section 2.2.1 of the "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21), which states: "Air exhausted from occupied or occasionally occupied areas shall be passed through prefilters and at least one stage of HEPA filters. Contaminated and potentially contaminated air exhausted from a hot cell, cave, canyon, glove box, or other primary containment structure or vessel shall be passed through at least two individually testable stages of HEPA filters in series plus prefilters, adsorbers, scrubbers, or other air cleaning facilities as required by the particular application."

1.2.1.11 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.C and 3.3.A. The criterion is based on the general requirement in 10 CFR 63.112(e)(1), which requires the performance analysis of the SSCs that are important to safety to include consideration of a means to limit concentrations of radioactive materials in air. This criterion also supports MGR RD 3.1.B and the performance objective in 10 CFR 63.111(a)(1), which requires the geologic repository operations area to provide protection against radiation exposures and release of radioactive material by meeting the requirements of "Standards for Protection Against Radiation" (10 CFR 20).

This criterion is based on Section 6.6.2.2.2.2 of "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988), which requires filtration of the recirculated air through a HEPA filter unit to prevent buildup of radioactive particulates in the air.

This criterion is supported by Guidance Statement 6.2g6 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.1.12 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; and MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on the general requirement in 10 CFR 63.112(e)(1), which requires the performance analysis of the SSCs that are important to safety to include consideration of a means to limit concentrations of radioactive materials in air. This criterion also supports MGR RD 3.1.B and the performance objective in 10 CFR 63.111(a)(1), which requires the geologic repository operations area to provide protection against radiation exposures and release of radioactive material by meeting the requirements of "Standards for Protection Against Radiation" (10 CFR 20).

This criterion is also based on Section 6.5.1.1.4 of "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992), which invokes the requirement for precluding flow of air from areas of higher potential for contamination to areas of lower contamination. This requirement is supported by the general concept of minimizing the potential for spread of contamination within the WHB during system normal operations and operational transients.

This criterion is supported by Guidance Statements 6.4g1 and 6.5g1 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.1.13 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; and MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on 10 CFR 63.112(e)(4) and 63.112(e)(10), which require the performance analysis of the SSCs that are important to safety to include consideration of means to monitor and control the dispersal of radioactive contamination and radioactive effluents.

This criterion is also based on "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21), Section 5.6.7; and "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992, Section 6.5.3). These documents require adequate instrumentation and controls to assess system performance and continuous monitoring (and alarm) of radioactive material level in confinement exhaust systems. In addition, "Nuclear Power Plant Air-Cleaning Units and Components" (ASME N509-1989), Section 4.9.2, requires design of adequate instrumentation (with appropriate alarms setpoints) for safety related and non-safety related air cleaning units. Instrumentation requirements are tabulated in Tables 4-1 and 4-2 of ASME N509-1989.

This criterion is supported by Guidance Statements 6.2g6, 6.2g12, and 7.1g3 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.1.14 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on "Nuclear Power Plant Air-Cleaning Units and Components" (ASME N509-1989, Section 4.9.4), which requires status indication of all equipment powered or controlled electrically. The required indications are tabulated in Tables 4-1 and 4-2 of ASME N509-1989.

This criterion is supported by Guidance Statement 6.2g6 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.1.15 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion establishes the requirement to provide adequate instrumentation and controls to detect and isolate equipment failures.

This criterion is based on "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21, Section 5.6.5), which provides a discussion on the importance of designing a reliable control system for the ventilation system.

This criterion is supported by Guidance Statement 6.2g6 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.1.16 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.

1.2.2.1.1 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 perform its safety functions during a loss of primary electric power. This criterion is based on 10 CFR 63.112(e)(11), which requires the performance analysis of the SSCs that are important to safety to include consideration of the means to provide reliable and timely emergency power to instruments, utility service systems, and operating systems important to safety if there is a loss of primary electric power. 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).

This criterion is supported by Guidance Statement 6.2g13 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.2.1.2 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 a design basis earthquake. This criterion is based on 10 CFR 63.112(e)(8), which requires the performance analysis of the SSCs that are important to safety to include consideration of the "Ability of structures, systems, and components to perform their intended safety functions, assuming the occurrence of design basis events." 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).

This criterion is supported by Guidance Statements 6.2g9 and 6.4g7 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

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 is based on the performance objective in 10 CFR 63.111(a)(2), which limits the annual dose to any member of the public. This criterion is also based on 10 CFR 63.112(e)(1) and 63.112(e)(4), which require the performance analysis of the SSCs that are important to safety to include consideration of means to limit concentration of radioactive materials in air and control the dispersal of radioactive contamination.

This criterion also supports DBE analyses that have taken credit for the system's filtration efficiency. "Design Basis Event Frequency and Dose Calculation for Site Recommendation" (Section 3.23) assumes 99 percent of particulate radionuclide releases are retained by the system.

II. Criterion Performance Parameter Basis

The 99 percent efficiency parameter is taken from "Design, Testing, and Maintenance Criteria for Postaccident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants" (Regulatory Guide 1.52), Section C.5.

1.2.2.1.4 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 have the capability to perform its important to safety functions during and after design basis events. This criterion is based on 10 CFR 63.112(e)(8), which requires the performance analysis of the SSCs that are important to safety 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. 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).

This criterion is supported by Guidance Statements 6.2g15, 6.2g27, and 6.4g6 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

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

1.2.2.1.5 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 important to safety 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 a 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).

This criterion is supported by Guidance Statements 6.2g15 and 6.4g6 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

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.

1.2.2.1.6 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)."

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.

This criterion also supports MGR RD 3.3.A, which requires compliance with the applicable industry codes and standards. 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."

This criterion is supported by Guidance Statement 6.2g14 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The project ALARA program goals are to be determined.

1.2.2.1.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C, and is based on the performance objective in 10 CFR 63.111(a)(2), which limits the annual dose to any member of the public. This criterion is also based on 10 CFR 63.112(e)(1) and 63.112(e)(8), which require the performance analysis of the SSCs that are important to safety to include consideration of means to limit concentration of radioactive materials in air and the ability of the system to perform its intended safety functions assuming the occurrence of a design basis event.

This criterion ensures that the probability of failure of the confinement and filtration HVAC, during a 24-hour period following an event involving the release of radioactive materials, is less than $1x10^{-4}$. A post-accident time of 24 hours has been applied to DBE analyses as sufficient time to maintain the mitigation function while notifications, personnel evacuations, and remedial actions are taken. The probability of failure of $1x10^{-4}$

is selected to ensure that the frequency of any unmitigated release scenarios initiated by anticipated operational occurrences will be less than $1x10^{-2}$ per year (i.e., they will become Category 2 events and subject to higher allowed dose limits), and to ensure that any unmitigated release scenarios initiated by unexpected events (i.e., initiating events having a frequency less than $1x10^{-2}$ per year) will become beyond design basis events.

II. Criterion Performance Parameter Basis

The failure rate ($4.2x10^{-6}$ per hour) is derived by dividing the probability of failure ($1x10^{-4}$) by the 24-hour period following the event. The failure rate is to be verified.

1.2.2.1.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion supports MGR RD 3.1.C, and is based on the performance objective in 10 CFR 63.111(a)(2), which limits the annual dose to any member of the public. This criterion is also based on 10 CFR 63.112(e)(1) and 63.112(e)(4), which require the performance analysis of the SSCs that are important to safety to include consideration of means to limit concentration of radioactive materials in air and control the dispersal of radioactive contamination.

The design of the system must consider the heat generated by filtered radioactive materials to ensure the filters do not burn or otherwise degrade, rendering the filtration and confinement systems inoperable.

II. Criterion Performance Parameter Basis

N/A

1.2.2.2.1 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. The criterion is based on 10 CFR 63.112(e)(13), which requires the performance analysis of the SSCs that are important to safety to include consideration of the means to inspect, test, and maintain SSCs important to safety, as necessary, to ensure their continued functioning and readiness.

This criterion is supported by Guidance Statement 6.4g16 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.2.2.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards, and MGR RD 3.1.G, which requires compliance with applicable U. S. Department of Energy (DOE) Orders.

II. Criterion Performance Parameter Basis

As mandated by Section 4.l(1) of "Worker Protection Management for DOE Federal and Contractor Employees" (DOE O 440.1A), "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices" must be used when threshold limit values are more protective than the Occupational Safety and Health Administration permissible exposure limits.

1.2.2.2.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A. In addition to Criteria 1.2.1.13 and 1.2.1.14 of this document (system parameters monitoring and equipment status monitoring), this criterion invokes a requirement for auditory and visual alarms for conditions that have the potential to cause injury or death, result in equipment damage, and affect system performance.

This criterion is supported by Guidance Statement 6.2g12 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.3.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion establishes the requirement for equipment environmental compatibility.

This criterion is based on the requirement in "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988), Section 6.9.2, which states, "System components shall be designed and qualified to operate within environmental limits established for their location within the installation including but not limited to temperature, humidity, and radiation levels for the applicable performance requirements."

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

This criterion is supported by Guidance Statement 6.2g27 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The Normal Environment temperatures for all areas, and the Off-Normal Environment temperature for the Electronics Equipment Areas, are based on the performance requirements of the system, as specified in Criterion 1.2.1.1 of this document.

The Off-Normal Environment temperatures for areas that are not controlled by the ventilation system are to be determined.

1.2.3.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion establishes the requirement for equipment environmental compatibility.

This criterion is based on the requirement in "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988, Section 6.9.2), which states, "System components shall be designed and qualified to operate within environmental limits established for their location within the installation including but not limited to temperature, humidity, and radiation levels for the applicable performance requirements."

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

Humidity is not controlled during off-normal conditions because of the generally 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 is supported by Guidance Statement 6.2g27 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The Normal Environment humidity values are based on the performance requirements of the system, as specified in Criterion 1.2.1.2 of this document. Humidity environments are not controlled in the Normally Unoccupied and Unoccupied Areas, and are to be determined.

1.2.3.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion establishes the requirement for equipment environmental compatibility.

This criterion is based on the requirement in "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988, Section 6.9.2), which states, "System components shall be designed and qualified to operate within environmental limits established for their location within the installation including but not limited to temperature, humidity, and radiation levels for the applicable performance requirements."

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

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

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

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

This criterion is supported by Guidance Statements 6.2g10, 6.2g21, and 6.2g27 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The radiation environment is to be determined.

1.2.3.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards.

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, and that system components are adequately protected from the wind. This criterion establishes the wind environment for the system's safety-related buildings and structures located outside.

According to Section 6.5.2 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. Also, based on the requirements in Section 3.3.1 of "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (NUREG-0800), safety related buildings or structures must also be evaluated for the maximum wind speed. Section 3.3.1.II.1 of NUREG-0800 states: "The wind used in the design shall be the most severe wind that has been historically reported for the site and surrounding area with sufficient margin for the limited accuracy, quantity, and period of time in which historical data has been accumulated."

This criterion is supported by Guidance Statements 6.2g15, 6.2g27, and 6.4g8 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The maximum wind speed is obtained from "MGR Design Basis Extreme Wind/Tornado Analysis," Section 7.

1.2.3.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards.

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. This criterion establishes the outdoor temperature environment in which SSCs are expected to operate.

This criterion is supported by Guidance Statement 6.2g27 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The extreme outside temperature range of 5 degrees F to 117 degrees F is based on the annual extreme minimum and maximum temperatures for the nine meteorological monitoring sites located in the Yucca Mountain area. Locations of the nine sites are shown in Figure 2-1 of "Engineering Design Climatology and Regional Meteorological Conditions Report." Extreme temperatures (and other data) are given in Tables A-1 through A-9 of the report.

The collected temperature data in Tables A-1 through A-9 are based on 11 years of monitoring at Sites 1 through 5 and four years of monitoring at Sites 6 through 9. Site 1 data are typically more representative of the nine sites because it is closest to the North Portal. 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 -13.1 degrees C and Site 9 has the highest of 45.1 degrees C. This temperature range was conservatively expanded to -15 degrees C (5 degrees F) to 47 degrees C (117 degrees F).

1.2.3.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on the discussion provided in "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21).

Section 2.3.3 of ERDA 76-21 emphasizes the importance of protecting the supply air intakes from the environmental elements. Similar requirements are invoked in "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992, Sections 6.4.4.1.3 and 6.4.4.1.4). In addition, snowfall is one of the primary design parameters needed for exposed structures to ensure external loadings are accounted for.

This criterion is supported by Guidance Statements 6.2g15, 6.2g27, and 6.4g8 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The "Engineering Design Climatology and Regional Meteorological Conditions Report" includes snowfall information for sites in the general area of the Yucca Mountain that are deemed adequate for bounding the snowfall environment for the Yucca Mountain site. The closest of these sites is Desert Rock Airport, south of Mercury. Snowfall data are also included for Tonopah. Although Desert Rock is closer to Yucca Mountain, the elevation of Tonopah is more representative of the elevation at the Yucca Mountain site (5,426 ft for Tonopah based on Table 1 of Chapter 24 of "Fundamentals," and 4,850 ft for Yucca Mountain based on Table 2-1 of the climatology report). Therefore, data for Tonopah is considered to be the conservative bound for Yucca Mountain.

Table A-14 of the "Engineering Design Climatology and Regional Meteorological Conditions Report" provides daily maximum and monthly maximum snowfall data. The maximum daily snowfall for Tonopah is 10 in. (rounded up from 9.7 in.). 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 (Table A-14).

1.2.3.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on the discussion provided in "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21).

Section 2.3.3 of ERDA 76-21 emphasizes the importance of protecting the supply air intakes from the environmental elements. Similar requirements are invoked in "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992, Sections 6.4.4.1.3 and 6.4.4.1.4). In addition, humidity is a primary environmental parameter that can affect component performance and anticipated life expectancy. This criterion establishes the external humidity environment at the site.

II. Criterion Performance Parameter Basis

The humidity values are taken from "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.

1.2.3.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on the discussion provided in "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21).

Section 2.3.3 of ERDA 76-21 emphasizes the importance of protecting the supply air intakes from the environmental elements. Similar requirements are invoked in "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992, Sections 6.4.4.1.3 and 6.4.4.1.4). In addition, 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 Guidance Statements 6.2g15, 6.2g27, and 6.4g8 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

The maximum annual precipitation is derived from "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 approximately 1 to 10 in. for the period of 1949 to 1995. The bounding maximum annual precipitation of approximately 10 in. 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 "Engineering Design Climatology and Regional Meteorological Conditions Report" (p. 4-21, last 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."

1.2.3.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The criterion is based on the discussion provided in the "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21). Section 2.3.3 of this document emphasizes the importance of protecting the supply air intakes from the environmental elements.

This criterion is supported by Guidance Statements 6.2g15, 6.2g27, and 6.4g8 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.4.1 Criterion Basis Statement

I. Criterion Need Basis

The Waste Handling Building System will provide space, layout, and structural support for the system, and will supply water for heating, cooling, and humidification requirements. In addition, interface will be required for maintaining specified pressures, temperatures, and humidity environments within the WHB.

II. Criterion Performance Parameter Basis

N/A

1.2.4.2 Criterion Basis Statement

I. Criterion Need Basis

Radiation monitors will be installed in the ventilation ductwork. Also, interlocks may exist between radiation monitors and the ventilation system (e.g., fans, dampers), therefore, interface between the system and the Site Radiological Monitoring System is required.

II. Criterion Performance Parameter Basis

N/A

1.2.4.3 Criterion Basis Statement

I. Criterion Need Basis

Smoke detectors and fire dampers will be installed in the ventilation ductwork, and interlocks with the fire detection system will be required upon detection of fire or smoke or initiation of the fire suppression system. Therefore, interface between the system and the Waste Handling Building Fire Protection System is required.

This criterion is supported by Guidance Statement 6.4g3 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.4.4 Criterion Basis Statement

I. Criterion Need Basis

The system will require normal electrical power for operation of fans, chillers, dampers, and instrumentation and control systems during normal operations. Based on the requirements invoked on the system in this document, it will also require emergency power for the important-to-safety functions, and standby power to support the equipment that support personnel safety and equipment that are required to operate after the loss of normal electrical power.

II. Criterion Performance Parameter Basis

N/A

1.2.4.5 Criterion Basis Statement

I. Criterion Need Basis

The system will require extensive control and monitoring during its operation. Therefore, interface with the Monitored Geologic Repository Operations Monitoring and Control System is required.

II. Criterion Performance Parameter Basis

N/A

1.2.5.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires the design of the system to address availability requirements.

II. Criterion Performance Parameter Basis

The availability parameter is from Table 7.2-1 of "Bounded Minimum Inherent Availability Requirements for the System Description Documents" (TBV-4655).

1.2.6.1 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.E, which requires compliance with the applicable provisions of "Occupational Safety and Health Standards" (29 CFR 1910).

II. Criterion Performance Parameter Basis

N/A

1.2.6.2 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.F, which requires compliance with the applicable provisions of "Safety and Health Regulations for Construction" (29 CFR 1926).

II. Criterion Performance Parameter Basis

N/A

1.2.6.3 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. "Nuclear Power Plant Air-Cleaning Units and Components" (ASME N509-1989) is deemed applicable because the system utilizes air cleaning units similar to those in nuclear power plants. ASME N509-1989, which covers the requirements for the design of the nuclear air cleaning units, is accepted and widely utilized by the nuclear industry.

This criterion is supported by Guidance Statements 6.2g1, 6.2g2, 6.2g16, 6.2g18, 6.2g19, 6.2g20, 6.2g22, 6.2g24, 6.2g26, 6.2g28, 6.2g29, 6.2g30, 6.2g31, 6.2g33, and 7.2g1 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.6.4 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. "Testing of Nuclear Air Treatment Systems" (ASME N510-1989) is deemed applicable because the system utilizes air cleaning units that require field testing similar to what is needed by those in nuclear power plants. ASME N510-1989, which covers the field testing requirements for the design of the nuclear air cleaning units, is accepted and widely used by the nuclear industry.

This criterion is supported by Guidance Statements 6.2g17 and 6.2g32 *contained in the* "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.6.5 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. "Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)" (ANSI/ANS-57.7-1988), is a widely referenced standard which provides design criteria for systems and equipment of a facility designed for the receipt and storage of spent fuel. Operations at the WHB will be similar to such facilities. Therefore, the design criteria from this standard are deemed applicable to the system. Heating, ventilating and air-conditioning criteria are provided in Section 6.6 of this standard.

"Design of an Independent Spent Fuel Storage Installation (Water-Basin Type)" (Regulatory Guide 3.49) provides guidance from the U.S. Nuclear Regulatory Commission on the use of ANSI/ANS 57.7-1988.

This criterion is supported by Guidance Statements 6.5g1, 7.1g1, 7.1g2, and 7.1g3 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.6.6 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. "Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)" (ANSI/ANS-57.9-1992) is a widely referenced standard which provides design criteria for systems and equipment of a facility designed for the receipt and storage of spent fuel. Operations at the WHB will be similar to such a facility. Therefore, the design criteria from this standard are deemed applicable to the system.

II. Criterion Performance Parameter Basis

N/A

1.2.6.7 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. "Nuclear Air Cleaning Handbook, Design, Construction, and Testing of High-Efficiency Air Cleaning Systems for Nuclear Application" (ERDA 76-21) is an extensive collection of design, construction, and testing requirements for air cleaning systems for nuclear applications, and is deemed applicable to this system.

This criterion is supported by Guidance Statements 6.2g23, 6.2g25, 6.2g30, 7.5g1, 7.5g2, 7.5g3, 7.5g4, 7.5g5, 7.5g6, 7.5g7, 7.5g8, and 7.5g10 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.6.8 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. The cited references, ASHRAE "Fundamentals"; "ASHRAE Handbook - Heating, Ventilating, and Air-Conditioning Systems and Equipment"; "Heating, Ventilating, and Air-Conditioning Applications"; and the ASHRAE handbook "Refrigeration" provide industry-wide accepted guidelines and design information for all ventilation system applications, and are deemed applicable to the system.

II. Criterion Performance Parameter Basis

N/A

1.2.6.9 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. "Standard for the Installation of Air Conditioning and Ventilating Systems" (NFPA 90A) is used industry-wide and is deemed applicable to the design of the system.

II. Criterion Performance Parameter Basis

N/A

1.2.6.10 Criterion Basis Statement

I. Criterion Need Basis

Design, selection, arrangement, configuration, and integration of 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) standard in conjunction with the other HFE standards and guidelines cited in this document, will provide a human-system interface that maximizes performance and minimizes risk to personnel.

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.11 Criterion Basis Statement

I. Criterion Need Basis

Maintainability of system equipment involves many factors, including the human-machine interface. This interface must address the design for maintainability through the incorporation of HFE criteria. In support of MGR RD 3.3.A, this criterion ensures 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

1.2.6.12 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.13 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.3.A, which requires compliance with applicable industry codes and standards. "Code on Nuclear Air and Gas Treatment" (ASME AG-1-1997) provides a methodology for the design of the components of HVAC systems and is deemed applicable to the system.

This criterion is supported by Guidance Statement 7.4g1 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.6.14 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.G, which requires compliance with applicable codes, standards, and regulations. "General Design Guide for Ventilation Systems for Fuel Reprocessing Plants" (Regulatory Guide 3.32) provides design guidance for ventilation systems required to prevent the uncontrolled release and dispersal of airborne radioactive material.

This criterion is supported by Guidance Statements 6.4g1, 6.4g2, 6.4g3, 6.4g5, 6.4g6, 6.4g7, 6.4g8, 6.4g9, 6.4g10, 6.4g11, 6.4g12, 6.4g13, 6.4g14, 6.4g15, 6.4g16, 6.4g17, 6.4g18, and 6.4g19 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.6.15 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.G, which requires compliance with applicable codes, standards, and regulations. This criterion identifies "Manual Initiation of Protective Actions" (Regulatory Guide 1.62) as applicable to the design of the system.

This criterion is supported by Guidance Statements 6.3g1, 6.3g2, and 6.3g3 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.6.16 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.G, which requires compliance with applicable codes, standards, and regulations. This criterion identifies Section 9.4.2 of "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (NUREG-0800) as applicable to the design of the system.

This criterion is supported by Guidance Statements 6.8g1, 6.8g2, 6.8g3, and 6.8g4 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.6.17 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.B, which requires compliance with applicable provisions of "Standards for Protection Against Radiation" (10 CFR 20).

II. Criterion Performance Parameter Basis

N/A

1.2.6.18 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

1.2.6.19 Criterion Basis Statement

I. Criterion Need Basis

This criterion is needed to support MGR RD 3.1.G, which requires compliance with applicable codes, standards, and regulations. This criterion identifies "Design, Testing, and Maintenance Criteria for Postaccident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants" (Regulatory Guide 1.52) as applicable to the design of the system.

This criterion is supported by Guidance Statements 6.2g1, 6.2g2, 6.2g4, 6.2g5, 6.2g6, 6.2g8, 6.2g9, 6.2g10, 6.2g12, 6.2g13, 6.2g14, 6.2g15, 6.2g16, 6.2g17, 6.2g18, 6.2g19, 6.2g20, 6.2g21, 6.2g22, 6.2g23, 6.2g24, 6.2g25, 6.2g26, 6.2g27, 6.2g28, 6.2g29, 6.2g30, 6.2g31, 6.2g32, and 6.2g33 contained in the "MGR Compliance Program Guidance Package for the Waste Handling Building Ventilation System."

II. Criterion Performance Parameter Basis

N/A

1.2.6.20 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to support MGR 3.1.G and to ensure exhaust air from the system, in combination with total site emissions, complies with federal regulations. "National Primary and Secondary Ambient Air Quality Standards" (40 CFR 50) provides air quality standards with which the system must comply. Design of monitors described in the appendices to 40 CFR 50 are not applicable to this system.

II. Criterion Performance Parameter Basis

N/A

1.2.6.21 Criterion Basis Statement

I. Criterion Need Basis

This criterion is required to support MGR 3.1.G and to ensure exhaust air from the system complies with federal regulations. "National Emission Standards for Hazardous Air Pollutants" (40 CFR 61), Subpart H provides exhaust emission standards with which the system must comply.

II. Criterion Performance Parameter Basis

N/A

1.2.6.22 Criterion Basis Statement

I. Criterion Need Basis

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

This criterion supports MGR RD 3.3.A. The DOE Good Practices Guide "Human Factors Engineering" (GPG-FM-027, paragraph 2.3.1), supports the use of NUREG-700. NUREG-0700, Sections 6.1 through 6.9, provide specific HFE design guidelines for control room elements.

II. Criterion Performance Parameter Basis

N/A

1.2.6.23 Criterion Basis Statement

I. Criterion Need Basis

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

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.24 Criterion Basis Statement

I. Criterion Need Basis

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

II. Criterion Performance Parameter Basis

N/A

1.2.6.25 Criterion Basis Statement

I. Criterion Need Basis

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

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

II. Criterion Performance Parameter Basis

N/A

APPENDIX B ARCHITECTURE AND CLASSIFICATION

The system architecture and QA classification are identified in Table 8. The QA classifications are established in "Classification of the Waste Handling Building Ventilation System" (Input Transmittal RSO-RSO-00054.T).

Table 8. System Architecture and Quality Assurance Classification

Waste Handling Building Ventilation System	QL-1	QL-2	QL-3	CQ
Confinement Area Ventilation System				
Primary Confinement Area Ventilation System		X		
Secondary Confinement Area Ventilation System		X		
Tertiary Confinement Area Ventilation System		X		
Non-Confinement Area Ventilation System				X

Note: Definitions for QA Classifications (QL-1, QL-2, etc.) may be found in "Classification of Permanent Items" (QAP-2-3), Section 3.13.

APPENDIX C ACRONYMS, SYMBOLS, AND UNITS

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

C.1 Acronyms

ALARA	As Low As Is Reasonably Achievable
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
CAEM	Continuous Air Emission Monitoring
CQ	Conventional Quality
DBE	Design Basis Event
DOE	U. S. Department of Energy
F	Function
HEPA	High-Efficiency Particulate Air
HFE	Human Factors Engineering
HVAC	Heating, Ventilating, and Air Conditioning
IEEE	Institute of Electrical and Electronic Engineers
MGR	Monitored Geologic Repository
MGR RD	Monitored Geologic Repository Requirements Document
QA	Quality Assurance
QL	Quality Level
SSCs	Structures, Systems, and Components
TBD	to be determined
TBV	to be verified
WHB	Waste Handling Building

C.2 Symbols and Units

%	percent
“	minute
‘	second
‘	Foot (Used in Figures 1 and 2)
°F	degrees Fahrenheit
C	Celsius
ft	feet
in.	inch
inwg	inches of water gauge
km	kilometer
psi	pounds per square inch
sec	second

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.

D.1 Issue 1 – Emergency (Diesel) Generator Room

Environmental conditions design criteria for the Emergency (Diesel) Generator Room must be determined.

APPENDIX E REFERENCES

This section provides a listing of references used in this System Description Document.

"Accessible and Usable Buildings and Facilities." Council of American Building Officials. CABO/ANSI A117.1-1992. December 15, 1992. Falls Church, Virginia: American National Standards Institute, Council of American Building Officials. TIC: 208806.

"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.

"Americans With Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities." Architectural and Transportation Barriers Compliance Board. 36 CFR 1191. 1998. Washington, D.C.: U.S. Government Printing Office. Readily Available.

"ASHRAE Handbook - Heating, Ventilating, and Air-Conditioning Systems and Equipment." American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 1996. Atlanta, Georgia: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. TIC: 243851.

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"Code on Nuclear Air and Gas Treatment." The American Society of Mechanical Engineers. ASME AG-1-1997. 1997. New York, New York: The American Society of Mechanical Engineers. TIC: 247207.

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"Design Basis Event Frequency and Dose Calculation for Site Recommendation." CRWMS M&O. CAL-WHS-SE-000001 REV 00. February 25, 2000. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.20000308.0243.

"Design Criteria for an Independent Spent Fuel Storage Installation (Dry Type)." American Nuclear Society. ANSI/ANS-57.9-1992. 1992. La Grange Park, Illinois: American Nuclear Society. TIC: 3043.

"Design Criteria for an Independent Spent Fuel Storage Installation (Water Pool Type)." American Nuclear Society. ANSI/ANS-57.7-1988. 1988. La Grange Park, Illinois: American Nuclear Society. TIC: 238870.

"Design of an Independent Spent Fuel Storage Installation (Water-Basin Type)." U.S. Nuclear Regulatory Commission. Regulatory Guide 3.49, Rev. 0. December 1981. Washington, D.C.: U.S. Nuclear Regulatory Commission. Readily Available.

"Design, Testing, and Maintenance Criteria for Postaccident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants." U.S. Nuclear Regulatory Commission. Regulatory Guide 1.52, Rev. 02. 1978. Washington, D.C.: U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation. Readily Available.

"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.19980304.0028. DTN: MO9811DEDCRMCR.000.

"Engineering Files for Site Recommendation." CRWMS M&O. TDR-WHS-MD-000001 Rev. 00. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.20000607.0232.

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

"Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity." Instrument Society of America. ANSI/ISA-S71.01-1985. 1985. Research Triangle Park, North Carolina: Instrument Society of America. TIC: 240306.

"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.

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