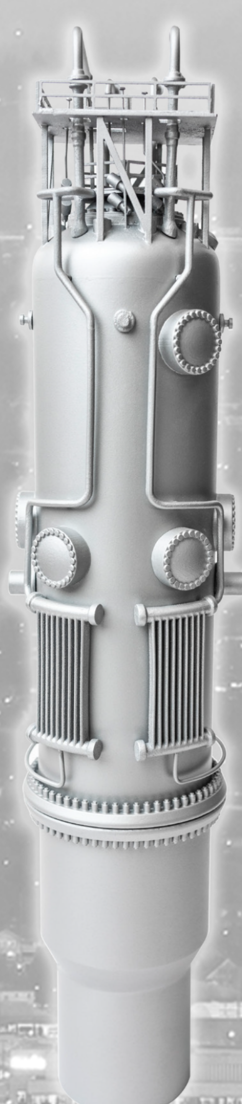
NuScale Standard Plant
Design Certification Application

Chapter Nine
Auxiliary Systems



PART 2 - TIER 2

Revision 5
July 2020

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES

CHAPTER 9 AUXILIARY SYSTEMS

9.1 Fuel Storage and Handling

9.1.1 Criticality Safety of Fresh and Spent Fuel Storage and Handling

9.1.1.1 Design Basis

This section identifies the required or credited functions for fresh and spent fuel storage and handling, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

General Design Criterion (GDC) 62, American National Standards Institute/American Nuclear Society (ANSI/ANS) 57.1 (Reference 9.1.1-5), ANSI/ANS 57.2 (Reference 9.1.1-6), and ANSI/ANS 57.3 (Reference 9.1.1-7) were considered in the design of the storage and handling facility for new and spent fuel assemblies. Section 9.1.2 describes the protection of the fuel storage racks from natural phenomena.

The design and controls for operation of the fuel handling equipment and fuel storage racks to prevent an inadvertent criticality using geometrically safe configurations, the use of plant programs and procedures for criticality control, and the provision for radiation monitors as discussed in Section 12.3.4 demonstrate conformance to 10 CFR 50.68(b). The fuel storage racks have an effective multiplication factor (k_{eff}) that meets 10 CFR 50.68(b) requirements.

9.1.1.2 Facilities Description

The storage and handling facility for new and spent fuel assemblies is located in the reactor building. The fuel storage racks in the spent fuel pool (SFP) can store either spent fuel assemblies, or new fuel assemblies. Section 9.1.2 describes the quantity of fuel assemblies that can be placed in the fuel storage racks and that travel limitations for the fuel handling machine prevent access to some of the fuel assembly storage locations.

The design of the fuel storage racks controls the center-to-center spacing between adjacent storage compartments for the fuel assemblies. The racks use square tubes for the fuel storage compartments. The spacing between compartments contains fixed neutron absorber plates and establishes flux traps. The neutron absorber plates use a boron carbide-aluminum metal matrix composite.

The geometrically safe design of the fuel storage racks allows storage of new or spent fuel assemblies in any accessible location. The racks stand freely on the floor of the SFP. The layout in the SFP prevents an accidental placement of a fuel assembly between racks. The travel limitations for the fuel handling machine prevent misplacement of a fuel assembly between a rack and a wall. As an abnormal condition, the criticality analysis in Reference 9.1.1-1 assumes a fuel assembly placed outside of, but next to, a rack in the corner of the SFP containing the new fuel elevator. The fuel assembly is assumed to be placed as close as possible to the filled storage racks.

Geometrically safe designs prevent criticality during fuel handling and for fuel stored in the fuel storage racks in accordance with 10 CFR 50.68(b). Fuel handling, described in Section 9.1.4, shows that the designs of the new fuel jib crane, the new fuel elevator, and the fuel handling machine allow each piece of equipment to move only a single fuel assembly at a time. Fuel handling procedures place controls on the movement of each fuel assembly and the designated storage location in a rack. The design of the fuel storage racks does not require loading patterns or zones for storage of the fuel assemblies. The design of the fuel storage racks eliminates the possibility of an inadvertent criticality occurring due to the selection of an inappropriate storage location or region. Plant programs and procedures track fuel assembly storage locations in accordance with special nuclear material regulations.

COL Item 9.1-1: A COL applicant that references the NuScale Power Plant design certification will develop plant programs and procedures for safe operations during handling and storage of new and spent fuel assemblies, including criticality control.

Section 9.1.2 describes the fuel storage racks; Section 9.1.3 describes the pool support systems; Section 9.1.4 describes the fuel handling equipment; and Section 9.1.5 describes heavy load handling.

9.1.1.3 Safety Evaluation

In accordance with GDC 62, the fuel handling equipment and fuel storage racks use geometrically safe configurations to prevent criticality. The design of the fuel handling equipment limits the number of new or spent fuel assemblies in motion to a single assembly for each piece of equipment. As described in Section 9.1.4, safety devices such as interlocks on the fuel handling equipment assist operators to prevent damage to an assembly and help minimize mishandling and movements not allowed by plant approved procedures.

The design of the fuel storage racks maintains stored fuel assemblies in subcritical arrays during normal and credible abnormal conditions. Reference 9.1.1-1 describes the details of the criticality analysis summarized below.

The fuel storage racks meet 10 CFR 50.68(b)(4) and have a k_{eff} no greater than 0.95, at a 95 percent probability and a 95 percent confidence level, for storage of new or spent fuel assemblies with credit for soluble boron. The analysis demonstrates that k_{eff} remains below 1.0 (subcritical), at a 95 percent probability, 95 percent confidence level, for fuel stored in the racks with unborated water.

The SFP is connected to the refueling pool and reactor pool which form the ultimate heat sink (UHS). The large volume of water (approximately 7 million gallons) prevents an undetected addition of unborated water sufficient to dilute the boron concentration from the expected value of ~1800 ppm boron (Table 9.1.3-2) to the minimum concentration of 800 ppm credited in the criticality analysis in Reference 9.1.1-1 and required by technical specifications section 4.3. The amount of water needed to dilute to the minimum concentration would take more than 16 days for the demineralized water system at a maximum pump capacity of 300 gpm and would be detected by pool level alarms and observed by operators after a one foot rise in water level (approximately 93,000 gallons) in approximately 5 hours. Once detected, the flow of unborated water would be stopped and the boron addition system could add borated water to the SFP to return the boron concentration to normal. Sufficient time is available for action to preclude a boron dilution event.

9.1.1.3.1 Analysis Code and Validation

The criticality analysis in Reference 9.1.1-1 uses the KENO-Va component of SCALE Version 6.1.3 (Reference 9.1.1-2) to calculate k_{eff} of the fuel in the storage racks. The calculations benchmark the ability of the criticality code to predict the reactivity of a system based on comparison to critical experiments. The criticality benchmark calculations establish the values of the calculational bias associated with the calculation methodology compared to benchmarks, and the standard deviation of the calculation bias. The validation determines the calculational bias and the uncertainty of the bias associated with the modeling methodology, the code, and the cross-section library for the criticality analysis. The validation uses the guidance of NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculational Methodology," (Reference 9.1.1-3) and NUREG/CR-6361, "Criticality Benchmark Guide for Light-Water-Reactor Fuel in Transportation and Storage Packages," (Reference 9.1.1-4).

9.1.1.3.2 Analysis Conditions

The criticality analysis in Reference 9.1.1-1 incorporates the following assumptions for the fuel storage racks:

- maximum fuel assembly enrichment of 5 percent U-235 by weight, and no credit for burnup of the spent fuel assemblies
- no burnable neutron poisons or axial blankets present in the fuel assemblies
- fuel storage racks contain a new fuel assembly with the maximum reactivity in every storage location (even the locations in the racks not accessible by the fuel handling machine)

The analysis considers the following conditions to determine the maximum k_{eff} at a 95 percent probability and a 95 percent confidence level:

- moderator density variations with temperature to determine the optimum value
- manufacturing tolerances for the fuel storage racks and fuel assemblies for dimensions and material compositions
- fuel assembly storage positions within the fuel storage compartments, either the assemblies centered, or eccentric within the storage locations
- fuel cladding damage for five spent fuel assemblies

- abnormal conditions with the drop of a fuel assembly onto a storage rack, the drop of an assembly outside of the storage racks, and the transient deflection of the storage racks during a seismic event

9.1.1.3.3 Criticality Analysis Results

The maximum k_{eff} remains below the applicable limits in the regulations and no abnormal condition would cause an inadvertent criticality (Reference 9.1.1-1).

9.1.1.4 References

9.1.1-1 NuScale Power, LLC, "Fuel Storage Rack Analysis," TR-0816-49833, Revision 1.

9.1.1-2 Oak Ridge National Laboratory, "SCALE: A Comprehensive Modeling and Simulation Suite for Nuclear Safety Analysis and Design," ORNL/TM-2005/39, Version 6.1, Oak Ridge, TN, June 2011.

9.1.1-3 U.S. Nuclear Regulatory Commission, “Guide for Validation of Nuclear Criticality Safety Calculational Methodology,” NUREG/CR-6698, January 2001.

9.1.1-4 U.S. Nuclear Regulatory Commission, “Criticality Benchmark Guide for Light-Water-Reactor Fuel in Transportation and Storage Packages,” NUREG/CR-6361, March 1997.

9.1.1-5 American National Standards Institute, “Design Requirements for Light Water Reactor Fuel Handling Systems,” ANSI/ANS-57.1-1992, La Grange Park, IL.

9.1.1-6 American National Standards Institute, “Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plants,” ANSI/ANS-57.2-1983, La Grange Park, IL.

9.1.1-7 American National Standards Institute, “Design Requirements for New Fuel Storage Facilities at Light Water Reactor Plants,” ANSI/ANS-57.3-1983, La Grange Park, IL.

9.1.2 New and Spent Fuel Storage

The new fuel assemblies (NFAs) and spent fuel assemblies (SFAs) are stored in fuel storage racks in the spent fuel pool (SFP) located in the Reactor Building (RXB). The structures that form the new and spent fuel storage facility consist of the fuel storage racks, the SFP, the stainless steel liner in the SFP, and the RXB.

9.1.2.1 Design Bases

This section identifies the system required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together this information represents the design bases defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The design for structures, systems, and components (SSC) that support storage of NFAs and SFAs complies with the applicable regulatory requirements in 10 CFR 50, Appendix A, General Design Criteria 2, 4, 5, 61, and 63 and 10 CFR 20.1101(b).

General Design Criterion 2 was considered in the design of the new and spent fuel storage facility. The fuel storage racks, SFP, liner, and RXB that form the facility protect the NFAs and SFAs from the effects of natural phenomena hazards, including earthquakes, hurricanes, tornadoes, floods, tsunami, seiches, and external missiles, and meet the applicable guidance for protection from such hazards in Regulatory Guides 1.13, Revision 2, 1.29, Revision 5, and 1.117, Revision 2 and ANSI/ANS 57.2 (Reference 9.1.2-1) and ANSI/ANS 57.3 (Reference 9.1.2-6).

The fuel storage racks, SFP, liner, and RXB meet Seismic Category I requirements and are protected from non-Seismic Category I SSC to ensure that the safe shutdown earthquake (SSE) would not cause a loss of capability to perform their safety functions.

The design of the SFP, liner, and RXB does not result in a substantial loss of water from the SFP as a result of an SSE. The design ensures that the spent fuel assemblies have sufficient cooling and shielding during and after an SSE.

General Design Criterion 4 was considered in the design of the fuel storage racks, SFP, liner, and RXB. These structures accommodate the effects of the environmental conditions during normal operation and postulated accidents. The design of these structures protects the stored fuel assemblies from dynamic effects that result from equipment failures in or outside of the RXB, including the effects of internal missiles, pipe whipping, and discharging fluids.

Section 3.5.1 provides a description of the approach to protection from potential turbine blade missiles. The approach ensures protection of the SFP and liner from such missiles.

General Design Criterion 5 was considered in the design of the new and spent fuel storage facility. Even though the fuel storage racks, SFP, liner, and RXB are shared between the NuScale Power Modules (NPMs), the sharing of these structures does not impair the performance of safety functions, including, in the event of an accident in one NPM, an orderly shutdown and cooldown of the remaining NPMs along with continued cooling and shielding of the SFAs.

General Design Criterion 61 was considered in the design of the fuel storage racks, SFP, liner, and RXB for storage of the NFAs and SFAs. The design meets the following requirements:

- The fuel storage racks, SFP, liner, and RXB that form the new and spent fuel storage facility permit periodic inspection and testing.
- During normal and postulated accident conditions, the large water volume in the SFP, refueling pool (RFP), and reactor pool provides the water inventory that ensures adequate shielding for radiation protection for storage of the SFAs.
- The structures and systems for containment, confinement, and filtering of radioactive materials released from the SFAs minimize contamination of the plant and environment and help to maintain doses to workers and the public as low as reasonably achievable.
- During normal and postulated accident conditions, the large water volume in the SFP, RFP, and reactor pool provides the water inventory that, together with the design of the SFP and fuel storage racks, ensures residual heat removal capability for storage of the SFAs.
- The SFP design prevents a significant reduction in the fuel storage coolant inventory under postulated accident conditions.
- The fuel storage racks use stainless steel or Ni-Cr-Fe alloys for materials of construction that resist corrosion from the borated water contained in the SFP.
- Fixed neutron absorbers used for criticality control have test coupons monitored for degradation.

Related to meeting the above requirements, Section 9.1.3 describes the design of the systems for pool water cooling, purification, inventory control, and for pool liner leakage detection. Section 3.8 describes the design of the SFP structure and liner for retaining pool water inventory. Section 9.2.5 describes the ultimate heat sink (UHS) that is formed by the SFP, RFP, and reactor pool.

General Design Criterion 63 was considered in the design of the instrumentation provided for SFP water level, SFP water temperature, and local area radiation monitoring.

Design of the new and spent fuel storage facility results in radiation doses that comply with the as low as reasonably achievable requirements in 10 CFR 20.1101(b). Leakage is collected to limit the spread of contaminated SFP water. Smooth and nonporous fuel storage rack surfaces prevent the buildup of radioactive material. Water and the concrete walls of the SFP are used to shield the SFAs in the SFP.

The design bases associated with criticality control for new and spent fuel storage are described in Section 9.1.1.

9.1.2.2 Facilities Description

9.1.2.2.1 Overview of New and Spent Fuel Storage Facility and Associated Systems

The new fuel staging area is located on the operating floor of the RXB near the SFP (Figure 9.1.4-1). This area provides space for opening the shipping containers with new fuel. Section 9.1.4.2.3 describes NFA handling operations.

The NFAs and SFAs are stored in the fuel storage racks that are arranged in the SFP as shown in Figure 9.1.2-1. The fuel storage racks provide space for storage of NFAs prior to movement to an NPM during a refueling outage. The fuel storage racks also provide space for longer-term storage of the SFAs for cooling prior to transfer to onsite storage or off-site shipment.

The RXB houses the SFP and the adjacent RFP, reactor pool, and dry dock as described in Section 9.2.5. There is a weir in the wall separating the SFP and RFP as shown in Figure 9.2.5-1. The water in the SFP above the top of the weir separating the SFP and RFP communicates with the water in the adjacent RFP and reactor pool. The dry dock has a gate to separate it from the RFP.

The RXB and SFP are reinforced concrete construction. Section 3.2 provides the safety and seismic classifications, and applicable quality assurance requirements, for the RXB and integral concrete that forms the SFP. Section 3.2 also provides the same information for the pool liners for the UHS pools in the RXB. The RXB, SFP concrete, and SFP liner meet seismic Category I requirements to withstand the SSE without loss of water retention capability.

For normal conditions of operation, the SFAs are cooled by the active spent fuel pool cooling system (SFPCS) and the NPMs are cooled by the active reactor pool cooling system (RPCS). The SFPCS works in conjunction with the RPCS to cool the total heat load in the UHS during normal operations (Section 9.1.3).

For an accident condition that disables the normal makeup supply and the active cooling systems, the large volume of water in the UHS is the backup cooling water source for the SFP. The water stored in the Seismic Category I UHS pools and liners is passively available for SFP makeup. The flow rate available to the SFP through the weir exceeds what could be provided by a typical SFP makeup line. A permanently installed Seismic Category I makeup line is also part of the UHS system. This supply line provides a second backup to the normal supply and is a separate and redundant flow path for adding makeup water to the SFP.

The dry dock is an area adjacent to the RFP used during cask handling for removing SFAs from the RXB.

COL Item 9.1-2: A COL applicant that references the NuScale Power Plant design certification will demonstrate that an NRC-licensed cask can be lowered into the dry dock and used to remove spent fuel assemblies from the plant.

Section 9.1.4 describes the new and spent fuel handling equipment used to move fuel assemblies. Section 9.1.5 describes the Reactor Building crane (RBC) for moving spent fuel casks and NPMs. Section 9.4.2 describes the RXB heating and ventilation equipment that supports the environment above the SFP for personnel working in the area. Section 9.5.2 describes the communications systems, including the public address system. Section 9.1.3 describes the pool leakage detection system. Section 3.4.2 describes the design features to prevent groundwater intrusion into the below-ground portions of the RXB.

9.1.2.2.2 Fuel Storage Racks Design

There are 14 fuel storage racks and each has 121 storage locations in an 11 x 11 array for a total of 1,694 storage locations. As shown in Figure 9.1.2-1, travel limitations for the fuel handling machine prevent access to storage locations at the outer edges of the racks. The layout of the fuel storage racks in the SFP and the gaps between the fuel storage racks prevent the accidental placement of a fuel assembly between the fuel storage racks. The travel limitations for the fuel handling machine prevent misplacement of a fuel assembly between a fuel storage rack and a wall.

Each of the 14 fuel storage racks in the SFP is a free-standing structure. Reference 9.1.1-1 provides the general configuration and a cross-section of a fuel storage rack. Each consists of 121 square stainless steel tubes in a square array with neutron absorber plates and a space forming a flux trap located between each of the tubes. A single base plate supports the tubes. Braces and grid assemblies center the tubes and maintain spacing between the tubes. Legs under the baseplate provide space for entry of cooling water into a hole at the bottom of the storage compartments. Section 3.2 provides the safety and seismic classifications, and applicable quality assurance requirements, for the fuel storage racks.

Based on the travel limitations of the fuel handling machine, the fuel storage racks can safely store 1,404 fuel assemblies vertically in the SFP; however, only 1,393 fuel storage locations are considered accessible due to the possible difficulty reaching the storage locations closest to the weir wall. The 1,393 fuel storage locations include storage for five damaged fuel assemblies and for non-fuel core components such as a control rod assembly (stored within a fuel assembly).

The fuel handling machine cannot travel past the outer edge of the fuel storage racks except over the weir and into the corner of the SFP that has the new fuel elevator rather than a fuel storage rack. The possibility of a drop of a fuel assembly in this corner is not likely because of the single-failure proof design of the fuel handling machine and the use of safe handling procedures for criticality control. Section 9.1.1 addresses the unlikely event of a drop or placement of a fuel assembly in the corner containing the new fuel elevator.

The design of the fuel storage racks considers normal and postulated accident conditions including the effects of an SSE. The fuel storage racks meet Seismic Category I design requirements and perform their safety functions during and after an SSE. Reference 9.1.1-1 provides a description of the structural, thermal hydraulic, and criticality calculations for the fuel storage racks.

The analyses of the fuel storage racks in Reference 9.1.1-1 address

- normal lifting forces
- abnormal conditions, including
  - uplift forces from a stuck fuel assembly
  - impact forces from the drop of a fuel assembly
  - loads resulting from thermal effects
  - loads caused by an SSE

Table 9.1.2-1 shows the load combinations and acceptance criteria.

The design of the fuel storage racks uses Section III, Subsection NF of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (Reference 9.1.2-2).

Design of the fuel handling machine ensures that excessive uplift forces cannot be applied to a fuel storage rack. Section 9.1.4 provides the mast capacity. The fuel storage rack is designed to withstand the maximum uplift force from the fuel handling machine.

The fuel storage racks are designed to withstand the impact resulting from a falling fuel assembly with an inserted control rod assembly dropped from the highest elevation reached during fuel assembly handling operations. The maximum lift height for a fuel assembly is 45' 3" building elevation. This lift height is required to clear the weir wall between the SFP and RFP. As described in Section 9.1.4, the grapple on the fuel handling machine is single-failure proof. This design prevents a grapple from failing and falling during fueling handling operations. Therefore, the heaviest load that can be dropped from the single-failure proof fuel handling machine and grapple onto a fuel storage rack is one fuel assembly with one control rod assembly inserted. As described in Section 9.1.5, the design of the RBC, in conjunction with procedures and safe load paths, minimizes the potential for a load drop into the SFP.

The structural analyses of the fuel storage racks in Reference 9.1.1-1 address seismic loadings with the storage locations full of fuel assemblies or partially filled with some racks empty. The seismic analyses consider the potential for rack-to-rack and rack-to-wall interactions from sliding and tipping.

The thermal hydraulic evaluations in Reference 9.1.1-1 analyze the adequacy of the design of the fuel storage racks for a full-core offload with normal operation of the active SFPCS and for loss of one train of cooling. The analysis considers the decay heat load from the accessible locations in the fuel storage racks full of SFAs, including one full-core offload from an NPM occurring 72 hours after reactor shutdown.

The materials of construction for the fuel storage racks are chemically compatible with the service conditions to enable performing their intended functions for the design life of the plant.

The fuel storage racks use integral neutron absorber plates made of boron carbide-aluminum metal matrix composite. The structural analyses of the fuel storage racks take no credit for the mechanical properties of the neutron absorber plates. For the criticality analyses, long-term testing is used to show that this material is suitable for the chemical, radiation, and thermal environment present in the fuel storage racks (Section 9.1.2.4).

9.1.2.3 Safety Evaluation

The design of the fuel storage racks, SFP, liner, and RXB that form the new and spent fuel storage facility meets GDC 2 and withstands the effects of natural phenomena hazards without the loss of capability to perform their safety functions. The design of the RXB withstands combinations of mechanical, hydraulic, and thermal loads and natural phenomena effects, including: severe winds such as hurricanes and tornadoes (see Section 3.3), floods (see Section 3.4), external and turbine-generated missiles (see Section 3.5), and the SSE (see Sections 3.7 and 3.8). The RXB protects the SFP, liner, and fuel storage racks from these hazards. For an SSE, the SFP and liner also meet the design requirements for Seismic Category I structures and withstand the effects as described in Section 3.8.4. The UHS design removes heat through boiling and evaporation if the active cooling systems are unavailable. The RXB structure and pool liners containing the coolant withstand the maximum temperature and pressure for pool boiling. As shown in Section 3.2, the SFP liner is a RXB component classified as nonsafety-related. The basis for this classification for accident conditions is provided in Section 9.2.5.

This classification for the liner is also appropriate for the protection provided by the liner for the concrete structure forming the SFP behind the liner. As shown in Section 3.2, the liner has augmented design requirements and is classified as Seismic Category I. In addition, the UHS pools have a pool leakage detection system that provides for collection of water leaking from a liner in the pools and detection of the leakage. As described in Section 9.1.3, the pool leakage detection system ensures that operators take actions to determine the cause of leakage and implement repairs, which protects the concrete from degradation.

The fuel storage racks are Seismic Category I structures that withstand the postulated design loads from an SSE and maintain the stored fuel assemblies in a cooled and subcritical configuration. As documented in Reference 9.1.1-1, the fuel storage racks meet the seismic design criteria for development of acceleration time histories as specified in the American Society of Civil Engineers (ASCE) and Structural Engineering Institute (SEI) standard, "Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities," ASCE/SEI 43-05 (Reference 9.1.2-4).

The fuel storage racks meet the structural integrity criteria specified in the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III, Division I, Subsection NF (Reference 9.1.2-2) and the American Institute of Steel Construction (AISC) Manual of Steel Construction 9th edition (Reference 9.1.2-5). Reference 9.1.1-1 demonstrates that the transient deflection of the fuel storage racks during an SSE and, considering the load combinations shown in Table 9.1.2-1, does not result in a k_{eff} that exceeds the applicable limit as described in Section 9.1.1. The structural analyses of the fuel storage racks also verify that although they are free-standing structures on the SFP floor, their movements in an SSE result in sliding and tipping without contact with the walls of the SFP.

As described in Section 3.7.3, non-Seismic Category I SSC that could adversely affect Seismic Category I SSC are categorized as Seismic Category II and analyzed using the methods described in that section. The fuel handling equipment other than the fuel handling machine meets Seismic Category II design requirements. The RBC and fuel handling machine meet Seismic Category I design requirements. The design of this equipment ensures that the fuel storage racks are not impacted by a collapse of this equipment during an SSE. Section 9.1.3 addresses a failure of the Seismic Category II dry dock gate due to an SSE.

An extreme wind or tornado event can generate external missiles that could strike the RXB. As described in Sections 3.3 and 3.5, the RXB is designed to withstand the effects of extreme winds and tornadoes, missile strikes (including turbine missiles), and protects the new and spent fuel storage facility within the building.

The design of the fuel storage racks, SFP, liner, and RXB meets GDC 4 and accommodates normal and accident conditions including the dynamic effects of equipment failure. The design protects the stored fuel assemblies using the thick concrete walls forming the SFP and the substantial depth of water above the fuel storage racks. These features provide protection from dynamic effects resulting from equipment failures in or outside of the RXB, including the effects of equipment collapse, pipe whipping, and discharging fluids.

The fuel handling equipment and RBC meet single-failure proof criteria that provide protection from damage due to drops of heavy loads. A single fuel assembly with a control rod assembly defines the heaviest load that can be dropped due to equipment failure during fuel movements by the fuel handling machine. Reference 9.1.1-1 evaluates this event for a shallow or horizontal drop onto the top of a fuel storage rack and for deep drops into empty storage locations. The loading combinations evaluated for such drop conditions demonstrate the continued functional capability of the fuel storage racks.

A stuck fuel assembly in the fuel storage racks could result in the fuel handling machine applying an uplift force greater than the weight of a fuel assembly plus control rod assembly. The fuel handling machine design has interlocks that prevent an excessive force from being applied and causing the stuck fuel assembly to damage the storage tube in a fuel storage rack. As shown in Reference 9.1.1-1, the fuel storage rack withstands fuel handling machine uplift forces and meets the applicable requirements in Reference 9.1.2-2.

The design of the fuel storage racks, SFP, liner, and RXB that form the new and spent fuel storage facility meets GDC 5 and allows the fuel storage racks and SFP to perform their spent fuel cooling and shielding functions while supporting the NPMs in a plant. The new and spent fuel storage facility can be shared by the NPMs for normal and accident conditions without impairing the performance of a safety function by the fuel storage facility or by the NPMs even with a postulated accident in one NPM and allowing for the safe shutdown of the remaining NPMs.

The new and spent fuel storage facility provides adequate safety under normal and postulated accident conditions and conforms to GDC 61 requirements as described below. The design of the new and spent fuel storage facility permits inspections and testing as described in Section 9.1.2.4. The design of the new and spent fuel storage facility ensures radiation doses that comply with 10 CFR 20.1101(b) as described in Section 9.1.2.3.7.

9.1.2.3.1 Containment, Confinement, and Filtering

The SFP liner, SFP, and RXB structures provide containment of the SFAs and the water cooling the assemblies. The liner contains the water and the systems described below support confinement and filtering of the radionuclides.

Section 9.1.3 describes the pool support systems that pump the UHS water through the pool cleanup system to remove radionuclides in the pool water and collect them on a filter or in a demineralizer vessel for subsequent handling as solid radioactive wastes.

The pool leakage detection system collects liner leakage that is routed to the liquid radioactive waste system for processing and disposal. As described in Section 11.2, the liquid waste management system also performs filtering and uses ion exchangers to collect radionuclides for disposal.

The RXB heating ventilation and air conditioning system filters and controls the release of airborne radioactive material from inside of the RXB, including from pool water evaporation for normal conditions and for loss of normal power supply (Section 9.4.2).

9.1.2.3.2 Residual Heat Removal Capability

The flow of cooling water through each storage location in the fuel storage racks removes decay heat from the SFAs during normal operating conditions and assuming a failure of one train in the SFPCS. The thermal hydraulic evaluations in Reference 9.1.1-1 use computational fluid dynamics to analyze the decay heat load from the SFAs stored in every accessible fuel storage location and assume one fuel storage rack contains the full-core offload from an NPM at 72 hours after reactor shutdown. In addition to assuming cooling with just one train of the active SFPCS, the analysis neglects the active cooling capacity of the RPCS. The SFP is treated as a self-contained pool without communication with the RFP through the open channel above the weir. For these conditions, the fuel storage racks have adequate natural circulation cooling flow into the base plate holes and through the fuel assemblies. The racks provide sufficient decay heat removal to maintain the peak temperature for a fuel rod below the local saturation temperature and prevent nucleate boiling (Reference 9.1.1-1). The conservatisms included in the analysis include:

- A decay heat load in the SFP for analyzing the performance of just the SFPCS that is greater than the value used in Section 9.1.3.3.4 when analyzing the combined cooling capability of the SFPCS and RPCS

- A heat exchanger cooling capability for analyzing just the SFPCS that is less than the value used in Section 9.1.3.3.4 when analyzing the combined cooling capability of the SFPCS and RPCS

The results of the heat exchanger performance analysis in Reference 9.1.1-1 show that for these conservative decay heat and cooling capability assumptions, the intake water temperature from the SFP remains below 140 degrees F with operation of a single SFPCS heat exchanger. This demonstrates that the SFPCS has a minimum heat removal capability for maintaining the SFP within the maximum pool water temperature established in the technical specifications.

Section 9.1.3 describes the minimum heat removal capacity of the active SFPCS operating in conjunction with the active RPCS. These systems are not designed to withstand accident conditions and, therefore, the RXB pool structures and their liners are designed to withstand coolant boiling.

The demineralized water system provides normal makeup to the SFP. Section 9.2.5 describes that there are two backup methods of providing makeup water to the SFP for keeping the SFAs cooled and shielded. The water inventory in the RFP and reactor pool above the top of the weir wall is contained within Seismic Category I structures and provides a passive source of water to supply the SFP. The Seismic Category I makeup line in the UHS system provides the redundant flow path for supply of makeup water to the SFP.

9.1.2.3.3 Prevent Coolant Inventory Reduction for Accident Conditions

The SFP maintains an adequate water level above the fuel storage racks. Section 9.1.3 describes the supply of makeup water to the pools and that the UHS pools do not have penetrations, drains, or piping that could drain the water level in these pools below the top of the weir. The water in the SFP below the top of the weir is the inventory of water that provides 10 ft of water above the tops of the fuel storage racks for cooling and shielding the SFAs.

An SSE event can generate waves in the UHS pools. An analysis of sloshing shows that an SSE generates a maximum wave height of less than 3 ft. The pools have at least 6 ft of freeboard (additional dry pool wall above the normal pool level) that prevents a loss of pool water from a 3 ft wave due to an SSE.

9.1.2.3.4 Materials

The SFP liner and the fuel storage racks use stainless steel and nickel-base alloy materials for chemical compatibility with the borated water in the SFP. As described in Reference 9.1.1-1, use of these materials recognizes the successful operational experience with them in current plants and existing SFPs. Stainless steel materials are used extensively in similar and more aggressive chemical environments without experiencing degradation due to pitting, intergranular, or galvanic corrosion mechanisms. The structural components in the SFP liner and fuel storage racks are protected from corrosion failure based on maintaining pool water chemistry as described in Section 9.1.3.

9.1.2.3.5 Fixed Neutron Absorbers

The neutron absorber plates in the fuel storage racks use boron carbide-aluminum metal matrix composite that provides stable properties for long-term use. The metal matrix composite material consists only of aluminum alloy and boron carbide, with no polymer or organic components. The metal matrix composite material uses fine boron carbide particles for improved performance when compared to earlier boron carbide-aluminum materials. Reference 9.1.1-1 describes the corrosion and radiation damage evaluations for the metal matrix composite material. Section 9.1.2.4 describes the surveillance test program to monitor long-term continuing effectiveness of the plates.

9.1.2.3.6 Monitoring

The design of the new and spent fuel storage facility meets GDC 63 and provides monitoring for the loss of decay heat removal capability using the temperature measuring instruments in the SFPCS and RPCS as described in Section 9.1.3. Monitoring for loss of water in the UHS pools is provided by the SFP water level instruments as described in Section 9.2.5. Radiation monitors are provided in the SFP area to detect both general area radiation levels and airborne contamination levels as described in Section 12.3. These instruments allow operators to initiate appropriate safety actions.

9.1.2.3.7 Radiation, Shielding, and Maintaining Doses as Low as Reasonably Achievable

The new and spent fuel storage facility meets the regulations in 10 CFR 20.1101(b) to ensure radiation doses that are as low as reasonably achievable. The design controls leakage, minimizes buildup of contamination, and provides adequate shielding as described below.

The liners for the UHS pools and dry dock in the RXB have channels that provide the ability to collect leakage. Section 9.1.3 describes the use of the pool leakage detection system to direct liner leakage to sumps in the radioactive waste drain system in the RXB bottom floor. This system limits the spread of contamination from liner leakage.

The surface finishes of the components for the fuel storage racks are smooth to minimize accumulation of radioactive materials and to facilitate surface decontamination. The legs supporting the baseplate of the fuel storage racks provide space to allow vacuuming under the baseplate for removal of crud and debris in support of contamination control in the SFP.

The depth of the water above the SFAs and the thick concrete walls of the SFP provide shielding for the assemblies. As described in Section 9.2.5, the large inventory of water in the UHS ensures shielding is adequate for postulated accident conditions. For a potential fuel handling accident, a minimum of 31 ft of water is provided above the damaged fuel rods to allow for iodine scrubbing.

9.1.2.3.8 Maintaining Subcriticality

See Section 9.1.1 for conformance with the regulations in 10 CFR 50.68.

9.1.2.4 Inspection and Testing

The design of the SFP liner and fuel storage racks facilitates inspections and testing. Most surfaces of these structures, including the spaces under the baseplates, are accessible for underwater inspection. The spaces under the racks also provide the ability to perform inspections to ensure the coolant flow paths are not obstructed.

For the inaccessible neutron absorber plates in the fuel storage racks, a surveillance test program in accordance with American Society for Testing and Materials C1187 (Reference 9.1.2-3) is used to test coupons to monitor long-term continuing effectiveness. The test coupons are from the same production lot used for construction of the plates in the fuel storage racks. One or more of the test coupons are removed and examined periodically. The results over time provide direct evidence of the condition of the plates in the SFP and ensure the continued neutron absorbing capability of the material. A set of at least 12 test coupons are located in the fuel storage racks in the SFP, and at least one archive specimen is retained and not submerged in the SFP for later comparison with the irradiated coupons.

The coupons are sized for performing tensile tests and B-10 density tests. The coupons are placed adjacent to freshly discharged irradiated fuel. At least one coupon is removed at approximately 2, 4, 6, 8, 10, 15, 20, 25, 30, 40, 50, and 60 years from first addition of irradiated fuel assemblies in the fuel storage racks. As described in Reference 9.1.1-1, the acceptance criteria consider general corrosion, pitting corrosion, edge corrosion, and B-10 areal density. Coupons may be returned to the SFP for continued use in the surveillance program.

Section 14.3 provides information related to development of Inspections, Tests, Analyses, and Acceptance Criteria for the NuScale Power Plant.

9.1.2.5 Instrumentation

Section 9.1.3 describes the SFP water temperature instrumentation. Section 9.2.5 describes pool water level instrumentation. Section 12.3 describes radiation monitoring instrumentation.

COL Item 9.1-8: A COL applicant that references the NuScale Power Plant design certification will provide a structural evaluation of the spent fuel storage racks, and fuel assemblies located in the racks, and confirm the thermal-hydraulic, criticality, and material analysis aspects of the design remain valid. This evaluation is dependent on the vendor-specific spent fuel storage rack design.

COL Item 9.1-9: A COL applicant that references the NuScale Power Plant design certification will provide a neutron absorber material qualification report which demonstrates that the neutron absorber material can meet the neutron attenuation and environmental compatibility design functions described in Technical Report TR-0816-49833. The COL applicant will establish procedures to evaluate the neutron attenuation uncertainty associated with the material lot variability and will establish procedures to inspect the as-manufactured material for contamination and manufacturing defects.

9.1.2.6 References

9.1.2-1 American National Standards Institute/American Nuclear Society, "Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plants," ANSI/ANS-57.2-1983, La Grange Park, IL.

9.1.2-2 American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section III, Division I, Subsection NF, 2007 Edition, "Class 1, 2, 3, and MC Supports," New York, NY.

9.1.2-3 ASTM International, "Standard Guide for Establishing Surveillance Test Program for Boron-Based Neutron Absorbing Material Systems for Use in Nuclear Spent Fuel Storage Racks," ASTM C1187-2007, West Conshohocken, PA.

9.1.2-4 American Society of Civil Engineers and Structural Engineering Institute, "Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities," ASCE/SEI 43-05, New York, NY.

9.1.2-5 American Institute of Steel Construction, "Manual of Steel Construction," 9th Edition, Chicago, IL.

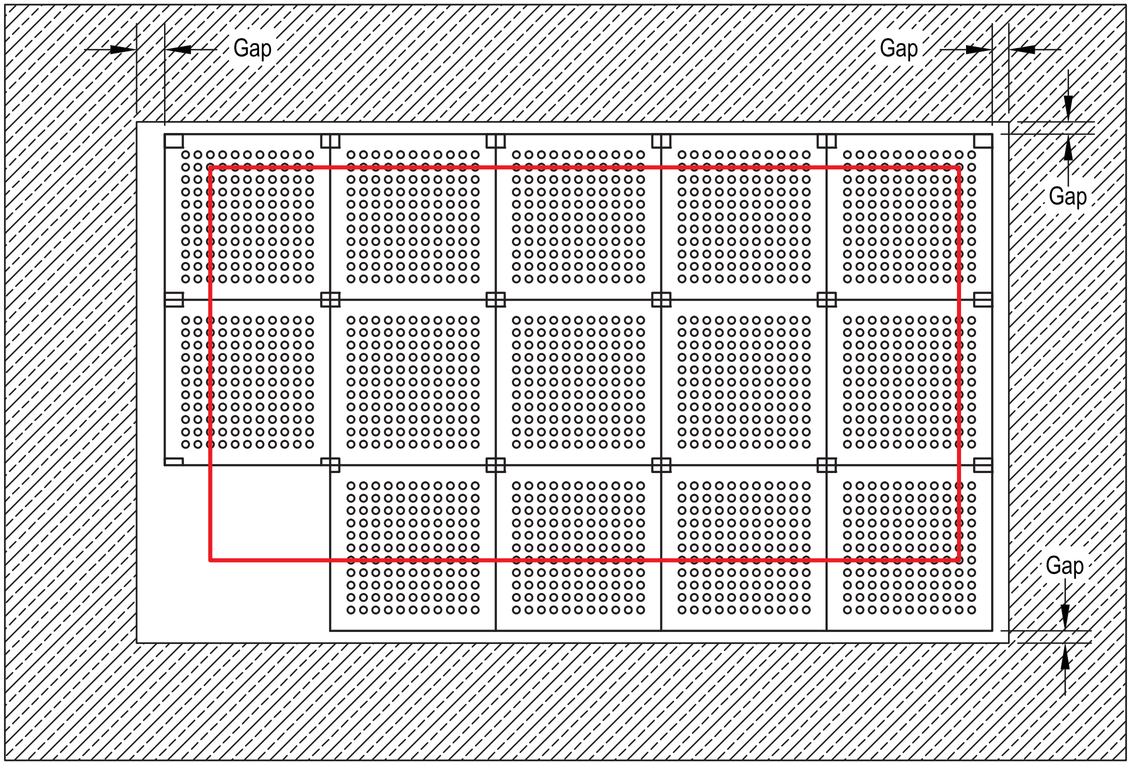
9.1.2-6 American National Standards Institute/American Nuclear Society, "Design Requirements for New Fuel Storage Facilities at Light Water Reactor Plants," ANSI/ANS-57.3-1983, La Grange Park, IL.

Table 9.1.2-1: Load Combinations and Acceptance Criteria for Fuel Storage Racks

Load Combination	Acceptance Limit
D + L D + L + T_o D + L + T_o + E	Level A service limits
D + L + T_a + E D + L + T_o + P_f	Level B service limits
D + L + T_a + E′	Level D service limits
D + L + F_d	Demonstrate functional capability of rack

Where:
D = Dead loads
L = Live loads
T_o = Thermal loads for normal operating and shutdown conditions
T_a = Thermal loads for abnormal conditions
P_f = Maximum uplift force that can be exerted by the fuel handling machine on a stuck fuel assembly
E = Dynamic loads due to an operating basis earthquake
E' = Dynamic loads due to an SSE
F_d = Impact loads due to a dropped fuel assembly

Figure 9.1.2-1: Spent Fuel Pool General Arrangement of Racks



Notes:
1. Drawing is not to scale.
2. Red outline illustrates the travel limitation of fuel handling machine.
3. Gaps are greater than needed to ensure no contact between the racks and SFP walls during safe shutdown earthquake.

9.1.3 Spent Fuel Pool Cooling and Cleanup System

For normal conditions of operation, the spent fuel cooling function is performed by the active spent fuel pool cooling system (SFPCS). For accident conditions, there is no credit for cooling by this active system and the design of the spent fuel pool (SFP) allows for passive cooling of the stored spent fuel assemblies (SFAs). As described in Section 9.2.5, the SFP is connected to the refueling pool (RFP) and reactor pool in the Reactor Building (RXB). These three pools form the ultimate heat sink (UHS) that provides the water for cooling and shielding the spent fuel for accident conditions.

The shared body of water in the UHS means that the cooling function of the active SFPCS works in conjunction with the active reactor pool cooling system (RPCS). The cooling function of the RPCS for normal conditions of operation is to cool the NuScale Power Modules (NPMs) located in the reactor pool and RFP. Because the reactor pool is part of the UHS and connected to the SFP, the active cooling function of the RPCS is addressed in this section along with the SFPCS.

The system that performs the SFP cleaning function is the pool cleanup system (PCUS). The PCUS supports water purification for the large bodies of water in the RXB, not just the SFP. In addition to the spent fuel pool, refueling pool, and reactor pool, the dry dock is a fourth large body of water in the RXB and is adjacent to the RFP and SFP. The dry dock has a gate that opens into the RFP. The dry dock can be drained partially or completely by the pool surge control system (PSCS) to support plant operations, including NPM inspections during refueling, and handling of a spent fuel cask. The pool leakage detection system (PLDS) collects leakage from the liners in the UHS and dry dock.

9.1.3.1 Design Bases

This section identifies the spent fuel cooling and cleaning structures and systems required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii). This section addresses normal conditions of operation. For accident conditions, the UHS supports spent fuel cooling and shielding as described in Section 9.2.5.

The five nonsafety-related pool support systems identified above (SFPCS, RPCS, PCUS, PSCS, and PLDS) perform the following functions for normal operations, but are not credited for performing these functions during accident conditions:

- remove heat generated by the SFAs and NPMs
- maintain water level in the pools by providing normal makeup
- remove impurities to reduce radiation dose rates and maintain water clarity and chemistry
- drain or refill the dry dock by transferring the water to or from the pool surge control storage tank
- collect leaks from the liners in the pools to allow detection and corrective actions

General Design Criterion (GDC) 2 was considered in the design of the pool support systems. Except for the pool surge control storage tank and associated piping and valves, the pool support systems are housed within the RXB, which is a Seismic Category I structure that protects the structures, systems, and components (SSC) within from effects of natural phenomena and external hazards, such as tornado missiles. For the safe shutdown earthquake, the pool support systems comply with GDC 2 and do not adversely affect Seismic Category I SSC.

GDC 4 was considered in the design of the pool support systems. The design of the pool support systems is compatible with the environmental conditions for normal operations, maintenance, and testing. For accident conditions, these systems comply with GDC 4 and do not create flooding, internal missiles, or pipe whip hazards for safety-related SSC.

GDC 5 was considered in the design of the pool support systems. Even though the pool support systems are shared among the NPMs, the sharing does not impair the ability to perform the pool support functions. In the event of an accident in one unit, the failure of these systems to perform their nonsafety-related functions does not prevent an orderly shutdown and cooldown of the remaining units, and cooling and shielding of the stored SFAs.

The pool support systems meet GDC 61 because these systems are designed to ensure adequate safety under normal and accident conditions by providing for the capability to permit periodic inspections and testing, ensure adequate radiation shielding, provide appropriate containment and confinement of pool water, remove heat from the SFAs and NPMs, and prevent a significant reduction in SFP and UHS pool water inventory.

The design of the SFP cooling-related structures and systems meets GDC 63 because monitoring is provided for the loss of decay heat removal capability and for excessive radiation levels in the SFP area.

GDC 60 and 64 were considered in the design of the PSCS, which provides radiation monitoring for a gaseous effluent discharge pathway for the pool surge control storage tank.

Per 10 CFR 20.1101(b), design measures are used to maintain radiation doses as low as reasonably achievable (ALARA) by collecting and processing pool liner and system component leakage, and by using the PCUS to filter and demineralize the water in the UHS and dry dock.

9.1.3.2 System Description

The arrangement of the UHS pools allows them to share their large volume of water as follows. The reactor pool and RFP share their body of water because there is no wall separating these two pools. As shown in Figure 9.2.5-1, the NPM bays line two sides of the reactor pool and form a clear area in the center, which allows movement of an NPM to and from the RFP. The RFP and SFP are separated by a wall with a weir and an open channel above the top of the weir. When the water level in the UHS pools is above the top of the weir, the water in the three pools is shared. The RFP and dry dock are separated by a wall with a gate. When the gate between the dry dock and the RFP is open, the dry dock and UHS pools share one large volume of water.

The active pool support systems, including cooling and pool water cleanup, are nonsafety-related systems and are described in the following sections.

The RXB heating and ventilation system is described in Section 9.4.2. The fixed area radiation monitoring system provides monitors in the SFP area as described in Section 12.3.4.

9.1.3.2.1 Spent Fuel Pool Cooling System

The SFPCS performs the following nonsafety-related functions:

1) maintains the water temperature of the SFP during normal operations by removing the decay heat from SFAs

2) serves as a backup to RPCS

3) maintains the water level of the UHS during normal operations to account for evaporation of pool water by providing makeup from the demineralized water system (DWS)

4) provides a flow path for addition of borated water from the boron addition system (BAS), and for removal of boron from pool water by the liquid radioactive waste system (LRWS)

The SFPCS is shown in Figure 9.1.3-1 and consists of two trains, each with an inlet strainer, a pump, and a heat exchanger. The system has intake skimmers, suction and discharge piping, valves, fittings, orifices, and instruments. Each major component train has manual isolation valves. Table 9.1.3-1a provides design information for the major components. Section 9.1.3.3.4 provides the heat loads in the SFP and the cooling capacity of the SFPCS. Section 3.2 provides the safety and seismic classifications for the system and identifies the applicable quality assurance (QA) requirements.

During normal plant operation with stored SFAs, the SFPCS operates continuously with either one or two trains. The train not in operation is kept in stand-by and started when needed. To support post-accident operations, the SFPCS has the ability to restart when AC power becomes available and operate with a pool water temperature near boiling. The SFPCS heat exchangers are cooled with water from the site cooling water system (SCWS).

Section 9.1.3.3.4 describes the heat loads from the SFAs in the SFP and from the NPMs in the reactor pool. The SFPCS and RPCS operate to cool these heat loads, and because the SFP and the RFP are connected via an open channel, the SFPCS operates in conjunction with the RPCS to remove the combined heat loads from the UHS. The SFPCS pumps provide the motive force to send pool water to the PCUS from the SFPCS as needed for pool water cleanup.

The elevation of the bottom of each SFPCS piping penetration through a SFP or RFP wall, and the open ends of the suction and discharge piping in the SFP and RFP, are above the 55 ft pool water level. Note: the Technical Specification 3.5.3 LCO Condition B minimum 65 foot pool level is only credited for establishment of the initial CNV wall temperature assumption in the containment response analysis and is not credited for containment heat removal purposes.

The SFPCS suction and discharge lines in the SFP are on opposite corners of the SFP to ensure cooling flow and mixing across the SFP. The SFPCS can also take suction from the north side of the RFP and can discharge water to the south side of the RFP. In the event that two trains of the RPCS are not operational, the flow through the SFPCS can be aligned to support cooling of either the reactor pool or the RFP, or both. Cooling of the reactor pool uses the PCUS connections to the RPCS discharge lines to send flow to the reactor pool from the SFPCS.

The DWS provides normal makeup water to the SFPCS. As described in Section 9.2.3, the DWS pumps have a flow capacity that ensures at least 100 gpm can be provided for SFP makeup. The makeup is added to the SFP and flows to the UHS through the open channel between the SFP and RFP. The UHS system provides the pool water level instruments located in the SFP and RFP as described in Section 9.2.5. A low water level indication on the level transmitters for the UHS alerts operators to open the normally closed valve in the DWS make-up line. The LRWS can also provide pool water makeup supply to the UHS pools from the low conductivity sample tank.

As described in Section 9.2.5, the UHS system provides an emergency makeup line for supply of water to the SFP. The elevation of the bottom of the UHS makeup line pipe penetration, and the open end of the discharge pipe in the SFP, are above the 55 ft pool water level. Note: the Technical Specification 3.5.3 LCO Condition B minimum 65 foot pool level is only credited for establishment of the initial CNV wall temperature assumption in the containment response analysis and is not credited for containment heat removal purposes.

The BAS provides a source of borated water for increasing the boron concentration in the UHS pools. The SFPCS provides pool water to the LRWS low conductivity collection tanks for processing if a reduction in boron concentration is needed in the UHS pools.

9.1.3.2.2 Reactor Pool Cooling System

The RPCS performs the following nonsafety-related functions:

1) maintains the water temperature of the reactor pool and RFP during normal operations by removing heat from the operating NPMs and from a disassembled NPM during refueling

2) serves as a backup to SFPCS

3) provides pump priming water for the containment flooding and drain system (CFDS) and receives drain water from the CFDS

4) provides reactor pool temperature information signals for post-accident monitoring

The RPCS is shown in Figure 9.1.3-2a and Figure 9.1.3-2b, and consists of two suction headers, each with a strainer, that supply three cooling trains, each with a pump and a heat exchanger. The system has intake skimmers, suction and discharge piping, valves, fittings, orifices, and instruments. Each major component train has manual isolation valves. Table 9.1.3-1b provides design information for the major components. Section 9.1.3.3.4 provides the heat loads in the reactor pool and RFP, and the cooling capacity of the RPCS. Section 3.2 provides the safety and seismic classifications for the system and identifies the applicable QA requirements.

During normal plant operation with up to 12 NPMs producing power, the RPCS operates continuously with two trains. The third train not in operation is kept in stand-by and started if needed. To support post-accident operations, the RPCS has the ability to restart when AC power becomes available and operate with a pool water temperature near boiling. The RPCS heat exchangers are cooled with water from the SCWS.

The heat loads from the NPMs in the reactor pool and RFP are cooled by the RPCS. Because the RFP and the SFP are connected via an open channel, the RPCS operates in conjunction with the SFPCS to remove the combined heat loads from the UHS. The RPCS pumps provide the motive force to send pool water to the PCUS from the RPCS as needed for pool water cleanup.

The RPCS intakes are in the north and south walls of the RFP, and there is a discharge into each of the NPM bays in the reactor pool. The water cools each NPM and mixes as it flows through the reactor pool to the RFP. The RPCS can also take suction from the west side of the SFP and can discharge water to the south side of the SFP. In the event that a train of the SFPCS is not operational, flow through the RPCS can be aligned to support cooling of the SFP.

The elevation of the bottom of each RPCS piping penetration through a wall of the refueling pool, reactor pool, or spent fuel pool, and the open ends of the suction and discharge piping in the pools, are above the 55 ft pool water level. Note: the Technical Specification 3.5.3 LCO Condition B minimum 65 foot pool level is only credited for establishment of the initial CNV wall temperature assumption in the containment response analysis and is not credited for containment heat removal purposes.

The RPCS provides borated pool water for priming the pumps in the CFDS prior to use of the pumps during NPM cooldown in preparation for refueling operations. The RPCS provides a flow path from CFDS to the UHS pools for returning water drained from a containment vessel after a refueling.

The RPCS has two temperature detectors in each of the NPM bays. These instruments are designed to support post-accident monitoring of reactor pool temperature. The detectors are qualified for the expected reactor pool water temperatures and radiation levels for accident conditions which assume reactor pool boiling occurs. Instrument signal transmitters are located adjacent to the bays, where the environmental conditions are not as severe.

9.1.3.2.3 Pool Cleanup System

The PCUS performs the following nonsafety-related functions:

1) removes impurities to reduce radiation dose rates

2) removes impurities to maintain water chemistry and clarity in the UHS pools and dry dock

The PCUS is shown in Figure 9.1.3-3 and consists of two parallel filters upstream of three parallel trains, with each train having a demineralizer followed by a resin trap. The system has inlet and outlet piping with valves, fittings, and instruments. Each major component has manual isolation valves. Inline samplers for obtaining grab samples are provided upstream of the demineralizers and downstream of the resin traps. Table 9.1.3-1c provides design information for the major components. Section 3.2 provides the safety and seismic classifications for the system and identifies the applicable QA requirements. The water chemistry parameters which are monitored are shown in Table 9.1.3-2. The PCUS is capable of cleanup of the combined volume of the UHS every two months.

The PCUS receives flow from the spent fuel pool cooling system, reactor pool cooling system, and pool surge control system. The SFPCS and the RPCS provide flow to the PCUS after cooling by the heat exchangers. Normal PCUS operation uses one train with a demineralizer and a resin trap to support the flow from one cooling train of the SFPCS or RPCS. The PSCS provides flow to the PCUS from the drain-down of the dry dock during a refueling. The PCUS provides cleanup of the dry dock water prior to adding the purified water to the pool surge control storage tank.

The PCUS demineralizers are of the non-regenerable mixed bed type. The demineralizer vessel is designed with piping for the spent resin to be sluiced from the demineralizer vessel to the solid radioactive waste system. Valves in the sluicing line are designed for remote operation from the main control room.

Operation of the PCUS maintains pool water chemistry, which is monitored to ensure it remains within the expected range of values shown on Table 9.1.3-2. Water filtration removes particulate materials, including crud, that are suspended in the pool. The amounts of particulates in the water are monitored based on total suspended solids. Water treatment using ion exchange removes both radioactive and non-radioactive chemical species dissolved in the pool water. Values outside of the expected range are used by operators to identify an impurity ingress pathway. Use of the expected range of values ensures that pool water chemistry minimizes corrosion of SSC wetted by pool water. The exterior surface of most of each containment vessel is immersed except when the upper portion is in the dry dock for inspection during refueling. During refueling, the interior of each NPM, along with the reactor vessel and its contents, are in contact with pool water when an NPM is opened for refueling. During a refueling, the contents of the reactor coolant system (RCS) are discharged directly into the RFP when an NPM is disassembled. When the NPM is reassembled, pool water forms the initial coolant for the RCS. At each refueling, the UHS pools receive contamination from an RCS and provide RCS makeup.

9.1.3.2.4 Pool Surge Control System

The PSCS performs the following nonsafety-related functions:

1) drains the dry dock using the evacuation pumps to support maintenance and refueling activities

2) transfers and stores excess water volume from the UHS to maintain the required water level in the pools during surge events, such as when an NPM is added to the pools

The PSCS is shown in Figure 9.1.3-4 and consists of two parallel dry dock evacuation pumps, a pool surge control storage tank, a containment catch basin, and a weather enclosure for the tank catch basin. The system has inlet and outlet piping with valves, fittings, and instruments. Each major component has manual isolation valves. Table 9.1.3-1d provides design information for the major components. Section 3.2 provides the safety and seismic classifications for the system and identifies the applicable QA requirements. The PSCS pumps provide the motive force to send water in the dry dock to the PCUS and then to the pool surge control storage tank. The PSCS returns the water stored in the pool surge control storage tank to the dry dock by gravity feed. The water stored in the tank can also be routed to the RFP by gravity feed. A bypass line allows dry dock water to be cleaned through the PCUS and returned to the dry dock without sending water to the pool surge control storage tank.

The pool surge control storage tank is located outside of the RXB in the plant yard. The tank has sufficient volume to store the contents of the drained dry dock. The catch basin around the tank has sufficient volume to store the pool surge control storage tank volume plus the contents of related piping. The catch basin is constructed of concrete and has a metal liner, which is sealed to prevent leakage to the environment. The catch basin includes piping and a drain valve to direct collected fluids to the LRWS in the Radioactive Waste Building (RWB).

During refueling, the dry dock water level is equalized with the level in the UHS pools to allow the dry dock gate to be opened for movement of the upper section of the NPM into the dry dock for inspection while the reactor is being refueled. Once the dry dock gate is closed, the dry dock evacuation pumps remove the water from the dry dock down to the level which still covers and shields some of the upper section of the NPM and allows access for inspections. The water from the dry dock is routed to the PCUS to remove particulates and radionuclides before being sent to the pool surge control storage tank. For dry dock refill operations, the pool surge control storage tank is emptied by gravity to the dry dock. A pipe connecting the dry dock and SFP contains two equalization valves that can be opened at the end of dry dock filling to equalize the water level in the dry dock and UHS pools.

Once the water level in the dry dock equalizes with the level in the UHS pools, the dry dock gate can be reopened to allow removal of the upper section of the NPM.

The elevation of the bottom of each PSCS piping penetration through a wall of the dry dock, RFP, or SFP; and the open ends of equalization line, are above the 55 ft pool water level. The piping deeper in the dry dock and RFP is equipped with anti-siphoning devices. These devices are also above the 55 ft pool water level. Note: the Technical Specification 3.5.3 LCO Condition B minimum 65 foot pool level is only credited for establishment of the initial CNV wall temperature assumption in the containment response analysis and is not credited for containment heat removal purposes.

The vent line on the pool surge control storage tank has a continuous air monitor with grab sample capabilities to monitor effluent releases from the tank. The radiation monitoring and sampling equipment for the tank vent are described in Section 11.5.2.

The supply and discharge lines to and from the pool surge control storage tank are embedded underground or in a yard area pipe chase. Each line is within a guard pipe from the catch basin to the RXB. The sump drain line is also embedded underground or in a yard area pipe chase and within a guard pipe from the catch basin to the RWB. Each guard pipe provides collection and permits periodic surveillance for PSCS piping leaks.

The PSCS storage tank is equipped with a water level instrument that provides overflow protection. In addition to initiating an alarm locally and in the main control room, the instrumentation provides an automatic isolation of the water transfer line to the tank when the water level reaches the high level setpoint.

9.1.3.2.5 Pool Leakage Detection System

The PLDS performs the following nonsafety-related functions:

1) provides for collection of water leaking from the pool liner

2) directs the flow to sumps for detection of collected leakage for operator evaluation

The PLDS consists of floor and wall leakage channels, perimeter leakage channels, channel drainage lines, leak collection headers, leakage rate measuring lines, and valves. The valves are used to isolate each channel drainage line and leakage rate measuring line. System components with the potential for contact with borated water are stainless steel. The floor leakage channels are embedded in the concrete beneath field welded seams of the pool floor liner plates in the UHS pools and dry dock. Additional leakage channels are attached behind the wall liner plate welds. The wall liner plates are erected prior to concrete placement. A perimeter channel is embedded in concrete at the wall and floor liner joint area. The channels collect leakage from the pool wall and floor liner plates and direct it to a sump or to collection header piping leading to a sump in the radioactive waste drain system (RWDS). The leakage collected in the RWDS sumps is routed to the LRWS for further processing. The PLDS will be accompanied by monitoring and surveillance by plant personnel (see COL Item 12.3-7). Section 3.2 provides the safety and seismic classifications for the system and identifies the applicable QA requirements.

Each zone of the pool leak chase system in the PLDS consists of one or more leakage channels that are interconnected to flow to one RWDS sump. The chase system segregates the PLDS into zones under the pool liner plates. Active leakage into a sump can be followed back to identify a leakage channel with flow. Leakage channels, channel drainage lines, and leak collection headers are accessible for inspection and cleaning.

As described in Section 9.3.3, the sumps in the RWDS are monitored for level. The RWDS supports the leakage detection function of the PLDS by providing local and control room indication and associated alarms when the leakage rate from the PLDS reaches a predetermined level.

9.1.3.3 Safety Evaluation

The pool support systems have sufficient capacity to perform their intended functions for normal operating conditions. The ability of the SFPCS and RPCS to transfer heat from the SFAs and the NPMs for normal operations is described further below. The ability of the DWS to provide normal makeup for pool water evaporation ensures sufficient shielding for the SFAs and NPMs for normal operations. As nonsafety-related systems, the continued performance of these active functions for cooling and shielding by these systems is not credited for accident conditions.

To ensure adequate safety under accident conditions when these active systems are assumed to not operate, the UHS provides a cooling water source as described in Section 9.2.5.

General Design Criteria 2, 4, 5, 61, and 63 were considered in the design of the structures that perform the function of cooling and shielding the stored SFAs for accident conditions. Section 9.2.5 describes how the UHS conforms to these GDC and meets Regulatory Guides 1.13, 1.26, and 1.29.

The pool support systems considered GDC 2 and are classified as Seismic Category III (see Section 3.2.1.3). However, as described in Section 3.7.3, piping or structures, such as in these five systems, with the potential for adverse interactions with Seismic Category I SSC, are designed as Seismic Category II. The piping, valves, and related components, which are designed to handle radioactive fluids in the pool support systems, are classified as Quality Group D and comply with Position C.3 of Regulatory Guide 1.26.

The PSCS storage tank is not required to meet Seismic Category I design requirements because the tank does not contain sufficient radionuclide inventory to result in an airborne dose consequence of greater than 500 millirem at the protected area boundary. The radionuclide concentrations in the UHS pools and dry dock are maintained at low levels, and the water in the PSCS storage tank is cleaned by the PCUS before being placed into the tank. Section 12.2.1 provides the radionuclide source term for this tank without credit for cleanup by the PCUS. Section 9.2.5 addresses the UHS pool boil off radiological consequences which bound potential doses from a failure of the PSCS storage tank because of the larger volume of water evaporated and the higher radionuclide concentrations in the water in the UHS pool boil off event.

The GDC 4 was considered in the design of the pool support systems. These systems are compatible with the environmental conditions for normal operations, maintenance, and testing. Section 3.4.1 addresses the potential flooding impact on SSC in the RXB due to pipe breaks, equipment failures, and fire suppression water. The worst failure of the piping in a pool support system is due to failure of the discharge line from the pool surge control storage tank in the RXB, which results in a floodwater flow rate value less than the flow rate from a failure of the SCWS header in the RXB. Section 3.5 addresses potential dynamic effects associated with missile impacts, and Section 3.6 addresses potential pipe ruptures. These sections of Chapter 3 demonstrate that the pool support systems do not result in floods, internal missiles, or pipe whip that adversely affect safety-related SSC.

The GDC 5 was considered in the design of the pool support systems. These pool support systems are shared among the NPMs and the sharing does not impair the performance of a safety-related function. The two nonsafety-related cooling systems for the UHS pools are designed such that no single failure in either system during normal operations prevents the continued active removal of heat, either in the SFP or in the reactor pool, by other trains in the systems. In the event of an accident in one NPM, the failure of the pool support systems to perform their nonsafety-related functions does not prevent an orderly shutdown and cooldown of the remaining NPMs.

The GDC 61 was considered in the design of the pool support systems. Each of the provisions is addressed in a section below to demonstrate adequate safety.

9.1.3.3.1 Design to Permit Inspection and Testing

The inspection and testing requirements of GDC 61 were considered in the design of the systems that support the UHS and the dry dock. For normal conditions, the five nonsafety-related pool support systems are designed to permit appropriate inspection and functional testing of system components as described in Section 9.1.3.4.

9.1.3.3.2 Shielding and Radiation Protection

The shielding and radiation protection requirements of GDC 61 were considered in the design of the pool support systems. Occupational exposures to radiation are minimized by removing impurities from the water in the RXB pools and by maintaining the minimum pool water level for shielding of stored SFAs.

The PCUS design reduces the dose rates for personnel exposed to pool water during operations near the UHS pool, such as refueling, by removing radionuclides in the pool water. Suspended solid radioactive materials, including crud, are filtered, and dissolved radioactive species are removed by ion exchange. The PCUS filters and demineralizers, which use these treatment processes to decontaminate the pool water, also concentrate the radionuclides removed from the pool water.

The filter and demineralizer vessels have the highest radiation source terms and require shielding and access control. The other components in the pool support systems are also designed to contain radioactive materials so that access controls and precautions to determine the need for additional temporary shielding apply. Section 12.2 describes radionuclide source terms for this equipment, and Section 12.4 provides occupational radiation exposures for personnel including during refueling and maintenance activities.

An adequate water level is maintained in the SFP by the DWS which provides at least 100 gpm of normal makeup water to the SFP and the connected UHS. A low water level alarm in the main control room meets Position C.7 of Regulatory Guide 1.13 and identifies to the operators that the UHS water level is low and that there is a need for adding makeup to the UHS. The alarm also alerts the operator of the potential for changes in boron concentration and to check that the proper concentration is being maintained in the UHS to meet the minimum boron concentration limit in Technical Specifications.

The normal pool makeup provided by the DWS meets Position C.8 of Regulatory Guide 1.13 by providing a supply sufficient to maintain UHS pool water levels during normal conditions and accounts for maximum pool evaporation and the potential for leakage from a liner in the UHS due to a dropped fuel assembly. The LRWS is also available to supply normal makeup water to the UHS pools from the low conductivity sample tank, which allows recycle of cleaned liquid radioactive waste streams. The effect of losing 100 gpm from the UHS pools is addressed in Section 9.1.3.3.5. The large inventory of water in the UHS means that many hours are needed to change pool depth by one foot and allows adequate time for operators to initiate appropriate safety actions.

A tube failure in a heat exchanger in the SFPCS or RPCS during normal operations leads to loss of SFP pool water when the pressure in either of these systems is higher than in the SCWS. To prevent loss of UHS pool water, the water pressure in the SCWS side of the heat exchangers is higher than in the SFPCS and RPCS. With this design, water leaks into the SFPCS or RPCS from the SCWS and increases SFP pool inventory. Because the SCWS water quality is lower than for the UHS pool water, conductivity monitors are provided on the piping at the outlet of each SFPCS and RPCS heat exchanger to detect possible heat exchanger tube leakage from the SCWS into either pool cooling system. To account for the possibility of a lower pressure in the SCWS than in the SFPCS or RPCS at the time of a heat exchanger tube failure, radiation monitors are provided on the piping at the outlet of each heat exchanger in these two systems to detect possible leakage from the SFPCS or RPCS into the SCWS. Identification of leakage from the SFPCS or RPCS to the SCWS alerts operators to isolate the train with the heat exchanger tube leak, which prevents the loss of water inventory from the UHS.

An adequate water level in the SFP for cooling and shielding the SFAs is also maintained by preventing an inadvertent drain down of the water in the UHS during accident conditions. The safety evaluation of these design features is addressed in Section 9.1.3.3.5.

9.1.3.3.3 Containment, Confinement, and Filtering

The pool support systems were designed to meet GDC 61 provisions for containment, confinement, and filtering of radioactive materials associated with storage of SFAs in the SFP as described below.

The PCUS meets Position C.13 of Regulatory Guide 1.13 and is designed for confinement of radionuclides removed from the pool water. The PCUS removes radionuclides in the pool water and collects them on a filter or in a demineralizer vessel for subsequent handling as solid radioactive wastes. Chapter 11 describes handling of used filters and sluicing of expended demineralizer resins.

Leakage from piping or components in the pool support systems in the RXB is contained within local floor drains and RXB sumps and is then transferred by the RWDS for processing by the LRWS.

The UHS pools meet Position C.12 of Regulatory Guide 1.13 and include the PLDS for detecting and containing pool liner leaks. The UHS pool liners have no drains and the leakage from a UHS pool liner is collected by the PLDS and directed to floor sumps in the RWDS. The RWDS provides local and control room indication and associated alarms when the leakage rate from the PLDS reaches a predetermined rate. This alerts operators to identify the area of the pool with leakage using the leak chase system in the PLDS. The set of leakage channels, or the individual channel, that flows to one RWDS sump form a leak chase and allow liner leakage to be isolated to a zone with a leak in the pool liner. From the sump collecting the leakage, a leakage channel with flow can be determined. After identifying a channel with flow, the flow rate for the leakage channel can be monitored by collecting and measuring the amount of water flowing from the channel. Knowing the leakage rate and location of the leakage channel provides the basis for further inspections from inside the pool.

The supply line from the RXB to the pool surge control storage tank and the discharge line from the tank back to the RXB are within a guard pipe between the catch basin and the RXB. Periodic surveillance of the guard pipes provides confirmation of the continued integrity of the PSCS piping.

The catch basin around the storage tank is constructed of concrete with a metal liner that is sealed and leak-proof. A level sensor is provided to alert operators when fluid has collected in the catch basin’s sump. There is a drain valve and piping to transfer fluids collected in the catch basin to the LRWS in the RWB. The sump drain line is within a guard pipe from the sump to the RWB. These design features reduce the possibility that a leak of radioactive UHS pool water from the pool surge control storage tank can reach the environment.

As described in Section 9.4.2, the area around the SFP is serviced by the nonsafety-related RXB heating and ventilation system that controls the release of airborne radionuclides from evaporating UHS pool water for normal conditions of operation, but is not credited for accident conditions.

9.1.3.3.4 Residual Heat Removal Capability

The pool cooling systems meet Position C.9 of Regulatory Guide 1.13 and maintain the pool bulk temperatures below 110 degrees F for design heat loads as described below. For these analyses, the following assumptions apply. The decay heat from the SFAs is cooled by the heat exchangers with no loss of heat to the pool walls, pool floors, or fuel storage racks; or by evaporation of pool water.

The SFP is in communication with the RFP and reactor pool to form the UHS. The heat loads in the three UHS pools are considered to ensure adequate active cooling capability. The heat exchangers in the RPCS and SFPCS are sized assuming the maximum water temperature for the SCWS and the design flowrates from Table 9.1.3-1a and Table 9.1.3-1b. The RPCS and SFPCS heat exchangers each have the same heat removal capacity, with two two exchangers in the SFPCS and three heat exchangers in the RFPCS. The five heat exchangers in the combined RPCS and SFPCS are cross-connected with piping and valves to provide sufficient redundancy to ensure adequate cooling while allowing for normal equipment maintenance. A heat exchanger in either system can withdraw water from either the SFP or the RFP, and can discharge cooled water to the spent fuel pool, refueling pool, or reactor pool. As heat loads change in the pools, the heat exchangers are operated to maintain the bulk pool temperatures at the normal operating temperature of approximately 100 degrees F.

The RPCS heat exchangers are sized so that with two of the three RPCS heat exchangers in operation the RPCS can remove the normal operating heat load of approximately 10.36 MMBtu/hr from 12 NPMs at full power operation in the reactor pool. As noted above, each of the five heat exchangers in the two systems is sized for half of this heat load.

For the cases below, the heat load in the reactor pool is added to the heat load from the SFAs in the SFP, and the heat load when an NPM is opened in the RFP, to ensure that the cooling capabilities for the combined SFPCS and RPCS are adequate. Several cases for the total heat load in the UHS pools are described below.

The first case is the normal operating heat load for 12 operating NPMs in the reactor pool and a full SFP. The decay heat for a full SFP is based on continuous operation of the plant with a refueling every two months. With 13 SFAs offloaded every refueling, more than 10 years are needed to fill the accessible storage locations in the fuel storage racks. The spent fuel decay heat is determined using American Nuclear Society Standard 5.1-2014 (Reference 9.1.3-1). For this case, the heat load in the UHS totals approximately 12.85 MMBtu/hr and three of the five heat exchangers operate to maintain the normal operating temperature in the pools.

The next case adds the incremental heat load from the opening of an NPM for refueling, which is equivalent to a full-core offload into the SFP from one NPM. With 11 NPMs remaining in operation, the heat load for the UHS pools totals approximately 16.56 MMBtu/hr. For this case, there is a reduction in operating NPM heat load from 12 down to 11 NPMs, but the decrease is more than offset by the increase from the open NPM in the RFP, or from a full-core offloaded into the SFP. This case assumes an additional heat load when an NPM is opened in the RFP 8 hours after a shutdown and is conservative for the time to disconnect, move, and open an NPM, and to then offload a full core into the SFP. For this case, four of the five heat exchangers can be operated to maintain the normal operating pool temperature.

The next case is not expected to occur during operations, but is used to ensure the design provides adequate heat removal capability. For a maximum design heat load of 0.3 percent of the total plant thermal output, which is 19.65 MMBtu/hr, four of the five heat exchangers are needed to maintain the normal operating pool temperature.

The final case is another that is not expected to occur during operations. The following applies if the SFPCS and RPCS are needed for cooling the SFAs stored from five or more years of operation plus a full-core offload from each of the 12 NPMs. Under this scenario, the total decay heat in the UHS for each of the NPM offloads must be evaluated before the additional core is offloaded to ensure that the bulk pool water temperature is maintained at less than the 110 degrees F limit established by Technical Specifications.

As described in Section 9.1.2.3.2, when cooling of just the SFP is considered, a single heat exchanger in the SFPCS can keep a full SFP with a recent core offload from one NPM below the maximum pool water temperature limit of 110 degrees F in the Technical Specifications. This demonstrates that the SFPCS has a minimum heat removal capability for maintaining the SFP temperature within the design for the structure.

9.1.3.3.5 Prevent Coolant Inventory Reduction for Accident Conditions

The requirements of GDC 61 to prevent loss of SFP coolant for accident conditions were considered in the design of the structures and systems supporting spent fuel cooling and shielding. The design provides the makeup water and prevents draining, siphoning, or other loss of water.

The safety function of providing makeup for spent fuel cooling and shielding is preformed passively for accident conditions, for the long-term safety period, and for a longer time period based on the design of the UHS pools in the RXB. As shown in Figure 9.1.3-5, the top of the weir wall between the SFP and RFP is at the 20 ft pool water depth. The tops of the fuel storage racks are below the 10 ft pool water depth. The water in the SFP below the top of the weir is the inventory of water that provides 10 ft of water above the tops of the fuel storage racks for cooling the SFAs. This minimum depth of water also provides shielding for operators to keep dose rates low while they are working around the SFP.

Preventing a reduction of the SFP coolant inventory below the top of the weir wall for accident conditions is performed by the large inventory of water in the UHS pools and by an emergency makeup line in the UHS system as described in Section 9.2.5. The water inventory above the top of the weir wall is contained within Seismic Category I structures. The UHS makeup line also meets Seismic

Category I design requirements. The Seismic Category I flow path for supply of makeup water to the lower portion of the SFP, coupled with the design of the UHS, meet Position C.8 of Regulatory Guide 1.13.

The capacity of each flow path exceeds the 100 gpm needed to supply makeup water to account for the maximum evaporation rate or the liner leakage rate from a dropped fuel assembly. The large inventory of water in the UHS above the top of the weir wall provides a supply of more than 4 million gallons of water. This automatically feeds into the lower portion of the SFP without the need for operator action to initiate the flow because the open channel above the top of the weir allows unrestricted flow between pools and there is no gate in the wall that could block flow. As described in Section 9.2.5, the large quantity of water in the UHS provides a supply of water that would take weeks to evaporate to the level of the top of the weir. This allows time for operators to connect a water supply to the emergency makeup line outside of the RXB. As shown in Figure 9.2.5-2, the emergency makeup line in the UHS system has a 6 inch diameter and slopes from outside of the RXB to the SFP. This line has the capability of providing several times the needed 100 gpm and permits operators to make the connections and flow alignments from a location remote from the operating floor near the SFP.

In addition to the capability to add makeup, the design prevents the loss of pool water inventory. The large inventory of water in the UHS increases the time needed for leaking, draining, or siphoning to impact the water level in the pools. Each foot of water depth in the UHS pools contains more than 90,000 gallons of water. At a leakage rate of 100 gpm, more than 900 minutes, or 15 hours, is needed for a one-foot drop in water level. The large amount of water to be lost and the time needed ensures that operators would be alerted to stop the loss of water. Sufficient time is available to preclude a loss of pool water that would create an unsafe water level in the UHS pools.

The design of the UHS pools meets Position C.6(b) of Regulatory Guide 1.13 and has no drains, piping, or other systems that would allow pool water to drain below the minimum level needed to support plant safety analyses, which is above the level needed for adequate shielding of the SFAs. The elevation of the bottom of each of the piping penetrations through the walls of the UHS pools and the dry dock is above the 55 ft pool water level. Also, the elevations of the open ends of the piping in the pools or the antisiphon devices on the piping are above this elevation. As shown in Figure 9.1.3-5, this elevation ensures that sufficient pool water inventory is available to support the plant safety analyses. A failure of the piping in these pool support systems does not drain the water to adversely affect the inventory of water available for cooling and shielding the NPMs or SFAs. The CFDS has an intake pipe with an open end above the 55 ft pool water level. The CFDS pipe exits the pool water surface and does not penetrate the wall of a UHS pool. There are no other penetrations in the UHS pools or dry dock. Note: the Technical Specification 3.5.3 LCO Condition B minimum 65 foot pool level is only credited for establishment of the initial CNV wall temperature assumption in the containment response analysis and is not credited for containment heat removal purposes.

Identifying leakage from components in the pool support systems prevents a loss of pool inventory and is another means to ensure an adequate water level in the

SFP for cooling and shielding the stored spent fuel. Leakage from piping or components in the spent fuel pool cooling system, reactor pool cooling system, pool cleanup system, and pool surge control system in the RXB is collected by local floor drains, which flow to sumps monitored by level instrumentation. An increase in sump level and subsequent alarm indicates an abnormal amount of water in the sump and possible system leakage. Each major component train in these systems has manual valves that allow isolation of the train for maintenance or repair.

Leakage from the UHS pool liner removes inventory from the SFP. The PLDS collects leakage from the liners and directs it to the floor sumps in the RWDS. The RWDS supports the leakage detection function of the PLDS by providing local and control room indication and associated alarms. When the leakage rate into a sump reaches a predetermined value, operators perform inspections to determine the cause and implement repairs as necessary to stop the leakage from the liner.

Pool water in the dry dock is not included in the inventory of water in the UHS because the dry dock gate may be closed at the time of an accident. The dry dock gate is classified as Seismic Category II, which does not ensure that the gate functions and can reopen after a safe shutdown earthquake. An empty dry dock at the time of an accident and a safe shutdown earthquake is assumed to cause the gate to fail and open. For this condition, water in the UHS pools reenters the dry dock and lowers the water level in the UHS pools by less than 12 ft. Because the UHS pool water level remains above the minimum pool level for accident mitigation and for cooling and shielding the SFAs after such a gate failure, the water level in the SFP and other two UHS pools provides a sufficient inventory of water for performing the cooling and shielding functions.

9.1.3.3.6 Monitoring Cooling Capability and Area Radiation Levels

The GDC 63 was considered in the design of the spent fuel cooling related structures and systems. Monitoring for the loss of decay heat removal capability is provided for both normal and accident conditions. Radiation monitors are provided for detecting excessive radiation levels in the SFP area of the RXB as described in Section 12.3.4. These design features meet Position C.7 of Regulatory Guide 1.13.

For normal operations, loss of cooling capability results from degradation or failure of the two active cooling systems, or leakage of the inventory of water in the UHS pools. The temperature detectors on the inlets and outlets of the heat exchangers in operation in the SFPCS and RPCS provide operators with information on the cooling performance of each heat exchanger. The outlet temperature detectors have a high setpoint for an alarm that alerts operators to determine the cause and ensure adequate active cooling system performance.

During normal operations, the following means are provided for detecting leakage from the UHS pools which helps maintain the inventory of water for cooling the spent fuel. The PLDS collects leakage from the UHS pool liners and directs it to the RWDS sumps for detection. Leakage from the piping and equipment in the other pool support systems is collected by the RWDS sumps for detection. Radiation monitors on the SCWS discharge lines from the SFPCS and RPCS heat exchangers identify leakage from either cooling system to the SCWS.

For normal and accident conditions, the UHS system provides redundant pool water level instruments as described in Section 9.2.5.

9.1.3.3.7 Monitoring Radioactivity Releases

The design of the PSCS meets GDC 60 and 64 by providing the capability to monitor radioactivity releases from the vent line on the PSCS storage tank. Radiation monitoring is described in Section 11.5.2. A high level of radioactivity on the monitor isolates the tank inlet and outlet piping while operators investigate the cause of the alarm.

9.1.3.3.8 Maintaining Doses as Low as Reasonably Achievable

The design of the structures for spent fuel cooling and the design of the pool support systems meet 10 CFR 20.1101(b) to achieve doses that are ALARA. These systems prevent the generation of, and minimize the spread of contamination consistent with the guidance in Regulatory Guide 8.8, Position C.2.f(2). The design of the pool support systems has features for flushing system components to remove crud accumulations, which is consistent with the guidance in Regulatory Guide 8.8, Position C.2.f(3). Information on compliance with the 10 CFR 20.1406 requirements for minimization of contamination is provided in Section 12.3.

The liners in the UHS pools are designed with floor and perimeter leakage channels as part of the PLDS. These channels collect leakage from these structures and direct it to RWDS sumps for subsequent treatment by the LRWS.

The SFPCS and RPCS are designed with equipment drains that connect to the RWDS and with piping connections for flushing system piping and components. The pumps, strainers, and heat exchanges in these systems are located within curbed areas in the RXB that are drained to RWDS sumps. These features reduce crud accumulations in system components, minimize the spread of contamination, and provide drainage control for contaminated fluids. These systems also operate with the water pressure in the SCWS side of the heat exchangers higher than in the SFPCS and RPCS. With this design, water leaks into the SFPCS or RPCS from the SCWS and not into the SCWS, which prevents contaminated water from entering the nonradioactive SCWS.

The PCUS is designed to remove radioactive materials from the water in the UHS pools and dry dock. These materials are removed by filters and demineralization to reduce the pool water's dose rate to operators near the pools, and to reduce the airborne doses resulting from evaporation of pool water.

The PCUS demineralizer vessels are designed for sluicing spent resins to the solid radioactive waste system. The resin traps downstream of the demineralizer vessels are designed for back flushing accumulated resins from the traps to the spent resin discharge piping. To minimize the use of clean water and the generation of liquid radioactive waste, spent resin sluicing can be performed with water cleaned by the

LRWS. As described in Section 11.2.2, the clean-in-place subsystem of the LRWS provides clean demineralized water for flushing the PCUS resin sluice lines. Use of demineralized water allows the contamination in a line after sluicing to be removed consistent with ALARA objectives.

The tank bypass line in the PSCS allows the water in the dry dock to be cleaned by the PCUS and returned to the dry dock without sending water to the PSCS storage tank. With the bypass line, the PCUS operates to lower the radionuclide concentrations in the dry dock water and can maintain water quality either during a refueling outage when the water level in the dry dock is lowered for inspection of an upper NPM, or when the dry dock is full of water prior to a maintenance activity. The PSCS storage tank level instrumentation provides overflow protection with an automatic control to stop the flow of water into the tank when a high level setpoint is reached.

The PLDS is designed with access for inspection and flushing of floor and perimeter leakage channels, channel drainage lines, and leak collection headers. This provides a means to contain and remove contamination buildup created by liner leakage. Operators can remove contamination buildup from the leakage and keep occupational exposures ALARA by removing radiation sources.

The BAS provides borated water and the DWS and LRWS provide makeup water sources to the SFPCS for adding to the SFP. The lines from the BAS and DWS to the SFPCS include check valves, which prevent the flow of contaminated water from the SFPCS and LRWS to the nonradioactive BAS and DWS.

9.1.3.4 Inspection and Testing

The pre-operational testing of the pool support systems is performed as part of the initial test program as described in Section 14.2.

The major trains or pieces of equipment in the pool support systems are provided with isolation valves that are located to allow for systematic inservice inspections, periodic maintenance, repairs, and functional testing. Adequate laydown space is provided for pump and heat exchanger disassembly and maintenance. Pull spaces are also provided for the heat exchanger tube bundles and head removal. The leakage channels in the PLDS are accessible for inspection of each channel.

Section 14.3 provides information related to development of Inspections, Tests, Analyses, and Acceptance Criteria for the NuScale Power Plant.

9.1.3.5 Instrumentation

The pool support systems include instruments to monitor the following process conditions:

- SFPCS
  - Temperature at the inlet and outlet of each heat exchanger
  - Pressure drop across each strainer

  - Pressure upstream and downstream of each pump
  - Flow rate at each pump's discharge
  - Conductivity at the outlet of each heat exchanger
- RPCS
  - Temperature at the inlet and outlet of each heat exchanger
  - Temperature in each NPM bay for post-accident monitoring inputs
  - Pressure drop across each strainer
  - Pressure upstream and downstream of each pump
  - Flow rate at each pump's discharge
  - Conductivity at the outlet of each heat exchanger
- PCUS
  - Temperature at the inlet of each filter
  - Pressure drop across each filter, demineralizer, and resin trap
  - Flow rate downstream of each resin trap
  - Conductivity at the outlet of each demineralizer
- PSCS
  - Pressure downstream of each pump
  - Water level in the dry dock and in the pool surge control storage tank
  - Radiation level in the vent line of the pool surge control storage tank

The PLDS has no instruments and uses the level indicators in the RWDS collection sumps for detecting leakage from a pool liner.

The plant control system interfaces with the equipment in the pool support systems that requires monitoring and controls. The readouts from the instruments are available from the plant control system in the main control room. The plant control system alerts operators after a setpoint is reached if an operator acknowledgment or other action is required. The RPCS provides temperature information to the module protection system for post-accident monitoring of the reactor pool water temperature at the discharge of the RPCS into each NPM bay. Chapter 7 describes the instrumentation and control systems for the plant. Section 7.1 describes PAM instrumentation. Section 9.2.5 describes the SFP water level instruments.

9.1.3.6 References

9.1.3-1 American National Standards Institute/American Nuclear Society, "Decay Heat Power in Light Water Reactors," ANSI/ANS-5.1-2014, La Grange Park, IL.

Table 9.1.3-1a: Equipment Parameters for the Spent Fuel Pool Cooling System

Spent Fuel Pool Cooling System		
SFPCS Pump A, B		
Design pressure	250 psig	
Design temperature	250°F	
Material	Stainless steel	
Flow capacity	1250 gpm	
SFPCS Heat Exchanger A, B		
Design pressure	210 psig	
Design temperature	250°F	
Material	Stainless steel	
Type	Shell and U-Tube (2 passes)	
Heat removal capacity	5.18 MMBtu/hr	
Fluid circulated	Pool water	SCWS water
Flow (per train)	620,000 lb/hr (1,250 gpm)	620,000 lb/hr (1,250 gpm)
Inlet temperature	Up to 110°F	Up to 90°F
Outlet temperature	Up to 100°F (dependent on conditions)	Up to 98°F (dependent on conditions)
SFPCS Strainer A, B		
Design pressure	150 psig	
Design temperature	250°F	
Material	Stainless steel	
Flow capacity	1250 gpm	

Table 9.1.3-1b: Equipment Parameters for the Reactor Pool Cooling System

Reactor Pool Cooling System		
RPCS Pump A, B, C		
Design pressure	250 psig	
Design temperature	250°F	
Material	Stainless steel	
Flow capacity	1250 gpm	
RPCS Heat Exchanger A, B, C		
Design pressure	210 psig	
Design temperature	250°F	
Material	Stainless steel	
Type	Shell and U-Tube (2 passes)	
Heat removal capacity	5.18 MMBtu/hr	
Fluid circulated	Pool water	SCWS water
Flow (per train)	620,000 lb/hr (1,250 gpm)	620,000 lb/hr (1,250 gpm)
Inlet temperature	Up to 110°F	Up to 90°F
Outlet temperature	Up to 100°F (dependent on conditions)	Up to 90°F (dependent on conditions)
RPCS Strainer A, B		
Design pressure	150 psig	
Design temperature	250°F	
Material	Stainless steel	
Flow capacity	1250 gpm	

Table 9.1.3-1c: Equipment Parameters for the Pool Cleanup System

Pool Cleanup System	
PCUS Filter A, B	
Design pressure	250 psig
Design temperature	250°F
Material	Stainless steel
Flow capacity	2500 gpm
PCUS Demineralizer A, B, C	
Design pressure	250 psig
Design temperature	250°F
Material	Stainless steel
Flow capacity	1450 gpm
PCUS Resin Trap A, B, C	
Design pressure	250 psig
Design temperature	250°F
Material	Stainless steel
Flow capacity	1450 gpm

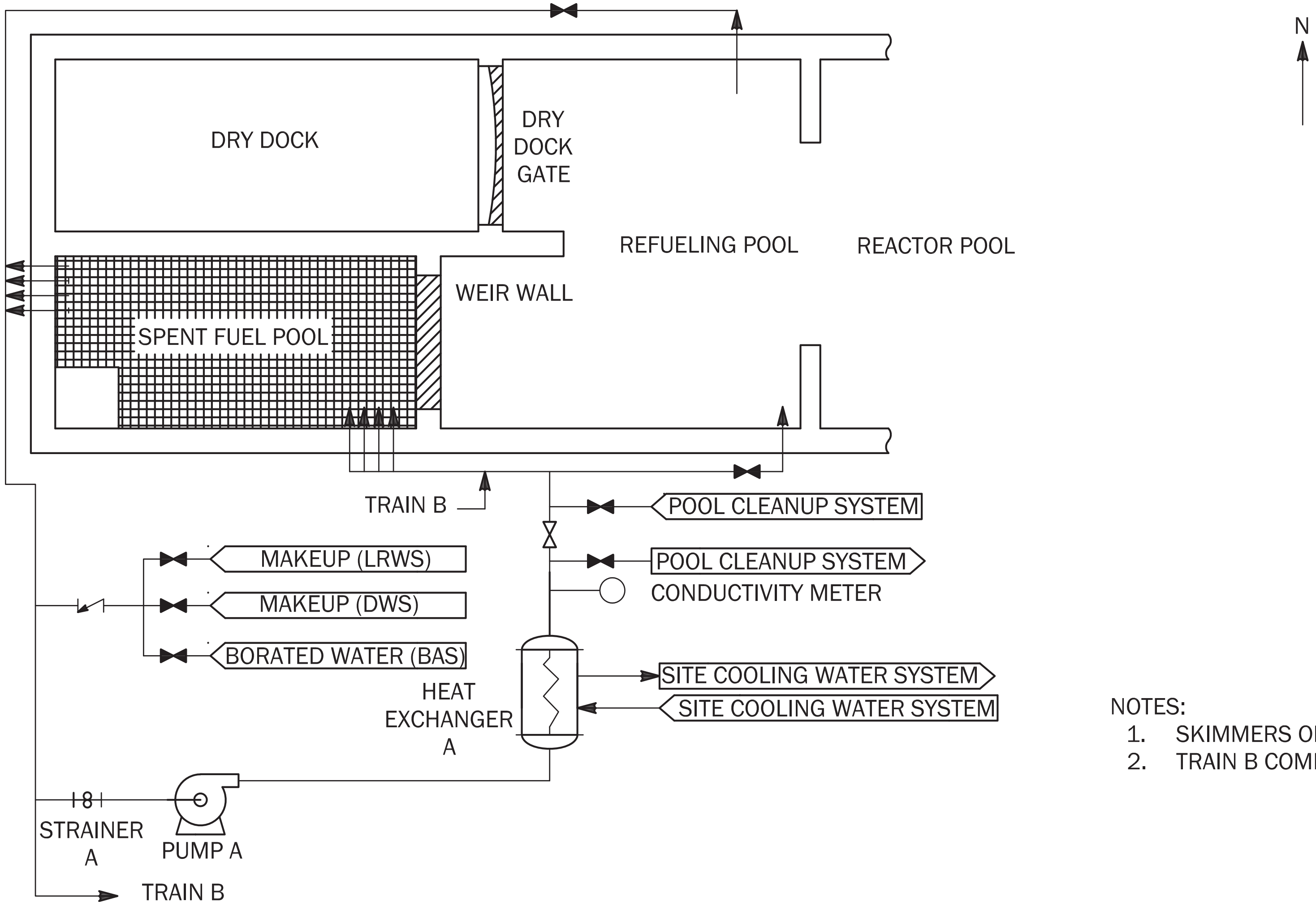
Table 9.1.3-1d: Equipment Parameters for the Pool Surge Control System

Pool Surge Control System	
PSCS Storage Tank	
Design pressure	Atmospheric
Design temperature	150°F
Material	Stainless steel
Capacity	1,100,000 gallons
PSCS Dry Dock Evacuation Pump A, B	
Design pressure	250 psig
Design temperature	150°F
Material	Stainless steel
Flow capacity	1250 gpm
PSCS Storage Tank Catch Basin	
Material	Concrete with metal liner

Table 9.1.3-2: Water Chemistry Parameters Monitored for the Ultimate Heat Sink Pools

Parameter	Expected Value
Conductivity	Trend for unexpected changes
pH	Trend for unexpected changes
Boron	≥ 1,800 ppm
Chloride	< 0.15 ppm
Fluoride	< 0.15 ppm
Sulfate	< 0.15 ppm
Silica	< 1 ppm
Total suspended solids	≤ 1.0 ppm
Gamma isotopic activity	< 0.001 µCi/gram

Figure 9.1.3-1: Spent Fuel Pool Cooling System Diagram



NOTES:
1. SKIMMERS ON TWO SUCTION LINES.
2. TRAIN B COMPONENTS NOT SHOWN.

Figure 9.1.3-2a: Reactor Pool Cooling System Diagram

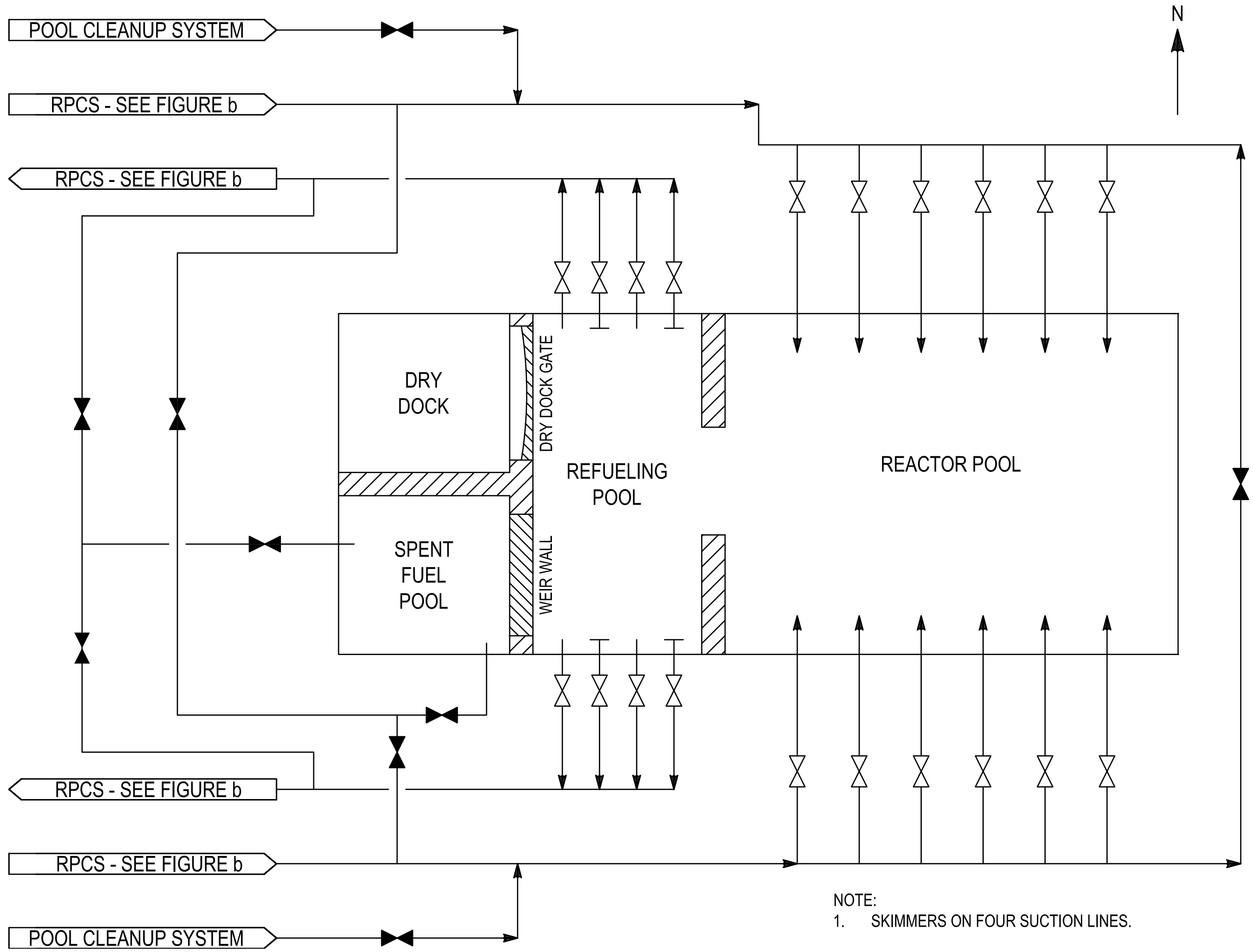


Figure 9.1.3-2b: Reactor Pool Cooling System Diagram

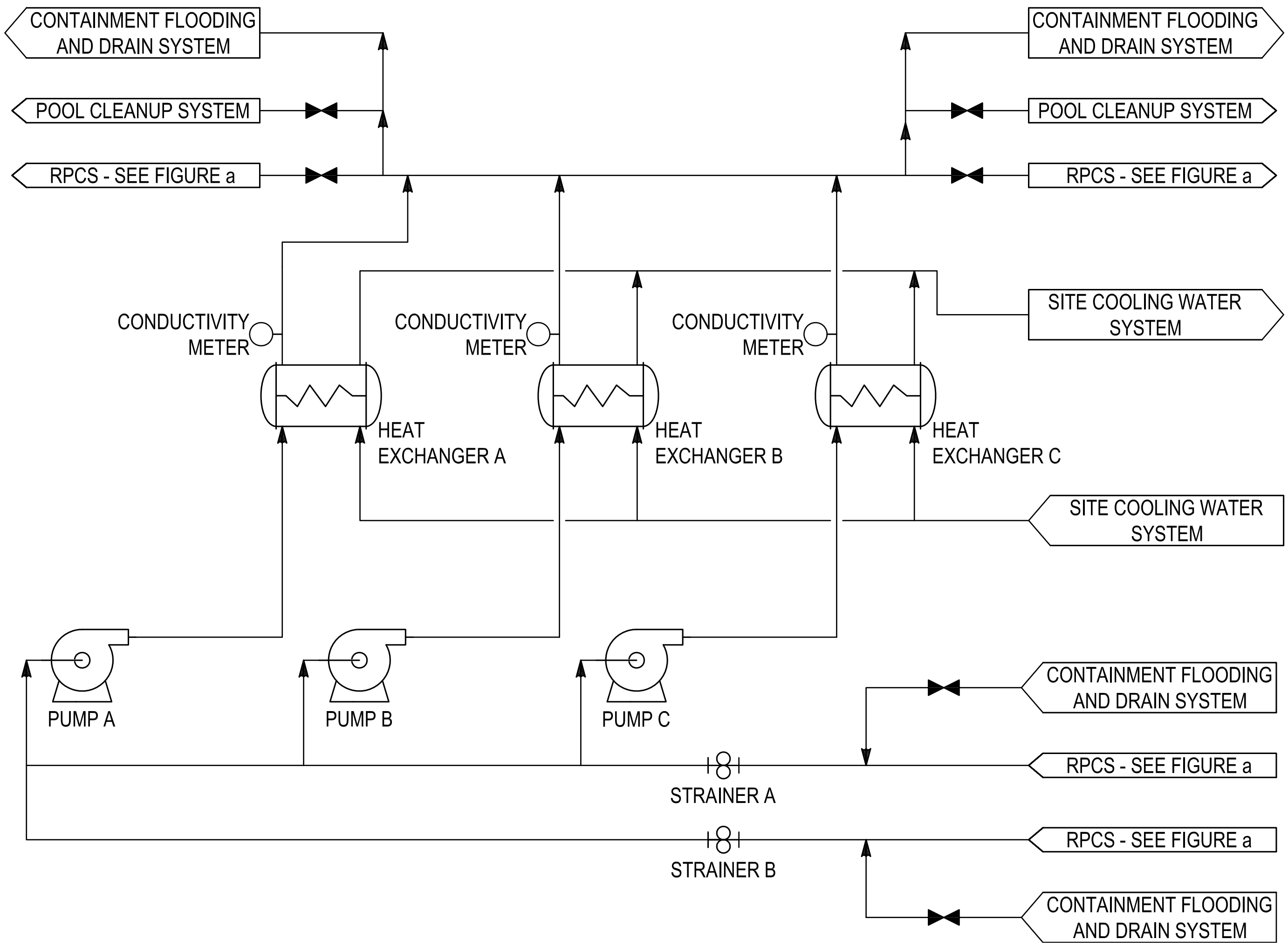


Figure 9.1.3-3: Pool Cleanup System Diagram

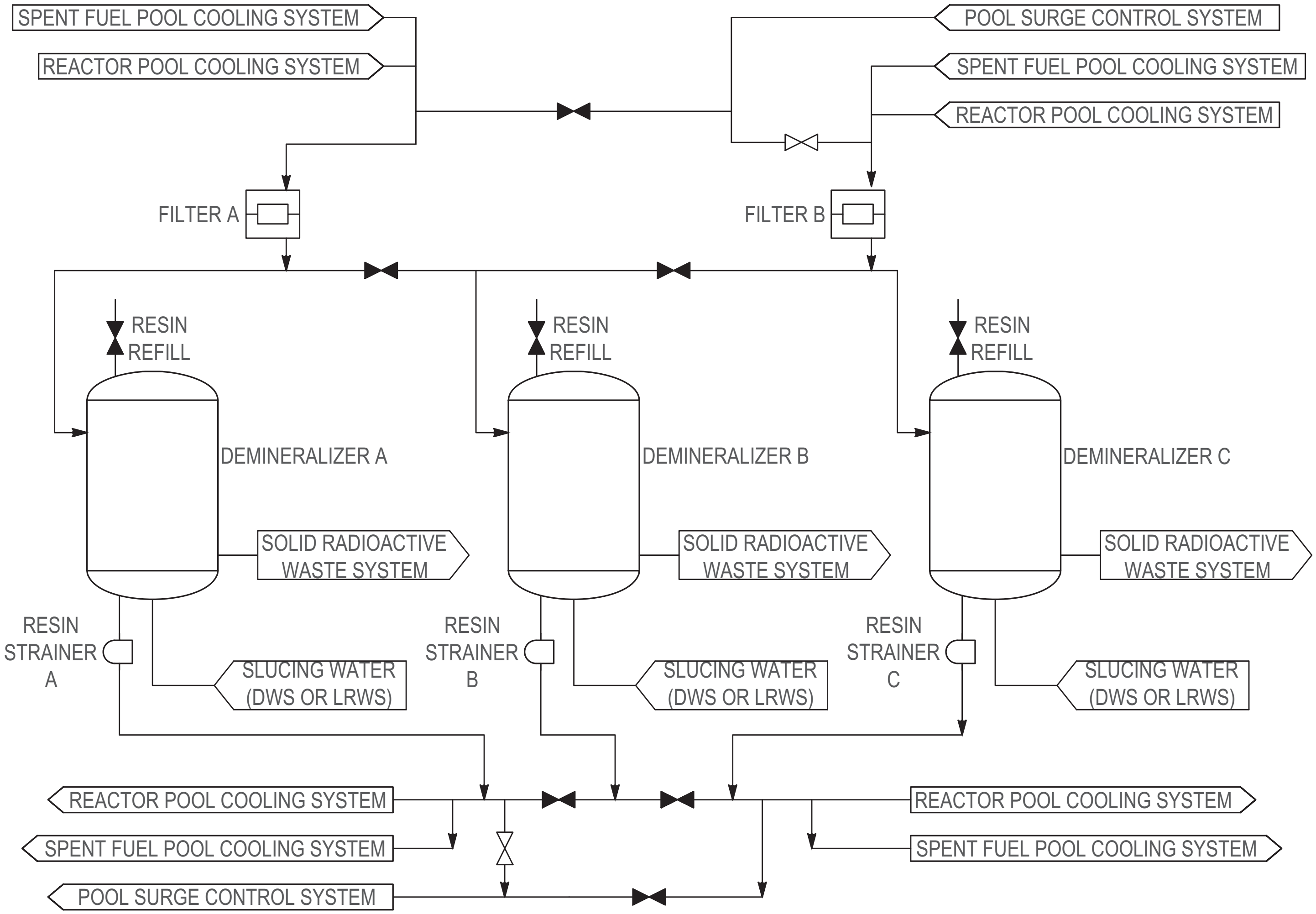


Figure 9.1.3-4: Pool Surge Control System Diagram

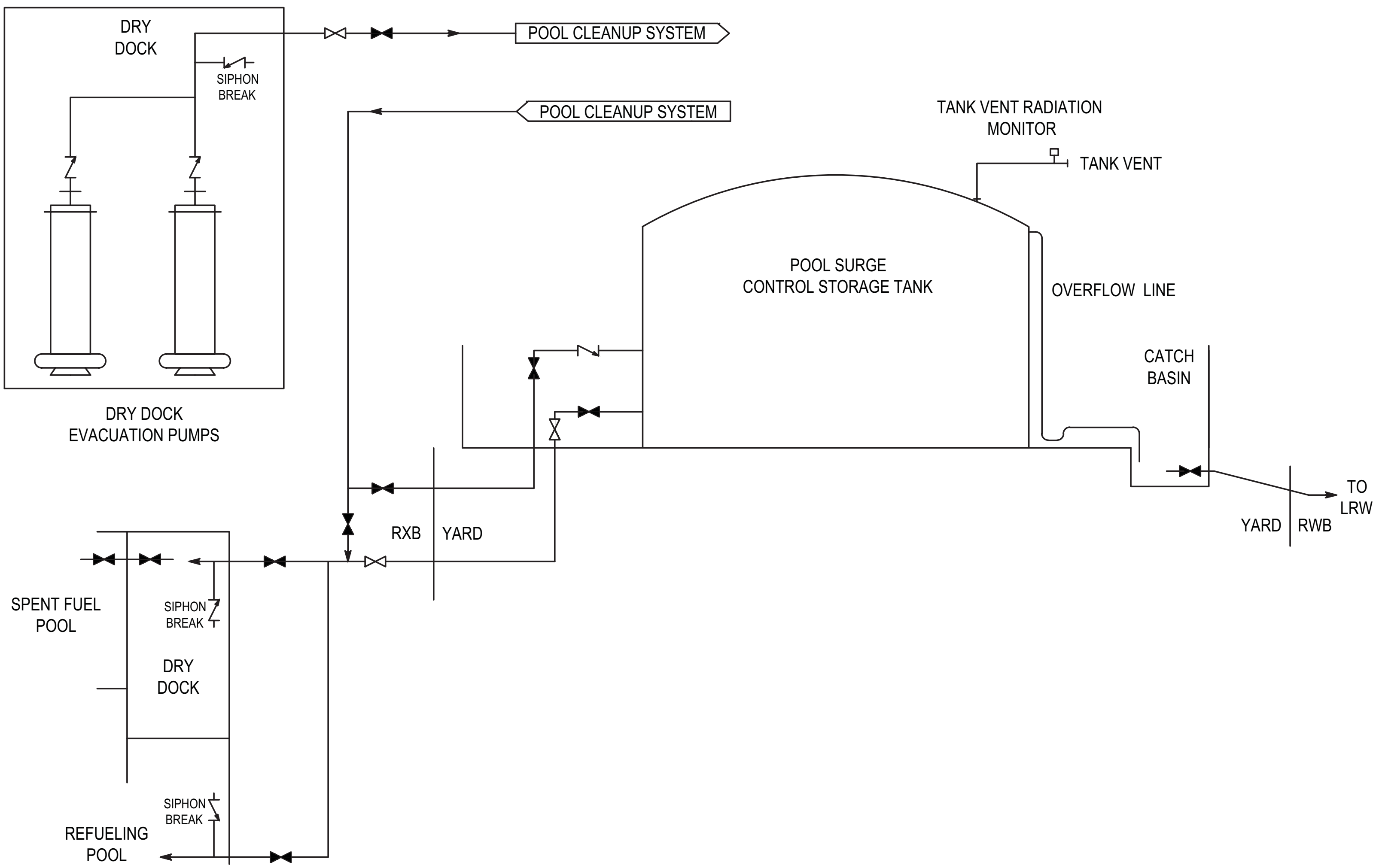


Figure 9.1.3-5: Reactor Building Pool Water Level and Plant Feature Elevations

{{ Withheld - See Part 9 }}

9.1.4 Fuel Handling Equipment

The fuel handling equipment consists of the components and equipment used to handle new fuel upon receipt on site, refueling operation, and to the loading of spent fuel into a shipping cask. The fuel handling equipment (FHE) includes the following:

- fuel handling machine (FHM)
- new fuel jib crane (NFJC)
- new fuel elevator (NFE)

9.1.4.1 Design Bases

This section identifies the FHE required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The FHE is designed to support the periodic refueling of the reactor as well as movement of control rods and other radioactive components within the reactor core, refueling pool (RFP), and spent fuel pool (SFP).

General Design Criteria (GDC) 2 was considered in the design of the FHE. The areas of the facility associated with the FHE are the SFP and RFP, that are located in the Seismic Category I Reactor Building (RXB). Refer to Sections 3.7 and 3.8 for information pertaining to the design analyses and criteria associated with establishing the ability of Seismic Category I structures housing the FHE and supporting systems to withstand the effects of natural phenomena such as the safe shutdown earthquake. In addition, figures in Section 3.8 depict the relationship between FHE and the RXB. The FHM is designed to Seismic Category I requirements. The NFJC and NFE are designed to Seismic Category II requirements. Refer to Section 3.2.1 for information pertaining to safety and quality class of structures, systems, and components (SSC).

General Design Criterion 4 was considered in the design of the FHE. The FHE is protected from the effects of external missile hazards by being located inside the RXB. Dynamic effects associated with missile impact are provided in Section 3.5.

General Design Criterion 5 was considered in the design of the FHE. The FHE interfaces with up to NuScale Power Modules (NPMs) for initial fueling, fuel shuffling, and removal of spent fuel. During initial fueling, or refueling, the appropriate module is shut down, disconnected, and brought to the RFP where the FHE can access the module. The design of the FHE allows for the performance of fueling activities on one module without affecting the operation of the other modules including potential shutdown and cooldown.

Consistent with GDC 61, the design of the FHE provides reasonable assurance that release of radioactive materials and unacceptable personnel radiation exposures from damage to irradiated fuel is avoided. Potential damage to fuel and release of radioactivity has been addressed through meeting requirements of American National

Standards Institute (ANSI)/American Nuclear Society (ANS) 57.1-1992 (Reference 9.1.4-1).

Consistent with GDC 62, the FHE is designed such that it does not cause, or contribute to, a criticality accident. Protection from a criticality event is provided by designing the FHE to meet the requirements of Reference 9.1.4-1.

Table 9.1.4-1 presents a listing of FHE design information. Section 9.1.4.3 contains detailed information on the safety evaluation for FHE.

9.1.4.2 System Description

9.1.4.2.1 General Description

The FHE consists of components and equipment associated with the handling of the new and spent fuel. The major FHE components are shown in Figure 9.1.4-1 through Figure 9.1.4-4b and include the FHM (Figure 9.1.4-2), NFJC (Figure 9.1.4-3) and NFE (Figure 9.1.4-4a and Figure 9.1.4-4b).

The handling of fuel during refueling is controlled by a series of interlocks to ensure adherence to fuel-handling procedures. The FHM has provisions to limit maximum lift height so that the minimum required depth of water shielding is maintained.

Fuel transfer from the point of receipt to inspection, storage, and placement in the reactor core is accomplished with fuel grapples. A grapple is used when fuel movement is performed by the NFJC. The FHM also utilizes a grapple to transfer fuel assemblies to and from the SFP.

The FHE is designed to convey a fuel assembly underwater from the time it is lowered into the SFP until the spent fuel assembly (SFA) is placed in a spent fuel transfer cask. Underwater transfer of SFAs provides radiation shielding, as well as a medium for removal of decay heat. Structures, components, and equipment that are required to function underwater are constructed of stainless steel or comparable corrosion resistant alloys. For the FHM, this includes the telescoping and grapple. For the NFE, this includes the elevator tracks, basket and carriage, wire rope, and bearings. The NFJC does not operate below pool water level and therefore does not require the level of corrosion resistance required of the FHM and NFE.

A direct communication system is provided between the control room and the FHE control stations (FHM, NFJC, and NFE).The communication system has battery back-up and is not susceptible to loss of off-site power. This communication system operates on a channel different from other communications networks in the plant.

9.1.4.2.2 Major Component Description

Fuel Handling Machine

The FHM performs fuel handling operations in the SFP and RFP. It provides a means of tool support and operator access for tools used in various services and handling functions. The FHM is designed to be single-failure- proof per American Society of Mechanical Engineers (ASME) NOG-1 (Reference 9.1.4-4) criteria. The FHM consists of the bridge, trolley, mast, and grapple. The instrumentation and controls associated with the FHE are described in Section 9.1.4.5.

The FHM bridge is a welded girder style crane. The bridge design capacity ensures that personnel, equipment, and operations do not affect the positioning of the crane and load. The bridge drive system is constructed so two opposite wheels are driven by motors in a master-slave relationship. Motors are fitted with brakes that can be manually released for emergency operation. A means for attaching a hand wheel to the drive system for manually moving the bridge is provided.

Seismic restraints and restraining bars prevent the FHM bridge from overturning or coming off its rails during a seismic event. Bumpers on the end trucks prevent damage in case there is a collision. The bridge structure and end trucks are welded construction and designed to the requirements of American Welding Society D1.1 (Reference 9.1.4-2). Bridge gearboxes are vented boxes with pans to collect oil leakage.

The position of the FHM bridge is monitored by a position monitoring system that relays location information to the FHM operator. In addition to the position monitoring system, a manual pointer system is mounted on the runway to provide positioning information to the operator.

Walkways are provided for access to the FHM bridge and trolley. The walkways include handrails, non-skid decking, and kick plates.

The FHM trolley is designed to be single-failure-proof and meets the requirements of NUREG-0554 (Reference 9.1.4-3) and Reference 9.1.4-4. The trolley structure and end trucks are welded construction. Each bridge girder contains a rail for trolley guidance. Trolley gearboxes are vented boxes with pans to collect oil leakage.

The FHM trolley drive system is configured with two motors driving opposite wheels. The drive system is a master slave configuration. Each motor is fitted with a brake that can be manually released. A means for attaching a hand wheel to the drive system for manually moving the trolley is provided.

The location of the FHM trolley is monitored and relayed to the operator by a position monitoring system. As a back up to the positioning system, a manual graduated scale with mechanical pointer is also available to the operator. End of travel bumpers are installed on the trolley.

The FHM mast consists of the stationary mast and telescoping mast. The stationary rotating mast is supported on the trolley at two levels. The mast above the lower deck is enclosed by a transparent splashguard to keep water from the ropes intruding on components on the deck while providing operator visibility. A camera provides a video signal to the operator to assist in grappling operations and visual verification. The telescoping mast is open at the bottom and has open portals allowing for cooling water flow. The mast design allows the mast and grapple mechanism to rotate about the mast axis.

The FHM mast hoist is single-failure-proof and is designed to the requirements of Reference 9.1.4-3 and Reference 9.1.4-4. The hoist is a closed kinematic loop design for added safety. It has redundant gearboxes and braking systems. The reeving ensures rope failure does not result in the load being uncontrolled. Dual hoist ropes, over-load detection, over-speed detection, and upper and lower hoist limits are incorporated into the FHM to ensure the mast hoist will not experience an active failure that will drop a fuel assembly. Vertical position of the mast is confirmed by two independent instruments to ensure accurate vertical positioning. Mechanical and electrical interlocks prevent raising a fuel assembly above the maximum lift height specified in Section 9.1.2.2.2, which ensures a shielding water depth of at least 10 feet.

The FHM grapple is attached to the telescoping mast. The grapple engages a fuel assembly or other light load core components. The mast is pre-programmed to open or close the grapple in a small vertical height band to ensure the grapple operates only when the fuel assembly is safely seated. The grapple is locked in the closed position by a mechanical mechanism that precludes unintended opening. The grapple release mechanism incorporates mechanical and electrical lockouts, and a redundant release system. Operator action or control failure cannot open the grapple when loaded. The fuel assembly grapple is designed to have flexibility to accommodate fuel assembly bowing or growth from power operations.

The FHM has an auxiliary hoist that will handle a special lifting device to move control rod assemblies during refueling operations. The auxiliary hoist is mounted on the upper structure of the FHM trolley.

New Fuel Jib Crane

The NFJC performs new fuel handling in the new fuel staging area. The NFJC supports fuel handling tools. The NFJC is used to remove new fuel assemblies (NFAs) from their shipping containers, support the NFAs during inspection, and move the NFAs to the NFE. The NFJC is comprised of a jib beam with an underhung trolley and hoist.

The NFJC jib beam is an engineered welded composite. The jib structure connects to the building wall via two connection brackets. The lower bracket is pinned directly to the end of the jib beam, and the upper bracket connects to the jib tie-rods. Tie rods connect the upper wall bracket to the tip of the jib beam. A rotating drive assembly is mounted to the top of the jib beam near the pivot end. Bumpers on the boom prevent damage in case there is a collision with the wall.

An underhung trolley runs on the bottom flange of the jib beam. This trolley uses one motor to operate the trolley wheels. The motor is fitted with a brake that can be manually released for emergency operation. A means for attaching a hand wheel to the drive system and manually moving the trolley is provided. Bumpers are installed on the trolley for end of travel stops.

The wire rope hoist unit is underhung from the trolley. The hoist provides true vertical lift over the entire lift range. The hoist contains a limit switch for height control, over-speed switch, and high hook weighted limit switch. A weigh system integrated into the reeving configuration monitors load on the hoist to prevent overloaded conditions and detect snagged or hung-up loads.

New Fuel Elevator

The NFE moves NFAs to the bottom of the SFP for receipt by the FHM. The components that comprise the NFE include the track, the carriage and basket assembly, hoist unit, and deflector sheaves. Mechanical stops and limit switches will stop the carriage at its upper and lower limits.

The elevator track structure is welded 304 stainless steel and is secured to the pool wall via bolted connection to permanently welded pads.

The NFE fuel carriage and basket assembly is welded stainless steel construction. The basket is integral to the carriage and holds one NFA. The basket and carriage can be removed from the track without adjusting water levels.

The NFE hoist unit is mounted below floor level in a recess. There are two wire ropes coming off the drum - one to perform hoisting and the other reeved to supply pull-down force to the bottom of the basket, if needed.

A set of deflector sheaves at the top and bottom of the pool direct the ropes from the hoist unit to the top and bottom of the fuel carriage. A weigh system measures load in the basket. If load is detected, the basket cannot be raised, preventing the inadvertent raising of a SFA.

9.1.4.2.3 System Operation

This section describes the FHE system operations associated with light load handling operations. The locations in the plant are described along with design features that assist in understanding the system design. Figure 9.1.4-1 shows the arrangement of the fuel handling equipment within the RXB.

New Fuel Receipt

Receipt of new fuel involves removing each NFA from its shipping container, placing the NFA in an upright position, and delivering the NFA to the fuel storage rack. The NFA is delivered to the SFP via the NFE. The steps involved in this activity include:

1) The NFAs and control rod assemblies (CRAs) arrive at the plant and are brought into the fuel handling area near the NFJC.

2) The NFJC lifts an NFA (and CRA, if applicable) out of its shipping container as an integrated unit.

3) The NFJC supports the NFA while inspections are performed.

4) The NFJC places the NFA into the NFE.

5) The NFE lowers the NFA (and CRA) into the SFP.

6) The FHM travels to the NFE and picks up the NFA (and CRA).

7) The FHM raises the NFA up into its protective mast, travels to the fuel storage racks in the SFP, and places the NFA into a storage position.

Initial Reactor Fueling

Reactor fueling involves placing the fuel assemblies for the initial core into the NPM. The set of fuel assemblies previously received as part of the new fuel receipt process are placed into the fuel rack. The module to be fueled is located in the RFP and is prepared to receive fuel. The following steps comprise the initial fueling sequence.

1) The FHM picks the fuel assembly up from the storage rack and retracts the assembly into the mast.

2) The FHM travels through the opening from the SFP into the RFP and is positioned over the appropriate location of the NPM reactor core to allow placement of the fuel assembly.

3) The fuel assembly is lowered into the NPM core.

4) The FHM returns to the SFP to retrieve another fuel assembly.

5) The fuel movement is continued until the NPM reactor core has a complete complement of fuel assemblies.

Reactor Refueling

Reactor refueling involves replacing and shuffling the previously used SFAs in the NPM. New fuel assemblies previously received and inspected, and located in the fuel rack are used for refueling. Fuel movements maintain the minimum water depth of 10 feet for personnel shielding. New fuel assemblies remain underwater and are treated as SFAs once they have been inserted into the fuel rack. The NPM is moved to the RFP and prepared for refueling. The following steps comprise the refueling sequence.

1) The FHM travels to the appropriate reactor core location and retrieves a SFA with a CRA.

2) The FHM raises the SFA up into its mast and travels from the RFP into the SFP.

3) The SFA is lowered into the appropriate location in the fuel storage rack.

4) The FHM repeats this process until the core is fully offloaded.

5) The FHM then removes a CRA and places the CRA into a designated fuel assembly (new fuel assembly or SFA).

6) The FHM then picks up a fuel assembly and CRA and places it in the reactor core.

7) The FHM repeats this process until reactor refueling is complete.

Loading Spent Fuel Transfer Cask

The SFAs designated for removal from the RXB are moved from the SFP to a specially designed transfer cask located in the RFP. Cask-handling is addressed in Section 9.1.5.

COL Item 9.1-3: A COL applicant that references the NuScale Power Plant design certification will develop procedures related to the transfer of spent fuel to a transfer cask.

9.1.4.3 Safety Evaluation

The FHE supports the periodic refueling of the reactor as well as movement of control rods and other radioactive components within the reactor core, RFP and SFP. The FHE maintains fuel integrity and prevents criticality during fuel handling activities. The classification of the FHE is further discussed in Section 3.2.

The FHE is located within the confines of the Seismic Category I RXB that protects the FHE from the effects of natural phenomenon.

The FHM bridge rails are anchored more than 4.5 inches from the edge of the spent fuel pool. The FHM is provided with seismic restraints to prevent the bridge and trolley from overturning or coming off rails during a seismic event.This design feature is consistent with the requirements of Regulatory Guide 1.29 and precludes adverse interactions with Seismic Category I SSC. The FHM trolley and mast are designed to be single-failure-proof and comply with the requirements of Reference 9.1.4-3 and Reference 9.1.4-4.

A seismic switch on or adjacent to the FHM shuts off power to the FHM. The FHM stops and its brakes set, and the machine comes to rest. These design features ensure that a fuel assembly continues to be suspended by the FHM during and after a seismic event.

The design of the FHM, per Reference 9.1.4-4, ensures that the FHM is able to withstand the highest expected seismic excitation. Large components (electrical cabinets, winches, masts, etc.) have also been analyzed to ensure these components do not come loose during a seismic event and become missiles potentially damaging other equipment. Manual methods of releasing brakes and performing the various functions are available to position the crane and place a suspended fuel assembly in a safe location after a seismic event or loss of power.

A seismic switch on or adjacent to the NFJC shuts off power to the crane. The NFJC stops, and its brakes set. These design features ensure that a fuel assembly continues to be suspended by the NFJC during and after a seismic event. Manual methods of releasing brakes and performing the various functions are available to position the jib crane and place a suspended fuel assembly in a safe location following a seismic event or loss of power. The NFJC is designed in accordance with the requirements of ASME NOG-1 (Reference 9.1.4-4).

A seismic switch near the NFE shuts off power. The NFE stops, and its brakes set. The design of the elevator ensures that the components of the NFE are able to withstand the seismic loading without coming loose and becoming missiles during a seismic event. A fuel assembly remains restrained and contained within the NFE during and after a seismic event. Manual release of brakes and performance of the various functions is available to position the elevator and place a suspended fuel assembly in a an appropriate position following a seismic event or loss of power.

The FHE is protected from the effects of external missile hazards by being located inside the RXB. Dynamic effects associated with missile impact are provided in Section 3.5. Zoning control interlocks ensure the RXB crane does not travel near the FHE when it is in operation to prevent impacts.

The FHE provides fuel handling for each of the NPMs that comprise the plant. Fuel handling for each module is a specifically planned activity. Each module, in turn, is shut down, disconnected, and brought to the RFP where the FHM can access it. Neither the NFJC nor the NFE interfaces directly with the modules. The NFJC and NFE are used to move NFAs from the shipping containers to the SFP. The design of the FHE allows for the performance of fueling activities on one module without affecting the operation of the other modules including potential shutdown and cooldown.

The design of the FHE precludes system malfunctions or failures that could cause criticality accidents, a release of radioactivity, or excessive personnel radiation exposures. The following attributes contribute to the prevention of criticality events, release of radioactivity, or excessive personnel radiation exposures.

- The FHE is designed such that probability of dropping a fuel assembly following a safe shutdown earthquake has been minimized.
- The FHE is designed with the capability to permit periodic inspection and testing of components.
- The FHE is designed with radiological shielding for personnel who operate the equipment.
- The speed of the FHM, trolley, and hoist motions are limited such that the inertial loads imparted to fuel assemblies and control components during handling operations do not exceed the allowable limits for which the fuel assemblies and components are designed.
- Protection from a criticality event is provided by designing the FHE to meet the requirements of Reference 9.1.4-1.
- Each fuel assembly and control rod is placed strategically to maintain a non-critical configuration by following a specific fuel movement plan. This plan is integrated with the FHM control system to monitor and verify each fuel movement and position. The control system prevents bundles from being placed on top of each other and in the wrong cell or core location using the inputs from the FHM location instrumentation.

- Shielding for radiation protection is maintained by designing the FHE to meet the requirements of Reference 9.1.4-1. Underwater transfer of SFAs provides radiation shielding. The FHE has provisions to limit maximum height to maintain sufficient water inventory above the top of the fuel assembly.
- The FHE include controls and interlocks that impose limits upon system operations, ensuring clearance between SSC, thereby preventing the potential for mechanical damage to fuel during fuel transfer operations. Application of interlock protection meets the applicable requirements of Table 1 of Reference 9.1.4-1. A description of relevant interlocks associated with the FHE is provided in Section 9.1.4.5.

Refer to Sections 12.3 and 12.4 for information pertaining to occupational radiation exposures and ensuring that radiation exposure during spent fuel handling is as low as reasonably achievable.

9.1.4.4 Inspection and Testing

Functional tests are performed on FHE equipment prior to shipment and when the equipment is received at the site. Functional tests include the following tests:

- incoming voltage
- machinery functions
- emergency stop
- safety functions
- startup current, running current, and frequency for drives
- startup current, running current, and frequency for hoists

The development methodology for the Inspections, Tests, Analyses, and Acceptance Criteria is described in Section 14.3.

Preoperational testing of the FHE is addressed in Section 14.2.

COL Item 9.1-4: A COL applicant that references the NuScale Power Plant design certification will provide the periodic testing plan for fuel handling equipment.

9.1.4.5 Instrumentation and Control

An operator interface is provided with the FHM control console that includes a monitor. The monitor provides the operator with easy-to-understand information on interlock status, current load conditions and bridge, trolley, and hoist position indicating the location of the FHM with respect to the core and spent fuel racks.

The FHM control system employs a fail-safe programmable logic controller (PLC) for machine control and operation and monitoring control devices. The functions of the PLC include: boundary zone monitoring, enforcing over-travel limits, load condition monitoring, and position monitoring. The PLC processor communicates over an Ethernet network. The machine control program is stored in non-volatile flash memory inside the PLC.

The operator interface consists of an industrialized computer in direct communication with the operational PLC. This computer contains, but is not limited to, the graphic user interface drivers for the operator interface, the database that enables converting of alphanumeric core locations into bridge and trolley positions, data logging files and fuel move sequence(s) when the system is preprogrammed. In addition, the computer provides information for operational interlocks and troubleshooting aids for maintaining the entire system, including the PLC.

The FHE controls are designed using human factors engineering guidelines as presented in Chapter 18. Controls can be operated with gloved hands. The FHE controls are placed to enable the operator to use the controls while visually observing the operations being performed.

For the FHM, in line with the wire rope is a load weighing assembly that constantly monitors the tension on the cables. The design of the weighing assembly ensures that a hoist overload condition does not cause a structural failure resulting in a dropped load. Load cell assemblies are separated structurally. The load weighing assembly has multiple functions including:

- monitoring for slack cable when lowering a load
- monitoring for high loads due to a too heavy load or hitting an obstruction
- monitoring for broken wire rope

An encoder is used to monitor grapple height. Limit switches are hard-wired into the control system as upper limit constraints.

Limit switches trip at setpoints corresponding to high position, low position, and slowdown zones.

Lifting a FA above the maximum lift height (Section 9.1.2.2.2) is prevented by a positive mechanical stop bolted into the mast system. This stop is removable to allow the empty grapple to be raised for maintenance and inspection. The presence of the bolted stop is sensed by a limit switch to allow operation of the FHM.

Sensors are positioned at the ends of travel to indicate slowdown and stop positions for traverse machinery. Tripping an end of travel slowdown switch allows the motion to continue in the direction of travel only at slow speed, or in the opposite direction at normal speed. Tripping an end of travel stop switch prevents further motion in the direction of travel, and only allows motion in the opposite direction.

A limit switch is located on the FHM grapple to monitor the disengagement status of the grapple. The grapple engaged or grapple disengaged limit switch must be actuated before the FHM hoist operates (i.e., the grapple must be fully open or shut for the hoist to work).

The NFE has a weigh system that measures the load in the basket. If load is detected, the basket cannot be raised, preventing the inadvertent raising of a SFA. The NFE also monitors basket elevation, and the status of upper and lower proximity slowdown and stop switches.

The FHE design includes the following interlocks for safe handling of the fuel assemblies. These interlocks are active during all modes of fuel handling operation.

- The FHM under-load safety circuit stops the hoist going down with a fuel assembly if a specified weight loss occurs except in the last few inches. This prevents inadvertently setting the full weight of a fuel assembly on an adjacent fuel assembly, thereby protecting the fuel assembly from damage.
- The FHM light and heavy load sensing allows the operator to change overload safety limits depending on whether the fuel assembly has a control rod in it (heavy or light). Placing the setting in light-mode reduces the load setpoints by a pre-determined value and helps prevent grid strap damage.
- The FHM hoist slow zones for fuel assembly insertion into, and removal from, the reactor core or storage rack.
- The FHM inching capability (indexing) is provided that allows the bridge and trolley to be moved at a slow speed with the mast down except in the lower slow zone. This permits an operator to re-index the mast when handling bowed fuel assemblies in order to aid insertion into the core or fuel storage racks.
- The FHM hoist up or down over-travel circuits are provided to prevent the mast from jamming in the up position and to prevent the hoist cable from completely unwrapping from the hoist drum. Position monitoring instruments contribute to the vertical positioning interlock functionality.
- The FHM load system is used to measure the tension in the main hoist cables connected to the grapple tube and gripper that is used to raise and lower fuel assemblies. The load cell provides load signals to the PLC in the control console in order to control the load related interlocks described above. These zones are controlled by the PLC as the mast travels and mast sections engage or disengage.
- The FHM is interlocked with the RXB crane to prevent inadvertent simultaneous overlapping operation. With the RXB crane positioned above the reactor flange tool, the zoning control of the FHM prevents it from traversing to this area of the runway.
- The FHM bridge, trolley, and hoist motion are driven by variable speed electric motors that are equipped with interlocks that limit the hoist speed and load when near the reactor core and prohibit motion outside prescribed boundaries. Hoist speed is limited by an over-speed sensor and hoist load is monitored by the FHM over-load system when near the reactor core. Zoning limits speeds near the reactor core and during insertion and withdrawal of fuel assemblies. A position monitoring system provides zoning control and prohibits motion outside of prescribed boundaries.
- Interlocks are provided to limit motion of the FHM hoist, bridge, or trolley so that simultaneous vertical or horizontal motion is prevented while fuel assemblies are being moved or when a grapple or other tool is being moved in the proximity of the core such that fuel assemblies in the vessel could be damaged.
- The FHM grapple design includes an interlock based on fuel assembly elevation that precludes release of the fuel assembly in the reactor core if the elevation is above the maximum limit.
- The FHM grapple engagement interlocks ensure that the grapple is properly located on the fuel assembly, does not lift until the grapple is fully closed and

locked, and does not open with a suspended load. The grapple design precludes the possibility of partial engagement.

- The NFJC interlock prevents a fuel assembly from being carried over the fuel storage racks in the spent fuel pool.

9.1.4.6 References

9.1.4-1 American National Standards Institute/American Nuclear Society, "Design Requirements for Light Water Reactor Fuel Handling Systems," ANSI/ ANS 57.1, 1992 (R2005), La Grange Park, IL.

9.1.4-2 American Welding Society, "Structural Welding Code - Steel," D1.1-2010 Miami, FL.

9.1.4-3 U.S. Nuclear Regulatory Commission, “Single-Failure-Proof Cranes for Nuclear Power Plants,” NUREG-0554, May 1979.

9.1.4-4 American Society of Mechanical Engineers, “Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)," NOG-1, 2004, New York, NY.

Table 9.1.4-1: Fuel Handling Equipment Design Information

System		Primary Design Code	Seismic Category	Capacity (lbs)
Fuel handling machine	Bridge	ASME NOG-1 Type I	I	1200
	Trolley			
	Mast rotate and hoist			
	Auxiliary hoist	ASME NOG-1 Type I	I	1000
New fuel jib crane		ASME NUM-1 Type II	II	1000
New fuel elevator		ANSI/ANS 57.1	II	1200

Figure 9.1.4-1: Refueling Floor Layout

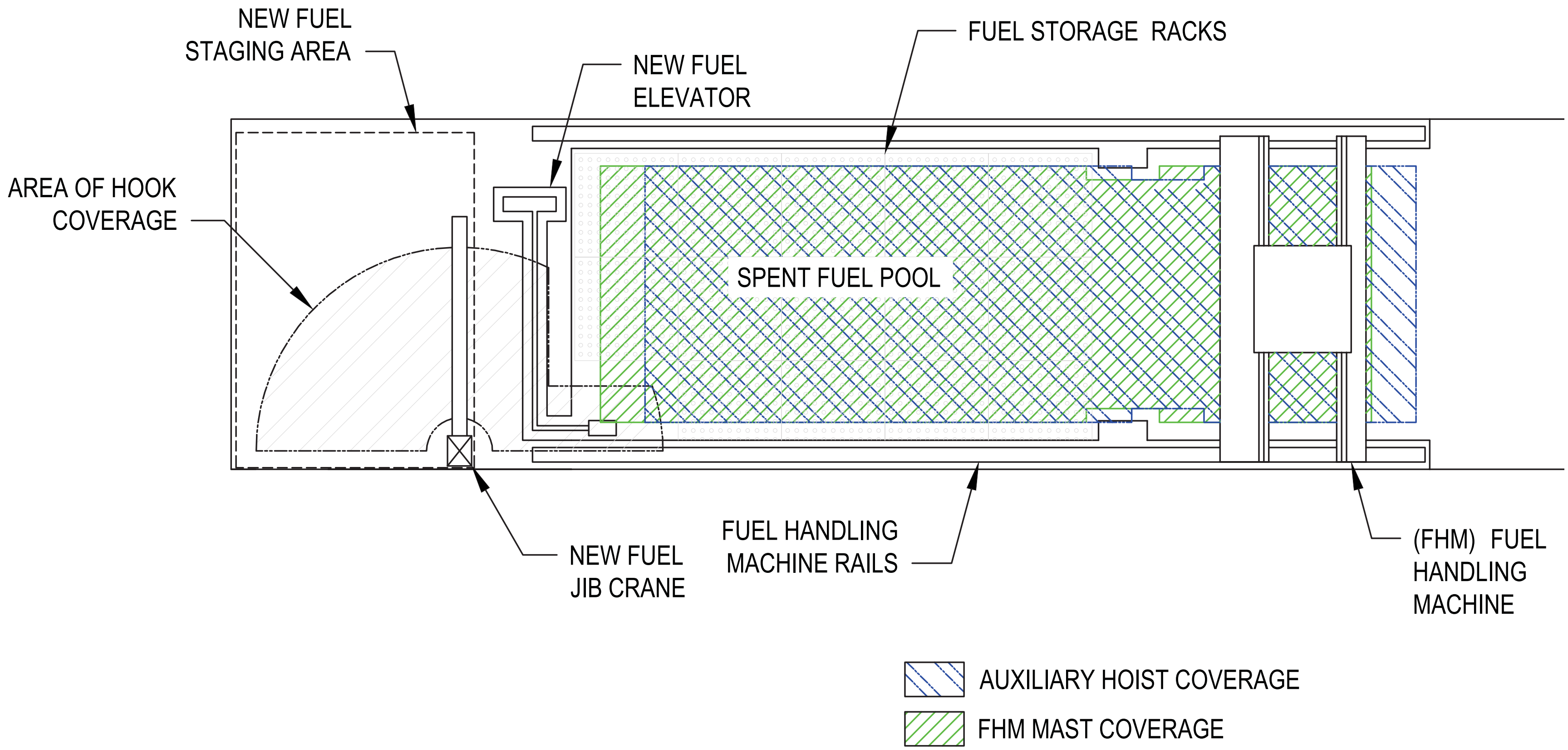


Figure 9.1.4-2: Fuel Handling Machine

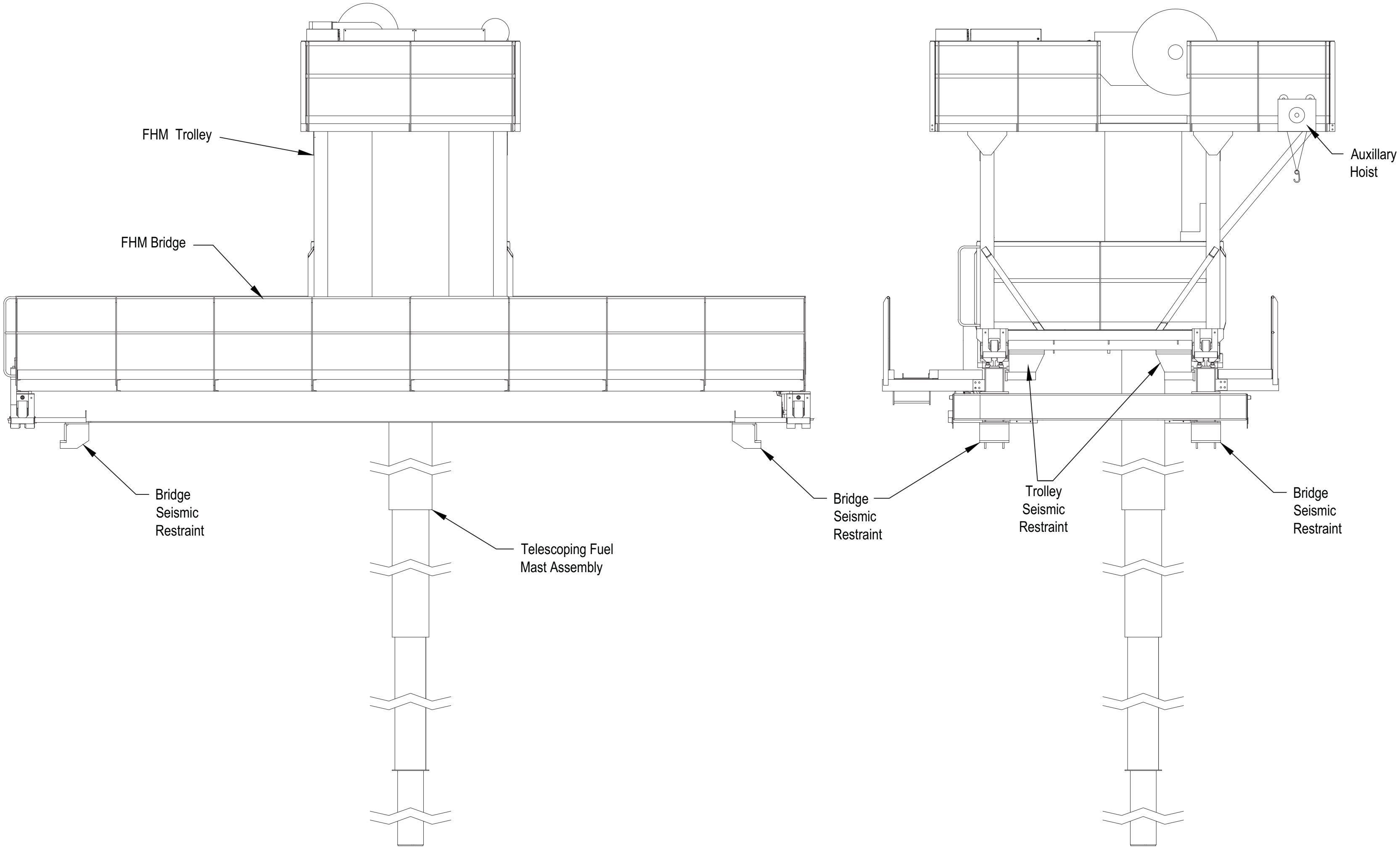


Figure 9.1.4-3: Jib Crane

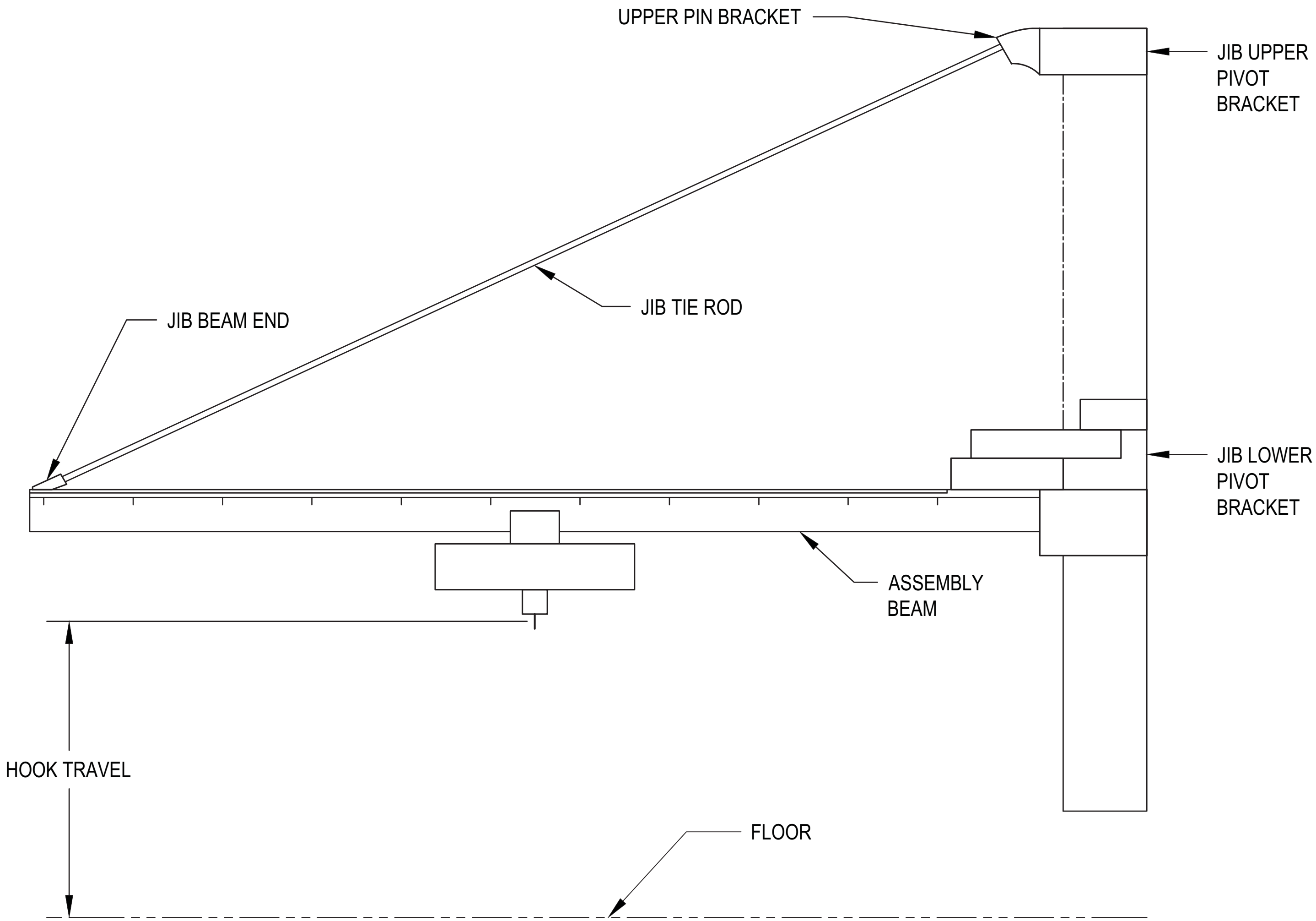
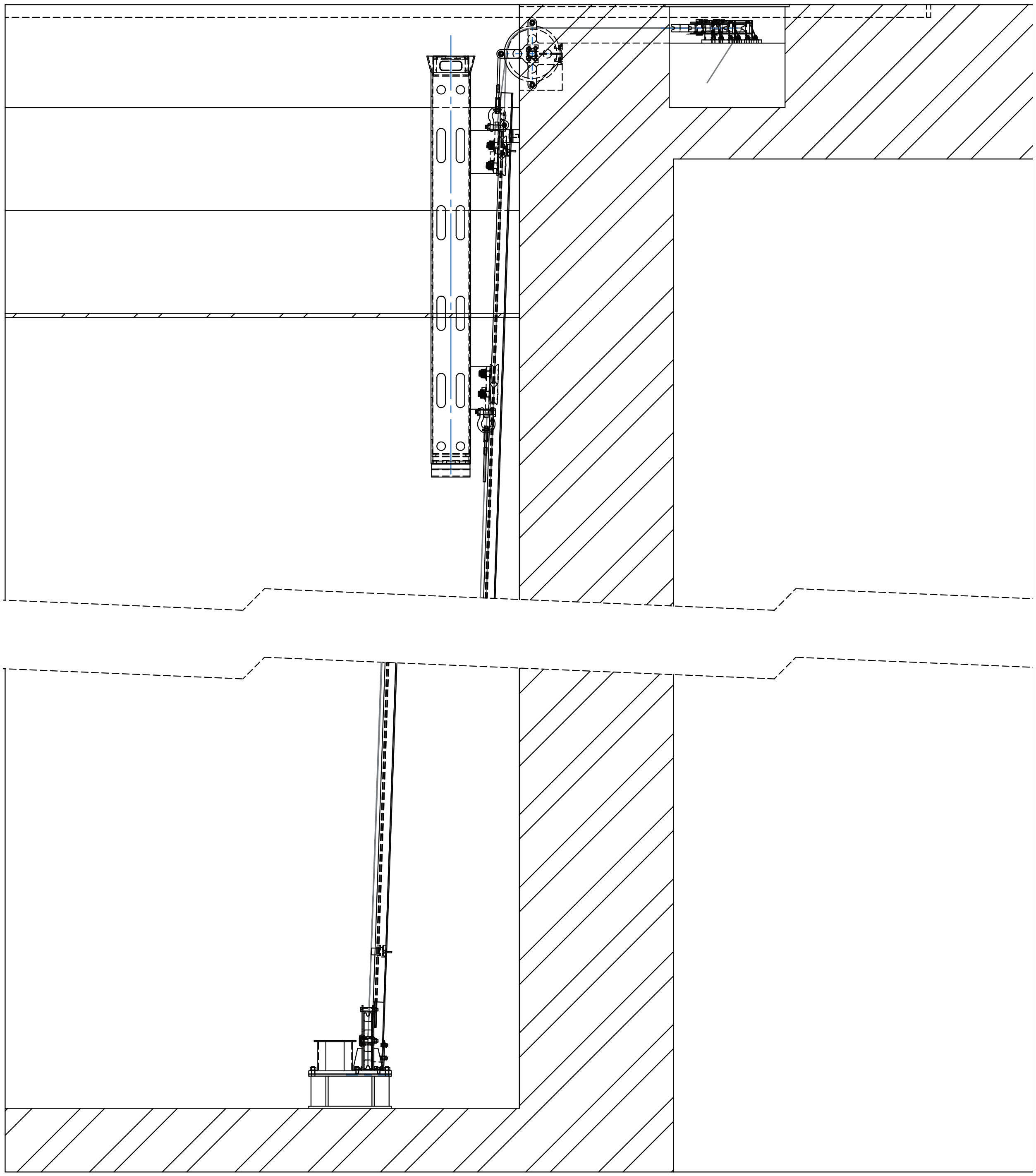


Figure 9.1.4-4a: New Fuel Elevator

{{ Withheld - See Part 9 }}

Figure 9.1.4-4b: New Fuel Elevator



9.1.5 Overhead Heavy Load Handling Systems

The overhead heavy load handling systems (OHLHS) consists of equipment that lifts loads whose weight is greater than the combined weight of a single fuel assembly and control rod assembly, 900lbs. The primary purpose of the OHLHS is to move a NuScale Power Module (NPM) for refueling. The principal equipment of the OHLHS includes the Reactor Building crane (RBC), the module lifting adapter (MLA), and various other hoists and load handling devices used by the RBC. Additional equipment that is used to inspect, assemble, and disassemble the NPM for refueling is also discussed in this section (i.e., containment vessel flange tool (CFT), reactor vessel flange tool (RFT), and the module inspection rack). The OHLHS also includes equipment accessories (e.g., slings and hooks) instrumentation, physical stops, electrical interlocks, and associated administrative controls.

A critical load handling evolution is defined as the handling of a heavy load where inadvertent operations or equipment malfunctions, separately or in combination, could: cause a release of radioactivity, a criticality accident, inability to cool fuel within the reactor vessel or spent fuel pool or prevent safe shutdown of the reactor. Heavy loads are defined as a load weighing more than one fuel assembly and control rod assembly. For the NuScale design, a heavy load is defined as any load greater than approximately 900 lbs.

Information related to handling new and spent fuel is discussed in Section 9.1.4. New and spent fuel storage is discussed in Section 9.1.2.

COL Item 9.1-5: The COL applicant that references the NuScale Power Plant design certification will describe the process for handling and receipt of critical loads including NuScale Power Modules.

9.1.5.1 Design Bases

This section identifies the OHLHS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure the functions are fulfilled. Together, this information represents the design bases defined in 10 CFR 50.2, and required by 10 CFR 52.47(a) and (a)(3)(ii).

The RBC system is classified as a nonsafety-related, risk-significant system designed for critical load handling operations.

General Design Criteria (GDC) 1 is considered in the design of the OHLHS. Consistent with GDC 1, OHLHS components are designed, fabricated, erected, and tested to appropriate quality standards such that their failure does not impact the function of other safety-related or risk-significant systems. The classification of structures, systems, and components (SSC) is further discussed in Section 3.2.

General Design Criterion 2 is considered in the design of the OHLHS including the ability of structures, systems, and components in the RXB and OHLHS to withstand the effects of earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches. The OHLHS is located in the Seismic Category I Reactor Building (RXB). The RBC, the Module Lifting Adapter, and the RFT are designed to retain their load before, during, and after a safe shutdown earthquake (SSE). The CFT and the module inspection rack are designed to ensure that their structural failure or interaction cannot degrade the functioning of Seismic Category I SSC during or after an SSE. Refer to Section 3.2 for information pertaining to safety, seismic, and quality classification of SSC.

General Design Criterion 4 is considered in the design of the OHLHS. No safety-related or risk-significant SSC are affected by load drops because the RBC is designed to meet single-failure-proof requirements in accordance with NUREG-0554 and supplemented by ASME NOG-1 (Reference 9.1.5-3). In addition, the OHLHS is protected from the effects of external missile hazards by being located inside the RXB. Dynamic effects associated with missile impact are provided in Section 3.5.

General Design Criterion 5 is considered in the design of the OHLHS. The RBC is used to move each NPM for refueling. However, only one NPM can be moved at a time.

Codes and standards associated with the design of the OHLHS are presented in Table 9.1.5-1, along with OHLHS system design information. Section 9.1.5.3 contains detailed information on the safety evaluation for the OHLHS.

9.1.5.2 System Description

9.1.5.2.1 General Description

The OHLHS includes equipment designed to handle critical loads in areas containing safety-related equipment that could be potentially impacted by the drops of such loads. The design of the OHLHS equipment, in conjunction with procedures and safe load paths, ensures the safe movement of critical loads. Safe load paths and heavy load exclusion zones are defined for the movement of heavy loads to minimize the potential for a load drop on irradiated fuel in a reactor vessel or spent fuel pool (SFP), on safe shutdown equipment, or that impacts an NPM. Figure 9.1.5-1 and Figure 9.1.5-2 show safe load paths and heavy load exclusion zones for the movement of the OHLHS.

The largest load handled is the NPM that is flooded to the pressurizer baffle plate prior to being moved for refueling using the module lifting adapter. The flooded NPM has an effective weight of 786 tons when buoyancy effects are taken into account. The total weight imposed on the crane is 837 tons at the highest lift point. The area of the plant where this load is handled is in the RXB between the operating bay (reactor pool), refueling area, and dry dock.

The major OHLHS components are:

- RBC
- NPM lifting fixture
- MLA
- wet hoist

Other refueling devices that are used in support of the module refueling, assembly, and inspection are:

- CFT
- RFT
- Module inspection rack

The movement of the RBC is controlled with the position control system by a series of interlocks to ensure that load movement procedures are maintained. The RBC has provisions to limit the path and the maximum height so that the minimum required depth of water shielding is maintained. The position control system is described in Section 9.1.5.5.

A direct communication system is provided between the control room and the RBC control station.

9.1.5.2.2 Component Descriptions

Reactor Building Crane

The RBC is a bridge crane that rides on rails anchored to the RXB. The RBC consists of a bridge, trolley, main hoist, and two auxiliary hoists. The RBC is designed as a single-failure-proof crane in accordance with the requirements of NUREG-0554 and ASME NOG-1 for Type I cranes. The RBC is service class D per CMAA-70 (Reference 9.1.5-6).

The RBC bridge is the main supporting structure of the RBC. It is supported by runway rails anchored to the RXB structure, more than 4.5 inches from the edge, and provides traveling motion across the length of the reactor pool, refueling pool, and dry dock. The bridge supports the RBC trolley, the attached main hoist, and the load. The wheels are double-flanged and fitted with sealed bearings.

The RBC trolley is the main structure for the hoisting equipment, providing the platform for the hoists. It is supported by the RBC bridge and travels across the width of the pool on the bridge rails. The trolley supports the lifted load and transfers the load to the bridge.

The trolley structure and end trucks are welded construction. The trolley drive system is constructed so that two opposite wheels are driven. The motor is fitted with a brake that can be manually released. A means is provided for attaching a hand wheel to the drive system and manually moving the trolley. Gear boxes and motors have drip pans to collect oil leakage. Figure 9.1.5-3 shows the RBC trolley.

A position feedback system provides trolley location information to the control system.

When a heavy load is detected by the RBC main hoist, the maximum trolley speed is limited to ASME NOG-1 values provided in Table 9.1.5-1. The trolley speed can be increased when a light load is detected and the operator uses a selector switch. The fast speed is not available with a heavy load regardless of the selector switch position.

The RBC main hoist is designed with dual rope reeving system. The dual rope reeving system includes two ropes, equalizer, lower block, and upper block. Each rope in the reeving system is designed to carry 100 percent of the rated capacity of the crane. The two ropes are attached to an equalizer for balancing the loads between the two rope reeving systems. The rope reeving system is designed to transfer the load to one rope without excessive shock in case of a failed rope system. Each rope is attached to one drum. The drum is provided with a catcher to retain the hoist drum in the event that a drum shaft or bearing fails. The drum catcher is designed to retain the drum and suspended load. The drum catcher is rated for the weight of the drum and RBC rated load capacity.

The hoist is provided with a hook eye. The hook eye is designed with a safety factor of 10:1 of ultimate strength of material to provide sufficient margin. The hook eye has a rotation drive that can orient a NPM 270 degrees to the proper direction for alignment in the NPM operating bay, refueling bay, and dry dock.

The hoist is designed such that a failure of the upper travel limit allowing the lower block to contact the crane structure (two-blocking), will not result in a rope cut or crushing of the rope.

The hoist drive system includes dual gearboxes and one power control braking system and redundant holding brakes. Each holding brake is designed and rated to 125 percent of the torque developed during hoisting operations to maintain a hoisted load at the maximum allowable crane load. The hoisting brakes are automatically set when electrical power is off or mechanically tripped by overspeed or overload devices.

The rope reeving system, including the drum, is designed so that the fleet angle of the rope meets the design requirements of Table 9.1.5-1. A mis-spool switch is provided to detect a rope mis-spool and stop the hoist.

The RBC main hoist includes a load weighing assembly to monitor the tension on the rope for slack rope when a load is lowered, high loads due to too heavy of a load or hang up, and broken rope. The design of the assembly ensures that a structural failure does not result in a dropped load. The main hoist monitors hook height and hard-wired limit switches as upper limit constraints.

There are two auxiliary hoists mounted on the RBC to provide low capacity (see Table 9.1.5-1 for capacity) lifting for equipment. The RBC auxiliary hoists are single failure proof underhung monorail type hoist. The auxiliary hoist rail is mounted off the outer surface of each bridge girder. The auxiliary hoists provide a method for the RBC to lift and carry lower weight items. The auxiliary hoists are single-failure proof to ensure that any failure of the load path component does not result in an uncontrolled load. The auxiliary hoist also contain a load weighing assembly that monitors for slack rope, high loads, and broken ropes. The hook height and hard-wired limit switches for overspeed and upper and lower limit constraints.

Design requirements associated with the RBC auxiliary hoist are specified in Table 9.1.5-1.

Module Lifting Adapter

The welded-construction MLA provides the connection method for the RBC to lift and carry the NPM from the operating bay to the refueling bay and dry dock. The module lifting adapter is depicted in Figure 9.1.5-4. The MLA is designed as a single-failure-proof lifting device in accordance with the requirements of ANSI N14.6 (Reference 9.1.5-1).

The MLA is designed with dual load paths consisting of four lifting arms that interface with the four lifting lugs on the NPM. The MLA attaches to the RBC hook eye with a pinned clevis that is designed to the 10:1 safety factors of the ultimate strength of material. The MLA engagement is mechanically and electrically locked when carrying a load to prevent inadvertent disengagement.

The four pins that engage the NPM lifting lugs are engaged with actuators. The engagement is confirmed by travel limit switches and visual indication. The MLA instrumentation and power is provided through the RBC instrumentation and power system.

NPM Lifting Fixture

The welded structure comprised of the NPM lifting lugs and top support structure diagonal lifting braces together constitute the permanently installed NPM lifting fixture. The NPM lifting fixture ends at the weld between the diagonal braces and the platform mount pad.

The NPM lifting fixture is designed with dual load paths per the requirements of ANSI N14.6 as a single-failure-proof lifting device.

Wet Hoist

The wet hoist is the main below-the-hook structure for lifting equipment underwater. The wet hoist is designed to be single failure proof in accordance with requirements in Table 9.1.5-1. It consists of two redundant open kinematic loops with two drums, two ropes, two motors, and two gear boxes. A geared limit switch, used to define the RBC low hook position keeps the wet hoist main frame and machinery above the reactor pool water level. Only the bottom block and ropes of the wet hoist enter the water. Holes in the bottom block sheave guard allow water to fill the space when lowered into the water and drain water when removed.

Components of the wet hoist that are be submerged in water are fabricated of stainless steel or a comparable corrosion resistant alloy for contamination control. A radiation alarm mounted on the wet hoist alerts the operator of unsafe radiation levels.

The wet hoist contains a load-sensing device that is interlocked with the RBC main hoist drive system. The load weighing assembly monitors for slack rope, high loads, contact with an obstruction, and broken wires.

The wet hoist contains redundant systems to prevent raising equipment above a safe carrying height. These systems include an upper stop limit switch, an overload sensor, and an upper mechanical stop.

Other Refueling Devices

The CFT is mounted at the bottom of the refueling pool adjacent to the SFP in the RXB. The CFT is used to assemble and disassemble the lower parting flange on the containment vessel (CNV). The CFT is composed of a CNV support stand, guides, and associated tooling for assembly, disassembly, and inspection of the CNV lower parting flange connection and fasteners. The RBC is used to place the NPM in the CNV support stand and remains connected to the NPM. The lower containment remains in the CFT once unbolted. The upper NPM is then moved to the RFT. The CFT is designed for service in a borated water environment.

The RFT is located at the bottom of the refueling pool adjacent to the CFT. The RBC moves the NPM from the CFT to the RFT and remains connected to the NPM. The RFT supports the lower portion of the reactor vessel, containing the core, during refueling operations. The RFT consists of a reactor pressure vessel (RPV) support stand, guides, and remotely-operated equipment that perform closure bolt installation and tensioning for assembly and disassembly of the RPV lower parting flange connection and fasteners. The RFT is designed for service in a borated water environment.

The module inspection rack is a permanently-mounted work platform located in the dry dock of the RXB used to support the NPM for inspection and maintenance. It supports the NPM in the vertical orientation. The RBC moves the upper CNV with the upper reactor vessel from the RFT to the module inspection rack. The design of the module inspection rack and its seismic analysis ensure that the SSC of the module inspection rack are be able to withstand the SSE and retain the load.

Special Lifting Devices

Special lifting devices for critical and non-critical loads are designed to meet the applicable requirements of ANSI N14.6. The load rating is based on the combined maximum static and dynamics loads that can be imparted to the special lifting device. Compliance with this requirement ensures that lifting devices that are used to handle heavy loads in the vicinity of the NPMs or the SFP are designed with stress factors that provide required margin to support operation. RBC special lifting devices are specified in Table 9.1.5-2.

Lifting Devices Not Specially Designed

Lifting devices that are not specially designed, slings and other lifting devices, are selected in accordance with ASME B30.9 (Reference 9.1.5-2). The load rating is based on the combined maximum static and dynamics loads that can be imparted to the sling.

Slings that are used to handle heavy loads in the vicinity of the NPMs or the SFP are designed in accordance with the requirements of ASME B30.9. Slings having a load rating of twice that required for non critical loads or dual or redundant slings are used for handling critical loads. Slings are constructed of metallic material such as chain or wire rope. Cable reels mounted on the RBC provide cable management.

Load Lifting Points

Load lifting points, such as lifting lugs or trunnions, are designed for stress safety factors consistence with the safety factors for special lifting devices. The design of lift points for critical loads is in accordance with NUREG-0612, Paragraph 5.1.6(3).

9.1.5.2.3 System Operation

General Reactor Building Crane Operation

The RBC is used to lift and move equipment within the RXB to support normal operations, maintenance, receipt of new equipment, and to assist in refueling operations. The crane is designed to withstand the RXB environmental conditions and to operate during all modes of plant operations.

The RBC is provided with both local and remote control capabilities to operate the bridge, trolley and hoist. A selector switch is provided to only allow control of the RBC from one control station.

Monitoring cameras are mounted on auxiliary pieces with monitor screens to observe and accomplish the crane functions. An operator interface is provided with a control console. The interface provides the operator with interlock status, current load conditions, and bridge, trolley, and hoist position indicating the location of the RBC with respect to the building.

The RBC is controlled with the precision required for heavy load lifts necessary for normal plant operations. Variable speed controls are provided. When the load weighing system senses a heavy load during crane operation, the maximum speed of the hoists, bridge, and trolley is limited. As a load approaches a critical position, the control system limits the RBC to slow it to a predetermined maximum speed. See Table 9.1.5-1 for RBC travel speeds.

The RBC is operated to move an NPM between its installed operating position in the reactor pool to the refueling pool and back. Travel paths are determined and attributes entered into the RBC control system. Each task is specified and scheduled by the crane operator. Figure 9.1.5-1 shows the safe load paths.

Heavy load exclusion zones and safe load paths are defined in operating procedures and equipment drawings. Heavy load exclusion zones are marked in the plant areas where the load cannot be handled. This restriction reduces the probability of a heavy load drop that could result in safe shutdown equipment damage or result in a release of radioactive material that could cause unacceptable radiation exposures.

The position control system assists in the alignment of the RBC with the NPM for engagement with the RBC prior to performing lifting operations. Heavy load exclusion zones are dependent on whether or not there is a load on the RBC. The travel path is chosen to accommodate this information. Repeatability, proper load path, and proper locations are ensured by semi-automatic crane operation.

Refueling Operations

Refueling operations for an individual NPM is independent of the operating status of the remaining NPMs; only one NPM can be moved at a time. Section 9.1.4 presents the process of moving fuel assemblies into an open reactor vessel. This section presents the process of moving the NPM from the operating bay to the refueling pool and preparing the vessel for the fuel movement described in Section 9.1.4.

Immediately prior to the start of a refueling outage, the RBC, CFT, and RFT are prepared by performing pre-startup operational steps.

To access the NPM, the Bioshield above the NPM needs to be moved. The Bioshield is mounted on an adjacent Bioshield and restrained during refueling.

Traveling wall-mounted jib cranes are provided along the walls above the NPM bay areas to support refueling operations. The jib cranes are used to lift spool pieces when disconnecting and connecting the NPM. The cranes are also used to lift heavy tooling or equipment required to support the disconnection and connection of the NPM to the NPM platform, including removal and installation of the NPM insulation. These jib cranes are ASME NUM-I, Type II cranes with single-failure-proof underhung hoists and Seismic Category II. Design requirements associated with the jib cranes are specified in Table 9.1.5-1.

The MLA is attached and mechanically locked to the RBC. The RBC control panel is preprogramed with heavy load exclusion zones, module bay locations, travel paths, and predefined locations in the refueling bay and dry dock. The RBC positioning system, defines the travel path for the RBC. Features located in the RXB and on the RBC are used to define safe load paths, monitor the location of the RBC, and aid in controlling the RBC hook to and from predefined reference positions while preventing overshoot. The system is designed to include appropriate elevation limits and rotational orientation limits for the RBC hook and any load on the hook. The RBC travel paths are also mechanically controlled to ensure safe operation if the programmed travel paths system malfunctions.

The operator selects the process to be performed and the operating bay containing the NPM that has been shut down for the required time. The operator verifies the travel path. The RBC moves to the desired operating bay. When the RBC hook gets within a predefined position, the RBC control system automatically slows to a micro-speed. Once the position controller verifies correct position, the MLA is lowered over the NPM lifting lugs. The MLA is lowered until the RBC hook reaches a pre-defined elevation. The MLA is manipulated until it is fully engaged to the NPM lifting lugs. Verification of MLA pin position is achieved by sensor feedback on the MLA and visual indicators. The MLA is then raised until the load sensing system detects load on the MLA, signifying that the NPM lifting lugs are fully engaged with the MLA. The NPM is raised to a pre-defined elevation and moved through the predefined paths to the CFT in the refueling bay.

Once the RBC is vertically aligned over the CFT, the NPM is lowered onto the stand of the CFT. With the RBC and MLA still attached to the NPM, the CFT de-tensions and removes the CNV flange closure bolts. The RBC lifts the upper CNV with the RPV attached from the lower CNV and transfers it into location over the top of the RFT. The lower CNV remains in the CFT during the remaining refueling process. The RBC lowers the upper CNV with the RPV onto the stand in the RFT. With the RBC and MLA still attached to the upper CNV, the RFT de-tensions and removes the RPV lower head flange closure bolts. Once all bolts are removed, the RBC lifts the upper CNV with the upper RPV still attached and transports it to the module inspection rack in the flooded dry dock. The RBC lowers the upper NPM into the module inspection rack. The NPM is confirmed to be properly seated in the module inspection rack. With the NPM in the inspection rack the MLA may be disconnected from the module and the MLA may be stowed making the crane available for other activities.

The process is performed in reverse to reassemble the NPM and move it back into the operating bay.

Spent Fuel Cask Handling

The RBC is capable of lifting and transporting a loaded spent fuel cask. The wet hoist is used with the RBC to lift the spent fuel cask and transport it to and from the cask loading area in the refueling pool. The cask follows the same analyzed safe load path as the NPM. Spent fuel casks are located in the RFT while spent fuel is loaded into the cask. The procedure for spent fuel cask loading is covered in Section 9.1.4.

COL Item 9.1-6: The COL applicant that references the NuScale Power Plant design certification will provide a design for a spent fuel cask and handling equipment including procedures and programs for safe handling.

9.1.5.3 Safety Evaluation

The design of the heavy load handling systems includes features to minimize the potential for a load drop and for the safe handling of heavy loads. The design includes single-failure-proof cranes, mechanical stops, electrical interlocks, well-defined safe load paths, established load handling procedures, and a plant configuration that provides redundancy and duality in certain components so the probability of load drops is minimized. The systems are designed to support a critical load during and after an SSE.

The RBC system design conforms to the single-failure-proof guidelines so that a credible failure of a single component does not result in the loss of capability to stop and hold a critical load. The use of this single-failure-proof crane precludes the need to perform load drop evaluations, and as a result, accident analysis is not required to assess radiological consequences of a spent fuel cask drop accident.

The RBC, including the auxiliary hoists and the wet hoist, are designed in accordance with the requirements of ASME NOG-1 for Type I cranes. The design of the RBC and the seismic analysis meet the NOG-1 requirements for a Type 1 crane to ensure that SSC are able to withstand the SSE and not drop the load. Large components are analyzed to ensure that components do not come loose during a seismic event and potentially damage other equipment. The MLA is designed as a single-failure-proof lifting device in accordance with the requirements of ANSI N14.6.

The RBC and RFT are Seismic Category I. The RBC meets the requirements of Section 2.5 of NUREG-0554, which invokes the design guidance of RG 1.29. The RBC is designed to ensure that the system retains its load throughout a SSE. Upon the onset of an earthquake, a seismic switch on the RBC disconnects power. The trolley, bridge, and hoist stop and the brakes set. Earthquake restraints keep the trolley on the bridge and the bridge on the runway. In the event that power cannot be restored, the brakes can be released manually, and the crane and suspended load can be safely positioned.

The CFT and module inspection rack are Seismic Category II and are designed to retain their load during and after an earthquake.

The safety and seismic classifications of the OHLHs are based on the functions they perform and on their location relative to spent fuel, fuel in the core, nuclear materials, or equipment that is required to achieve safe plant shutdown. Refer to Section 3.2 for the safety and seismic classifications for the OHLHS cranes and equipment.

Other plant cranes are designed in accordance with the requirements of ASME NOG-1 (Reference 9.1.5-3) or ASME NUM-1 (Reference 9.1.5-4). Cranes are designated as Type I, II, or III based on their requirement to handle critical loads and their seismic design criteria.

The OHLHS is protected from the effects of external missile hazards by being located inside the RXB. Dynamic effects associated with missile impact are provided in Section 3.5. The control of heavy loads in the RXB meets the guidance presented in RG 1.13, Position C.5. In addition to being designed to meet the single-failure-proof criteria, the cranes are designed with a system of interlocks that prevents movement in heavy load exclusion zones to prevent impacts.

The module assembly equipment discussed in Section 3.8 is located and designed such that internal missiles are not created, and impacts with safety-related equipment are prevented.

The OHLHS provides equipment and NPM movement for the NPMs that compose the plant. Equipment and NPM movement is a specifically planned activity. Each module, in turn, is shut down, disconnected, and moved one at a time.

The RBC heavy load exclusion zones represent analyzed safe load paths (Figure 9.1.5-1). Heavy load exclusion zones are marked in the facility areas where the load cannot be handled. The heavy load exclusion zones represent areas where heavy loads cannot travel because a heavy load drop in the exclusion zones could potentially impact safe shutdown equipment, cause a release of radioactive materials, or a criticality accident that could cause unacceptable radiation exposures.

The load path analysis includes transfer speeds, weights, and dimensions of anticipated loads and the geometric arrangement relative to other plant features. The RBC load path analysis provides safe load handling during normal operations and off-normal conditions in which loads are placed in safe and stable conditions. Design and code requirements are identified to demonstrate the load path analysis is adequate for the components. Physical limits and administrative controls are included to ensure safe handling of critical loads. Thus, the design of the OHLHS, in conjunction with safe load paths and heavy load exclusion zones, allows for moving an NPM or other equipment without impacting the operation of the other NPMs, including safe shutdown and cooldown.

The process of accepting and receiving a new NPM into the dry dock while the plant is operating is performed using the module assembly equipment discussed in Section 3.8. The module inspection rack is part of the module assembly equipment used, not only in initial receipt of the NPM, but during refueling. In addition, the RBC is used during initial delivery of an NPM. Because only one NPM can be moved at a time, the receipt of a new NPM cannot occur when the RBC is being used for other lifting or during an NPM refueling. In addition, the safe load paths apply to the initial delivery of an NPM. Therefore, the operation of other modules is not affected by the receipt and delivery of a new NPM.

Operator training, handling, handling system design, load handling instructions, and equipment inspection provide reasonable assurance of a reliable operation of the handling system.

COL Item 9.1-7: The COL applicant that references the NuScale Power Plant design certification will provide a description of the program governing heavy loads handling. The program should address

- operating and maintenance procedures
- inspection and test plans
- personnel qualification and operator training
- detailed description of the safe load paths for movement of heavy loads

9.1.5.4 Inspection and Testing

Preoperational inspection and testing of overhead cranes is governed by ASME NOG-1. Non-destructive examination of critical crane structural welds is performed in accordance with ASME NOG-1. Tests include operational testing with 100 percent load to demonstrate function and speed controls for bridge, trolley, and hoist drives, and proper functioning of limit switches, locking, and safety devices. A rated load test is performed with a 125 percent load.

The RBC is inspected, tested, and maintained in accordance with ASME B30.2 (Reference 9.1.5-5). This inspection requirement reduces the probability of a load drop due to a malfunctioning RBC that could result in a release of radioactive materials from damage to irradiated fuel, a criticality accident, or damage to essential safe shutdown equipment that could cause unacceptable radiation exposures.

Testing of the MLA is conducted per ANSI N14.6. Rated load testing of single load path portions, such as the main pin, is performed with a 300 percent load. Rated load testing of dual load path elements, such as the four paddles and pins that interface with the module lifting tabs, is performed with a 150 percent load. Operational testing is conducted per the requirements of ANSI N14.6, and includes annual NDE and dimensional checks.

Testing of the permanently installed NPM lifting fixture is conducted per ANSI N14.6. A rated load test is performed with a 150 percent load. Operational testing is conducted either annually or before each use per the requirements of ANSI N14.6, and includes annual NDE and dimensional checks.

Inspection and testing of special lifting devices are in accordance with ANSI N14.6. Inspection and testing of lifting devices not specially designed are in accordance with ASME B30.9.

Refer to Section 14.3 for information pertaining to the methodology and approach utilized to develop related Inspections, Tests, Analyses, and Acceptance Criteria.

Preoperational testing of the RBC is addressed in Section 14.2.

9.1.5.5 Instrumentation and Control

The bridge and trolley have redundant position control systems. The position control systems allow the operator to position the RBC according to defined coordinates and therefore, directly over the vertical centerline of the NPM or a defined lifting position. The RBC, including the auxiliary hoists and wet hoist, include load-sensing devices. Limit switches on the runway and bridge determine the edges of the heavy load exclusion zones for the RBC. Positioning and weighing capability ensures that the RBC does not travel within heavy load exclusion zones.

The following RBC control system devices are provided:

- hoist overtravel
- hoist load limits
- hoist overspeed
- hoist drum rope mis-spooling
- bridge and trolley overtravel limits
- restricted handling path

Limit switches are included in the design to provide protection for overtravel, overspeed, overload, unbalanced load, and proper spooling of the hoisting ropes onto the hoist drums. The limit switches and interlocks are active during all modes of operation, and are displayed on the operator control panel. The RBC limit switches and interlocks include:

- upper limit switch - If the upward-bound hoist contacts this limit switch, the control system stops ascending, sets the brakes, and issues a fault warning. Hoist raise is disabled, but hoist lower is permitted.
- secondary upper limit switch - In the event of failure of the upper limit switch, if the secondary upper limit switch is contacted, the control system stops ascending, sets the brakes, and issues a fault warning. Hoist raise is disabled, but hoist lower is permitted.
- upper block shock absorbing system - In the event both upper limit switches fail, and the bottom and upper blocks "two block," the upper block shock absorbing system absorbs the shock due to two structural components colliding for the short time it takes for the overload switch to shut down the hoist.
- over-load switch - The over-load sensor system, which measures the amount of load on the RBC hoist, indicates one of the following conditions: trying to lift an excessive load, a load that has hung up, or a two-blocking situation. In this situation, the control system stops ascending, sets the brakes, and issues a fault warning. Hoist raise is disabled, but hoist lower is permitted.
- slack rope indication - A load weighing less than the low-load set point on the overload switch indicates that the ropes are slack. This can be due to the load having reached the bottom of its position or that a load has hung up as it descends. In this situation, the control system stops lowering, sets the brakes, and issues a fault warning. Hoist lower is disabled, but hoist raise is permitted.
- un-balanced load - Detection of excessive movement of the equalizer mechanism results in tripping this device and shuts down the hoisting motion.
- overspeed switch - An overspeed switch monitors the rotation of the hoist drum. If the drum is rotating too fast, the switch cuts power to the hoist and sets the brakes.
- hoist lower limit switch - Shaft cuts power to the hoist and sets the brakes after a predetermined number of revolutions.
- Reactor Building crane-fuel handling machine (FHM) interlock - The RBC fuel handling machine interlock prevents inadvertent simultaneous overlapping operation. With the FHM positioned above the RFT during the refueling process, the zoning control of the RBC prevents travel in the area. Likewise, with the RBC over the CFT or RFT, the FHM cannot enter the zone.
- motor power circuit disconnecting device – The device opens the power circuit to all crane drive motors. The device opens automatically on failure. The device is unable to reclose until a reset function is performed. Upon opening, the crane braking system is automatically set.

9.1.5.6 References

9.1.5-1 American National Standards Institute, “American National Standard for Radioactive Materials - Special Lifting Devices for Shipping Containers

Weighing 10 000 Pounds (4500 kg) or More," ANSI N14.6-1993, La Grange Park, IL.

9.1.5-2 American Society of Mechanical Engineers, "Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings," ASME B30.9-2014, New York, NY.

9.1.5-3 American Society of Mechanical Engineers, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)," ASME NOG-1-2004, New York, NY.

9.1.5-4 American Society of Mechanical Engineers, "Rules for Construction of Cranes, Monorails, and Hoists (With Bridge or Trolley or Hoist of the Underhung Type)," ASME NUM-1-2016, New York, NY.

9.1.5-5 American Society of Mechanical Engineers, "Overhead and Gantry Cranes – Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist," ASME B30.2-2005, New York, NY.

9.1.5-6 Crane Manufacturers Association of America, "Specifications for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes," CMAA-70- 2010, Charlotte, SC.

Table 9.1.5-1: Heavy Load Handling Equipment Design Data

Equipment	Rated Capacity (Tons)	Design Code	Single-Failure-Proof	Seismic Category	Maximum Traverse Speed[1] (fpm)	Maximum Hoist Speed[1] (fpm)	Maximum Lift Height (ft)
RBC Main Hoist	850	ASME NOG-1, Type I	Yes	I	30	2	50
RBC auxiliary hoists	15	ASME NOG-1, Type I	Yes	I	N/A	25[2] / 37[3]	65
MLA	790	ANSI N14.6	Yes	N/A	N/A	N/A	N/A
NPM lifting fixture	790	ANSI N14.6	Yes	I	N/A	N/A	N/A
Wet hoist	250	ASME NOG-1, Type I	Yes	N/A	N/A	4	75
Traveling Jib Crane Hoist	2000 lbs (1 ton)	ASME NUM-I, Type II	No	II	30	21	40

Notes:
1. Bridge, trolley, and hoist speeds are within the recommended ranges of ASME NOG-1.
2. With load on the hoist
3. Without load on the hoist

Table 9.1.5-2: Reactor Building Crane Special Lifting Devices

Lifting Device	Description
Module Lifting Adapter	The module lifting adapter is a 4 arm, lifting device that engages 4 lifting lugs located on the top support platform on the upper NPM. This adapter moves the NPM from the dry dock to the refueling pool and into the operating bay.
NPM Lifting Fixture	The NPM lifting fixture consists of the NPM lifting lugs and top support structure diagonal lifting braces that are used to lift the NPM, and is permanently attached to the NPM.
Reactor Vessel Internals Lifting Adapter	The reactor vessel internals lifting adapter is designed to handle the core support assembly and lower riser assembly. This adapter is a 4 arm lifting device that engages to the core support assembly lower locking mechanism and the lower riser assembly trunnions for installation and removal from the lower RPV.
Lower Vessel Lifting Adapter	The lower vessel lifting adapter is a 4 arm lifting device that interfaces with the outside diameter of the lower RPV and lower CNV bolting flanges. This adapter is used to lower the lower RPV and lower CNV into the reactor pool.

Figure 9.1.5-1: Safe Load Paths and Heavy Load Exclusion Zones

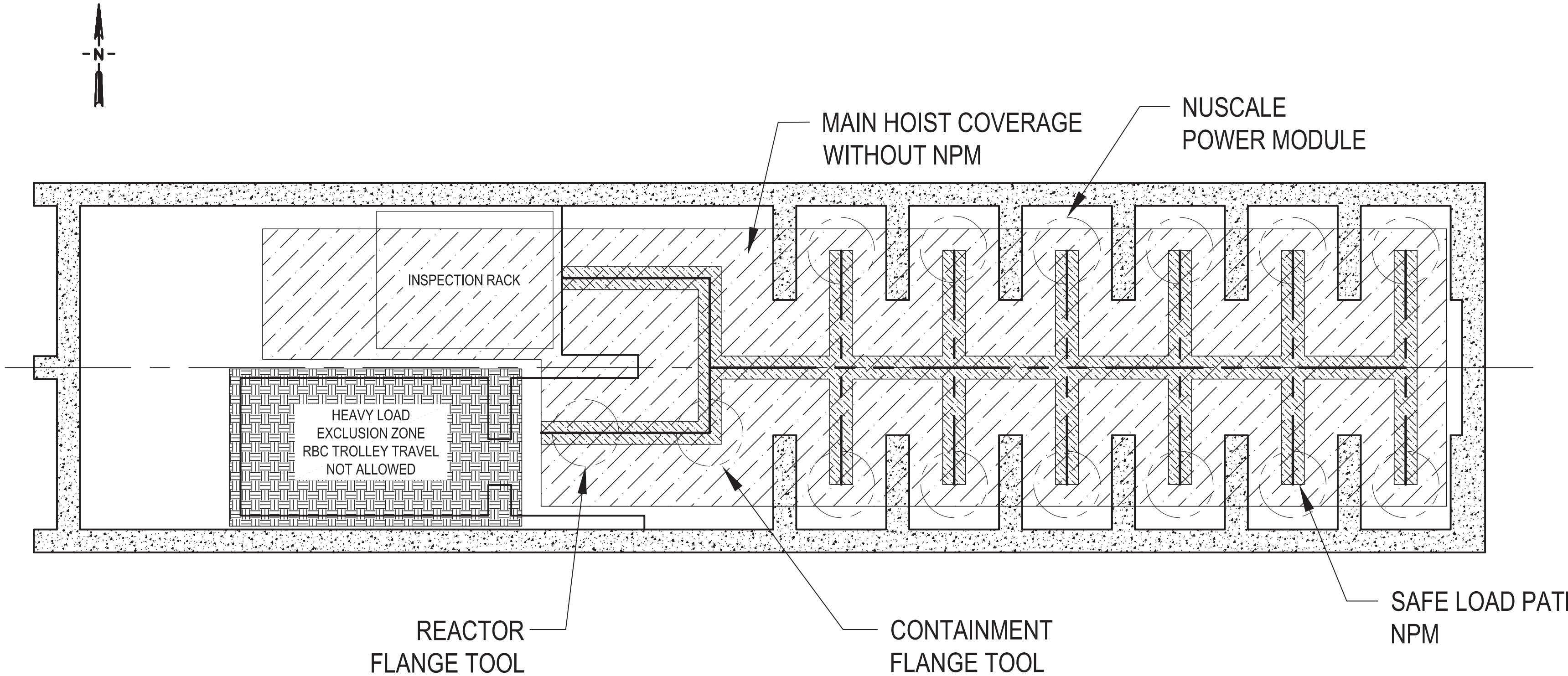


Figure 9.1.5-2: Safe Load Paths

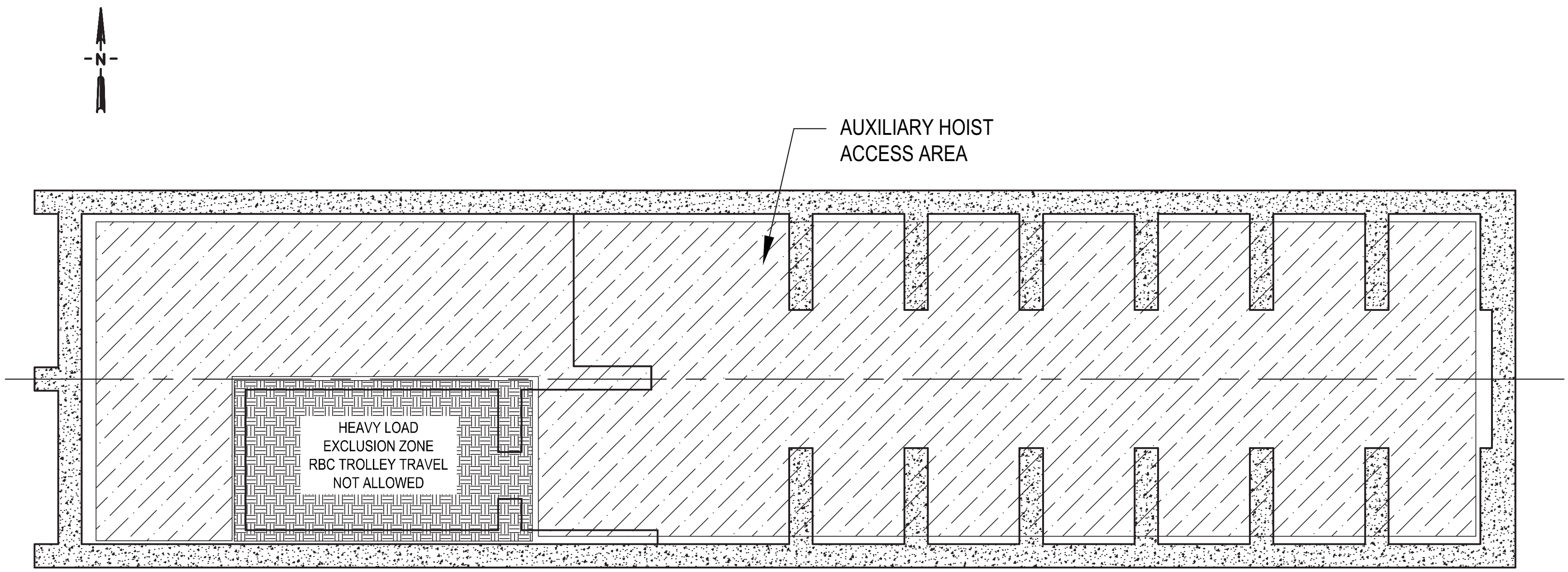


Figure 9.1.5-3: Reactor Building Crane

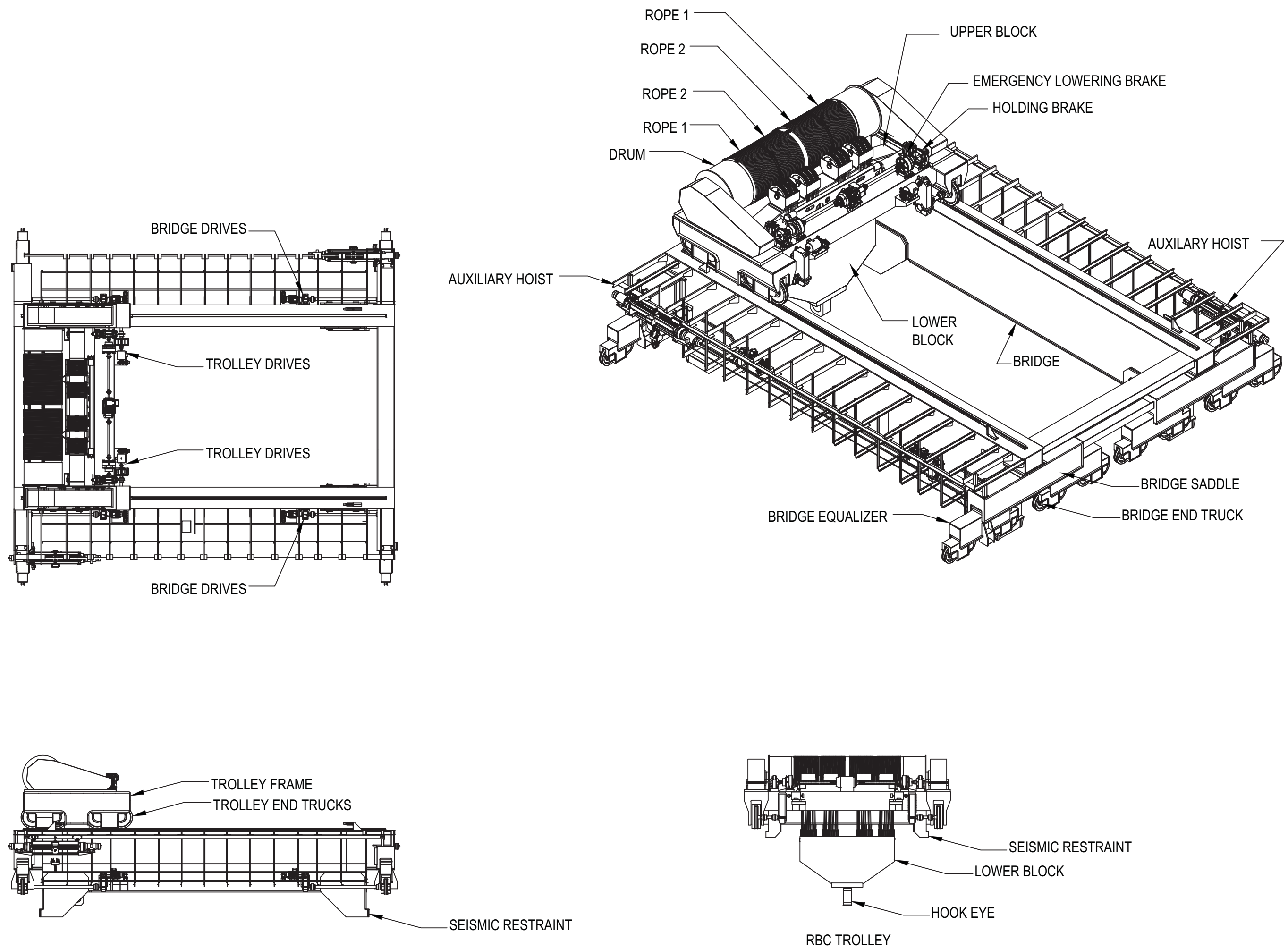
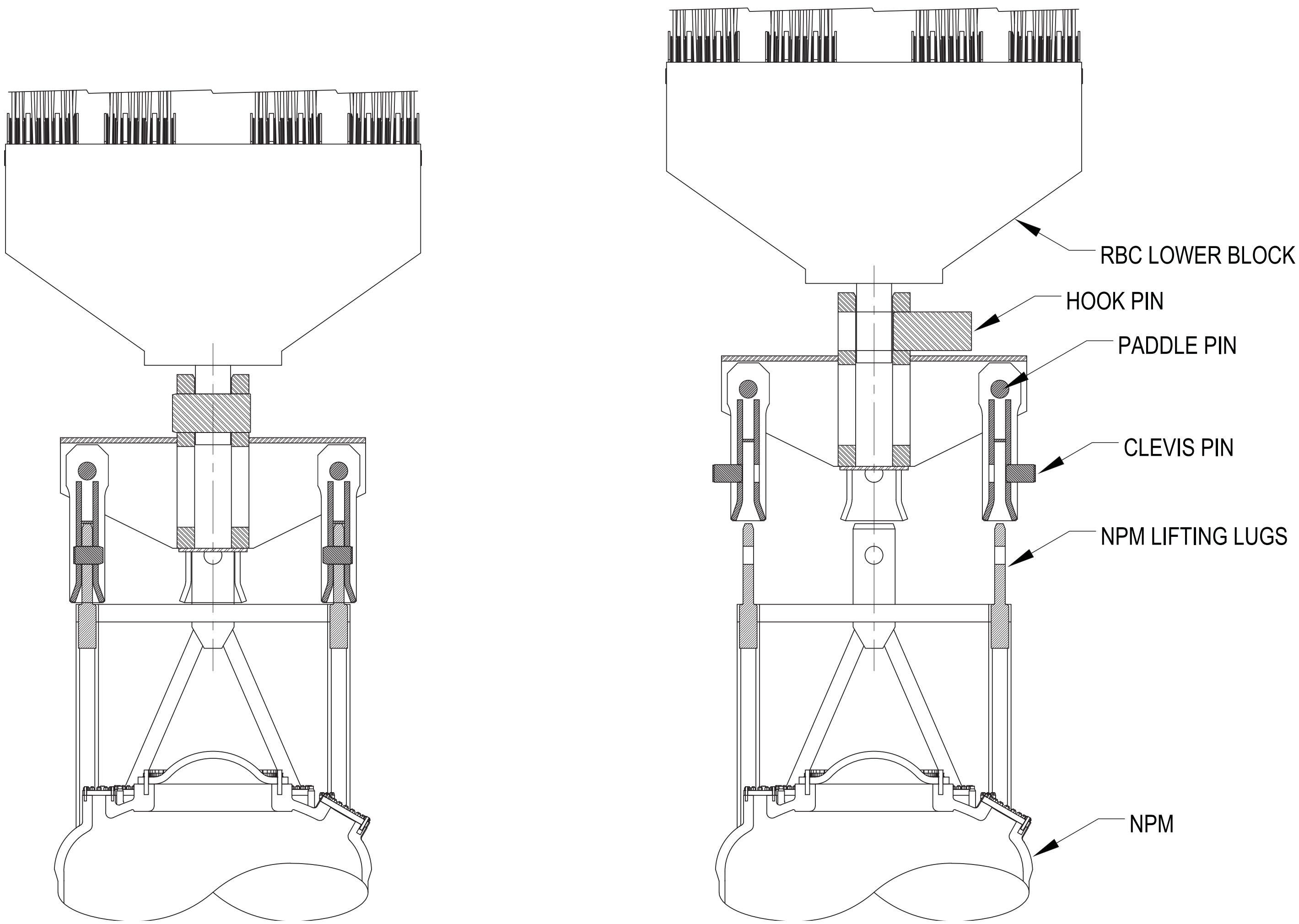


Figure 9.1.5-4: Module Lifting Adapter



9.2 Water Systems

9.2.1 Station Service Water System

This section is relevant to light water reactor (LWR) active designs that incorporate a service water system serving as the final heat transfer loop between various heat sources and the plant ultimate heat sink (UHS). The NuScale Power Plant design does not have a service water system.

A typical LWR service water system provides essential cooling to safety-related equipment and can also cool nonsafety-related auxiliary components used for normal plant operation. The NuScale Power Plant passive design does not rely on active systems such as a service water system to provide cooling to essential equipment. The NuScale Power Modules are partially submerged in the reactor pool portion of the plant UHS. This design configuration ensures passive heat transfer from essential systems and components directly to the UHS, with no intermediate heat transfer loop such as that provided by a typical LWR essential service water system.

9.2.2 Reactor Component Cooling Water System

The reactor component cooling water system (RCCWS) is a nonsafety-related, closed loop cooling system.

The RCCWS provides cooling to the following:

- control rod drive mechanism (CRDM) electromagnetic coils housing
- chemical and volume control system (CVCS) non-regenerative heat exchangers
- containment evacuation system (CES) condensers and vacuum pumps
- process sampling system (PSS) coolers and analyzer cooler temperature control units (TCUs)

The CVCS heat exchangers, CES condensers, CES vacuum pumps, and the PSS coolers and TCUs are located inside the Reactor Building. The CRDM electromagnetic coils are located inside containment, and outside of the reactor pressure vessel.

The RCCWS is comprised of two identical subsystems each supporting up to six NuScale Power Modules (NPM). The two subsystems are independent and do not have the ability to be cross-connected. The heat from these systems is transferred by the RCCWS to the site cooling water system (SCWS), and then to the environment through the SCWS cooling tower. The RCCWS is designed as a closed loop system to act as an intermediate system between radioactive systems and the nonradioactive SCWS.

The RCCWS supplies cooling water to the CRDM electromagnetic coils, which are located inside the containment vessel. The system boundary for the RCCWS ends outside of containment. The containment isolation valves (CIVs) are part of the containment system. The piping inside containment is part of the control rod drive system (CRDS). Section 4.6 discusses CRDS piping and Section 6.2 describes CIVs.

9.2.2.1 Design Bases

This section identifies the RCCWS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The RCCWS provides no safety-related function, is not credited for mitigation of design basis accidents, and has no safe shutdown functions. The RCCWS is shared by up to six NPMs. General Design Criteria (GDC) 2, 4, and 5 were considered in the design of the RCCWS. The RCCWS is not required to function during or after a natural phenomenon event or other events that result in the generation of missiles, pipe whipping, or discharging fluids. Portions of the system that are in proximity to Seismic Category I SSC are designed to Seismic Category II standards. The RCCWS has no function in the orderly shutdown of an NPM or the ability to maintain the NPM shut down.

The RCCWS design meets GDC 60 and GDC 64 as related to the control of radiological effluents and monitoring of releases. The RCCWS acts as an intermediate system to ensure that potentially radioactive leakage into the RCCWS is detected and isolated as soon as possible to prevent release to the environment.

The RCCWS is designed to remove the heat load from the CRDMs, the CVCS nonregenerative heat exchangers, the CES condensers and vacuum pumps, and the PSS coolers and TCUs during normal plant operation.

The RCCWS is designed such that no single component failure can cause the loss of RCCWS heat removal from more than one NPM.

9.2.2.2 System Description

9.2.2.2.1 General Description

The RCCWS is a closed loop system and is shown in Figure 9.2.2-1. There are two subsystems that comprise the RCCWS. Each RCCW subsystem is equipped with an expansion tank and a chemical feed pot. The RCCWS process fluid passes through a network of three 50% capacity pumps. The pumps discharge into a common header serving two 100% capacity heat exchangers. These heat exchangers transfer heat from the RCCWS to the SCWS. The cooled water then enters a supply header which services the CRDMs (16 per NPM), CVCS nonregenerative heat exchangers (one per NPM), CES condensers and vacuum pumps (two vacuum pumps and one condenser per NPM) and the PSS components (an analyzer cooler per NPM and a single TCU to serve up to six NPMs). The heated water returns to the pump suction header. Radiation monitors are located downstream of the coolers, condensers and heat exchangers to alert the control room of radioactive leakage into the RCCWS.

The RCCWS is designed such that no single failure can cause the loss of RCCWS heat removal from more than one NPM. This is accomplished by having redundant major active components that allow maintenance or replacement of these components during RCCWS operation. Each RCCW subsystem has three pumps (with automatic start of the idle pump) and two heat exchangers. A leak in any cooler, heat exchanger, condenser or tank can be isolated locally, possibly resulting in the shutdown of an individual module but not multiple NPMs.

Makeup water, when needed, is provided from the demineralized water system via the RCCWS expansion tank. The RCCWS is powered from the nonsafety-related, low voltage AC electrical distribution system.

There are 16 CRDMs in each reactor vessel. The RCCWS provides cooling water for the CRDM electromagnetic coils housing through a single inlet line penetrating containment. In-line filters are provided in each cooling supply line (outside the containment boundary) to ensure that foreign material does not obstruct CRDM flow. Inside containment, this line is subdivided into separate lines each servicing a single CRDM. After passing through the CRDMs, the smaller lines rejoin into a single outlet line leaving containment.

During normal operation, one of the three RCCWS pumps and one heat exchanger are sufficient to remove the heat load expected from six modules. Table 9.2.2-1 provides the design parameters for the RCCWS and major components.

Under normal plant operating conditions, the environmental conditions (ambient temperature, humidity, radiation, noise, etc.) are such that RCCWS equipment is accessible to personnel for operation, inspection, maintenance, and testing.

The RCCWS utilizes stainless steel materials for wetted parts subjected to the cooling water, which includes but is not limited to heat exchanger tubes, tube sheets, baffles, pump casings, pump impellers, valve bodies, pipe, fittings, and tanks. The RCCWS design complies with applicable industry codes and standards, commensurate with the function of the system. As such, the RCCWS components are fabricated, installed, and maintained in compliance with:

- ASME Power Piping Code B31.1 (Reference 9.2.2-1)
- ASME Boiler and Pressure Vessel Code (BPVC) Section VIII Division I (Reference 9.2.2-2) (chemical feed pots and expansion tanks)

The RCCWS is classified as Quality Group D for all portions of the system. The RCCWS is classified in accordance with Regulatory Guide 1.26 as Quality Group D because it does not perform safety functions but does have the potential to contain radioactive material.

The seismic category is determined in accordance with Regulatory Guide 1.29, with the exception as noted in Section 3.2.1 for classifying SSC as Seismic Category II. The RCCWS piping from the NPM disconnect flange to the pipe gallery wall is Seismic Category II because the piping does not provide a safety-related function, but it must be properly restrained to prevent adverse effects on Seismic Category I SSC such as the containment vessel, containment isolation valves, and equipment on the top head of the module. The RCCWS components beyond the pipe gallery wall are Seismic Category III because the system is not required to continue operating during or after a safe shutdown earthquake, and failure of an SSC does not adversely affect a Seismic Category I SSC or the occupants of the control room.

The safety, risk significance, seismic, quality, and other design classifications for the RCCWS structures, systems and components are provided in Table 3.2-1. Additional information pertaining to impact of environmental effects associated with flooding is provided in Section 3.4. Dynamic effects associated with missile impact and pipe rupture are provided in Sections 3.5 and 3.6, respectively.

9.2.2.2.2 Component Descriptions

Each RCCW subsystem consists of three equally-sized pumps, two heat exchangers, one expansion tank, and a chemical feed pot. Each component, except the expansion tank, can be isolated to ensure system function, control system leakage, and allow system maintenance. Design and operating information for this equipment is provided in Table 9.2.2-1.

Reactor Component Cooling Water System Pumps

Three constant speed pumps are provided for each subsystem. The pumps are horizontal centrifugal single stage pumps and are electric motor driven. The design head of the pumps is based upon the pressure losses in the system piping, valves, heat exchangers, and suction head created by the expansion tank elevation. The design flow rate is based on the maximum anticipated simultaneous flow required to cool all RCCWS loads. The pumps are sized for 50% of RCCWS capacity. For most normal conditions one pump is sufficient with the other pumps in standby. A standby pump starts automatically upon the loss of an operating pump. Each RCCW subsystem includes a duplex strainer in the pump suction line. Vents and drains are provided for each pump.

Reactor Component Cooling Water System Heat Exchangers

The RCCWS uses plate and frame design heat exchangers to transfer the heat from the RCCWS to the SCWS. There are two heat exchangers for each RCCWS subsystem. The heat exchangers are sized for 100% capacity. One is normally operating and one is in standby.

Reactor Component Cooling Water System Expansion Tank

An RCCWS expansion tank is provided for each subsystem to accommodate expansions and contractions of the RCCWS volume. The expansion tank allows for thermal expansion of water in the system, provides adequate net positive suction head, reduces the potential for water hammer, and provides system back pressure to prevent flashing across the heat exchangers. The expansion tank pressure vessel is designed to ASME Section VIII, Division 1 requirements.

Reactor Component Cooling Water System Chemical Feed Pot

Each RCCW subsystem contains a chemical feed pot to inject chemical corrosion inhibitors into the RCCWS to prevent corrosion in the piping, valves, pumps, and heat exchangers.

COL Item 9.2-1: A COL applicant that references the NuScale Power Plant design certification will select the appropriate chemicals for the reactor component cooling water system based on site-specific water quality and materials requirements.

9.2.2.2.3 System Operation

Normal Operations

The RCCWS operates continuously. The normal operating equipment for each subsystem is one pump and one heat exchanger, with the remaining pump(s) and heat exchanger in standby. Two pumps can run simultaneously, if required. The RCCWS pumps and heat exchangers are provided with isolation valves to allow for isolation of the train in stand-by. The RCCW fluid is cooled in the RCCWS heat exchanger (depending on the SCWS supply temperature), and is then distributed to the CVCS, CRDS, CES, and PSS coolers.

The RCCWS is monitored from the main control room via remote instrument indication and alarms to determine important parameters such as the heat exchanger inlet and outlet temperatures and cooling water flow rates. The start of a standby pump upon the loss of a pump is automatic. The makeup to the expansion tank is automatic after a permissive is acknowledged by the control room operator. The RCCWS can be controlled from the main control room.

Off-Normal Operations

In the event of a pump failure in the RCCWS, the standby pump will automatically start. In the event of leakage out of the RCCWS, the operator is notified of low expansion tank level by an alarm. After the permissive is acknowledged by the operator, the automatic makeup valve will open and makeup water from the demineralized water system will fill the expansion tank. In the event the expansion tank level is high, the automatic makeup valve to the tank will close.

In the event radiation is introduced into the RCCWS piping, in-line radiation monitors in the RCCWS piping will detect the radiation and alarm in the control room. If radiation is detected, the leak is isolated by the operators and the source of leakage determined. Grab sample points are provided in the RCCWS to assist in the confirmation of radionuclides in the system.

The radioactive fluid can be drained to the radioactive waste drain system and the leaking heat exchanger or cooler can be identified and isolated. Vents and drains are also routed to the radioactive waste drain system. The RCCWS normally contains a nonradioactive fluid which is routed to the radioactive waste drain system nonradioactive waste drain tank for sampling, release and treatment in the liquid radwaste system, if necessary.

The RCCWS is a closed system that is expected to have very low levels of radioactivity because there would have to be a pressure boundary failure of a heat exchanger or cooler for radioactive material to enter the RCCWS. This design minimizes the contamination of the facility and the environment in accordance with Regulatory Guide 4.21 and 10 CFR 20.1406. The radiation monitors are described in Section 11.5.

In the event a NPM is shut down for maintenance or refueling, the RCCW subsystem will continue to operate under normal conditions for the other five NPMs with the isolation valves closed to the CRDMs for the unit that is shutdown.

In the event of a plant wide shutdown, the RCCWS is not required for safe shutdown of the plant.

Accident Operating Conditions

A single NPM design basis event only isolates containment for the affected NPM. RCCWS continues to operate, but CRDM, CVCS, CES and PSS heat loads for the affected NPM are eliminated when the containment isolation valves are shut. RCCWS continues to flow to provide cooling to the unaffected NPMs. Depending on the type of accident, either the decay heat removal system or emergency core cooling system will actuate to provide cooling for the affected NPM.

A design basis event, such as a loss of offsite power that causes the shutdown of all NPMs, will cause a loss of power to the RCCWS pumps, resulting in a loss of RCCWS flow. The containment isolation valves will close on loss of power. RCCWS heat loads will be eliminated with the loss of AC electrical power to the station. Closure of CIVs secures RCCW flow to CVCS, CRDMs, CES and PSS. Containment isolation removes the heat load from CVCS, CES and PSS. All CRDMs de-energize and all rods release, shutting down the NPM and eliminating this RCCWS heat load. The decay heat removal systems for each module actuate to remove reactor heat to the ultimate heat sink.

9.2.2.3 Safety Evaluation

The RCCWS does not perform safety-related or risk-significant functions (containment isolation valves are part of the containment system and covered under Section 6.2). RCCWS cooling is not required for safety-related or risk-significant components to perform their functions. While the CRDMs are safety-related due to their function of safe shutdown of the reactor, the electromagnetic drive coils and rod position indication that are cooled by RCCWS are part of the control rod drive system and do not impact the ability to safely shut down the reactor.

General Design Criteria 2, 4, and 5 were considered in the design of the RCCWS. Consistent with GDC 2, components whose failure could adversely impact Seismic Category I components are designed to Seismic Category II standards.

Consistent with GDC 4, the RCCWS is not required to function following an event that results in the generation of missiles, pipe whipping, or discharging fluids. Also, the RCCWS is designed to ensure that its failure will not adversely affect the functional performance capabilities of safety-related and other augmented quality systems or components.

Consistent with GDC 5, even though the components in the RCCWS are shared between up to six NPMs, the RCCWS and the loads to which it provides cooling do not perform safety-related functions or function to shut down the NPM or maintain the NPM in a shutdown condition. Therefore, the RCCWS does not impair the ability of NPMs to perform their safety functions including the ability to mitigate the consequences of an accident on one unit and shutdown and cooldown the remaining units.

The RCCWS design meets GDC 60 and GDC 64 as they relate to the control of radiological effluents and monitoring of releases. In addition, the RCCWS also meets the requirements of 10 CFR 20.1406 related to minimization of contamination. All systems cooled by the RCCWS with the exception of the CRDMs contain fluid that has the potential to contaminate the RCCWS with radioactivity. The RCCWS is designed as a closed loop system to act as an intermediate system between radioactive systems and the nonradioactive SCWS that transfers the heat to the environment. This design ensures that potential contamination is contained within the Reactor Building. Radiation monitors are located downstream of the cooled components to alert the control room if there is a radioactive fluid leak into the RCCWS. Manual isolation valves are provided on all coolers and condensers to isolate leaks.

During normal and off-normal conditions, sufficient redundancy and cross connectivity within each subsystem exists to remove heat from the serviced systems. During and after an accident, the RCCWS is not relied upon to remove heat from the affected NPM. In the event of an RCCWS pipe break inside containment, the volume of RCCWS fluid is limited by the available inventory in the RCCWS. Makeup to the RCCWS expansion tank requires an operator action to acknowledge the low expansion tank level. A variety of instrumentation is available to identify RCCWS leaks in containment including RCCWS pump low suction pressure, RCCWS pump flow high or low, and RCCWS heat exchanger inlet temperature high. Individual NPM control rod drive mechanisms also have alarms for low flow or high temperature. In addition, the RCS leakage detection system (Section 5.2.5) is capable of detecting RCCWS leakage into containment.

9.2.2.4 Inspection and Testing Requirements

Preoperational testing is performed in accordance applicable codes, manufacturer recommendations, and normal startup testing practices. The RCCWS components are inspected and tested prior to installation and as an integrated system following installation. Preoperational testing of the RCCWS is described in Section 14.2.

Inspections are specified and performed based on the applicable codes, manufacturer standards, and good engineering practice.

Periodic visual inspection of the RCCWS can be performed during normal operation. In addition flow, temperature, pressure, and level measurements can be used to verify RCCWS condition.

The methodology associated with the development of inspections, tests, analyses, and acceptance criteria is presented in Section 14.3.

9.2.2.5 Instrumentation Requirements

RCCWS instrumentation includes the following:

- temperature, flow, and radiation detectors for heat exchangers
- pressure and flow for pumps
- level and valve position for tanks
- position indication for power-operated valves

RCCWS instrumentation signals that are NPM specific are sent to the module control system, and RCCWS main header signals are sent to the plant control system. A summary of the instrumentation, associated indications, and alarms used to monitor the RCCWS is provided in Table 9.2.2-2.

The RCCWS is designed to be controlled remotely from the main control room. The control room operator selects and controls pump operation. The pumps will alarm upon a low suction pressure and trip on low-low suction pressure signal. Pump discharge pressure is used to trigger an automatic start of a standby pump. Status indication of remote manual controls is available in the main control room.

Expansion tanks are equipped with high-level and low-level indication. In the event of a low level in the expansion tank, an alarm will notify control room operators. Once the permissive is acknowledged, the makeup water supply control valve will open to fill the expansion tank. Upon high level in the expansion tank, the control valve will automatically close. Alarms are triggered by both high-level and low-level switches.

Radiation monitors are located downstream of RCCWS heat exchangers and will alert plant operators of abnormal radiation levels within the system. An alarm alerts the operators in the main control room of a potential radioactive leak into RCCWS.

9.2.2.6 References

9.2.2-1 American Society of Mechanical Engineers, *Power Piping,* ASME Code for Pressure Piping, B31, ASME B31.1, New York, NY.

9.2.2-2 American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, 201 Edition, Section VIII, Division 1, “Rules for Construction of Pressure Vessels,” New York, NY.

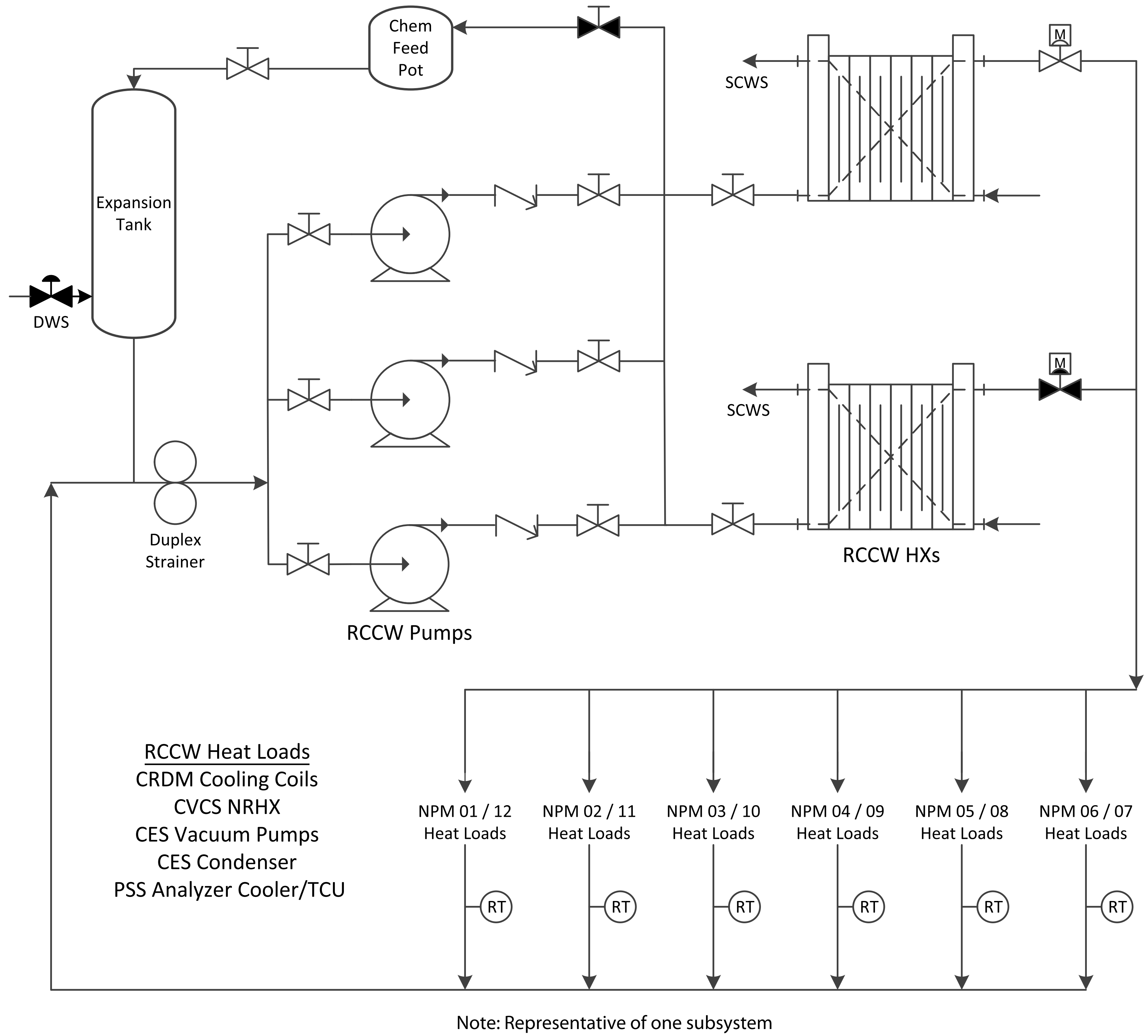
Table 9.2.2-1: Reactor Component Cooling Water System Equipment Design Data

Description	Technical Data
Pumps	
Quantity	3
Type	Horizontal centrifugal pump
Flow rate (design)	660 gpm
Design head	125 ft
Motor horsepower	60 hp
Heat Exchangers	
Quantity	2
Type	Plate and frame
Design heat load	21 MBtu/hr
RCCWS design pressure	150 psig
RCCWS design temperature	200 °F
SCWS design pressure	250 psig
SCWS design temperature	150 °F
Expansion Tank	
Quantity	1
Capacity	200 gallons
Temperature (design)	200 °F
Temperature (operating)	60-141 °F
Pressure (design)	150 psig
Pressure (operating)	Atmospheric
Chemical Feed Pot	
Quantity	1
Temperature (design)	200 °F

Table 9.2.2-2: Reactor Component Cooling Water System Instrumentation

Type	Location	Local Indication	MCR Indication
Temperature indicating transmitters	Inlet and outlet of each heat exchanger Downstream of cooled components	Yes	Yes
Radioactivity transmitters	Downstream of cooled components	No	Yes
Pressure indicating transmitters	RCCWS pumps - suction and discharge inlet to each heat exchanger Expansion tank	Yes	Yes
Pressure differential indicating transmitters	Across each heat exchanger	Yes	Yes
Flow indicating transmitters	RCCWS pump discharge downstream of all cooled components	Yes	Yes
Valve position	Makeup supply line Outlet isolation valve for each heat exchanger	Yes	Yes

Figure 9.2.2-1: Reactor Component Cooling Water System Diagram



9.2.3 Demineralized Water System

The demineralized water system (DWS) is designed to treat the water from the utility water system (UWS) and provide and distribute high-quality demineralized water to the plant.

The DWS provides demineralized water, including condensate makeup water of a quality and quantity which is suitable for long-term plant operation. The DWS provides makeup water for all plant conditions including power operation, startups, shutdowns, extended outages, and off-chemistry conditions.

9.2.3.1 Design Bases

This section identifies the DWS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure the functions are fulfilled. Together, this information represents the design bases defined in 10 CFR 50.2, and required by 10 CFR 52.47(a) and (a)(3)(ii).

The DWS does not perform safety-related functions, is not credited for mitigation of design basis accidents, and has no safe shutdown functions. General Design Criteria (GDC) 2, 4, and 5 were considered in the design of the DWS. The DWS is not required to function during or after a natural phenomenon event or other events that result in the generation of missiles, pipe whipping, or discharging fluids. Portions of the system that are in proximity to Seismic Category I SSC are designed to Seismic Category II standards. The DWS has no function in the orderly shutdown of an NPM or the ability to maintain the NPM shut down. The DWS does not perform safety related or safe shutdown functions. See Section 9.2.3.3 for the safety evaluation.

The DWS is designed to inhibit backflow from radiologically contaminated systems. The DWS provides water to the Reactor Building and Radwaste Building for maintenance and decontamination operations. Compliance with the requirements of 10 CFR 20.1406 is presented in Section 12.3.

9.2.3.2 System Description

9.2.3.2.1 General Description

The DWS processes water from the UWS through the demineralized water treatment (DWT) skid to meet water chemistry requirements. The treated water is delivered to the demineralized water storage tank (DWST) and periodically tested to ensure water chemistry is within the required limits established by the plant water chemistry program. The demineralized water supplies up to 12 NPMs and various buildings by the demineralized water supply pumps. The DWS provides demineralized water to the following:

- auxiliary boiler system makeup water for the auxiliary boiler condensate tanks
- condensate polishing system resin sluicing, resin regeneration and effluent dilution in the neutralization and waste inspection tanks prior to discharge
- Turbine Generator Building for miscellaneous uses

- condenser air removal system makeup water to the suction of the liquid ring vacuum pump and seal water for the liquid ring vacuum pumps
- feedwater and condensate system makeup water to the main condenser hotwell via the condensate storage tank and initial system fill through the condenser
- feedwater treatment system chemical dilution in the amine/hydrazine skids prior to injection
- normal control room heating ventilation and air conditioning system water used by the humidifier
- Reactor Building for miscellaneous uses
- spent fuel cooling system makeup water to maintain pool level during normal operation
- pool cleanup system water for filter back flush, demineralizer bed flushing, and resin sluicing as a backup to the solid radwaste management system and liquid radwaste management system
- containment evacuation system water for sample tank flushing
- chemical and volume control system water to be used for reactor coolant makeup, chemical addition, tank flushing, and resin transfer
- process sampling system
- reactor component cooling water system for initial filling, makeup, and the chemical feed pot
- boron addition system makeup water
- liquid radioactive waste management system water to fill the demineralized water break tank, provide chemical mixing for the liquid radioactive waste neutralization skid and water for decontamination to reduce operator exposure during maintenance
- Annex Building for miscellaneous services
- Radwaste Building for miscellaneous services
- Reactor Building Ventilation System, Radwaste Building Ventilation System, Turbine Building Ventilation System, and Annex Building Ventilation System for the purpose of providing humidified air

9.2.3.2.2 Component Description

The major components of the DWS include one DWT skid, one DWST and three DWS pumps. The DWS is classified as Quality Group D per RG 1.26 and is designed to meet ASME B31.1 (Reference 9.2.3-1).

The DWS materials, except for the demineralized water treatment degasifiers, are stainless steel or corrosion resistant material equivalent. A diagram of the DWS is provided in Figure 9.2.3-1.

Demineralized Water Treatment Skid

The DWT skid processes incoming water from the UWS or recirculated water from the DWST into water acceptable for plant use and discharges it to the DWST. The DWT is designed to produce enough high quality water to satisfy continuous users of the DWS. The skid contains two trains; one normally operating and one in standby. Equipment required for site water treatment can fit onto a single transportable skid. Skid-mounted analyzers monitor the water quality throughout the treatment process to verify skid component performance and have connections located at various points in the treatment skid.

Demineralized Water Storage Tank

The DWST is a holdup tank that supplies demineralized water to the plant. The DWST is designed to hold enough demineralized water to supply up to 12 NPMs water for systems with infrequent or intermittent use.

The DWST provides for holdup and sampling of treated demineralized water from the DWT. A grab sample connection is located on the tank. Chemical analyzers located on the discharge of the DWS pumps monitor the quality of the water from the DWST and recirculate water to the DWT skid if degraded water quality is detected.

Table 9.2.3-1 provides design information for the DWST. Table 9.2.3-2 shows the demineralized water system parameters that are monitored.

Demineralized Water System Pumps

The DWS pumps provide sufficient head to the demineralized water to deliver it to the systems in the plant supplied by the DWS (Section 9.2.3.2.1). There are three pumps, each capable of operating at 50 percent system flow capacity in the DWS. During normal operation, two pumps are operating with the third pump on standby. Each of the two normally operating pumps is powered from a separate power source. The standby pump starts automatically if one of the operating pumps trip. Design parameters for the DWS pumps are shown in Table 9.2.3-1.

Backflow Prevention

The DWS does not normally contain radioactive materials but does interface with systems containing radioactive contaminants. Backflow into the DWS is inhibited by the use of backflow preventers.

9.2.3.2.3 System Operation

The DWS is remotely operated from the main control room. The control room receives warnings or notices of inadequate water quality, DWST high and low level, DWS pump high and low pressure, and pump isolation valve closure. Following a warning or notice, plant operators verify the appropriate corrective actions have taken place and verify system status. Locally mounted manual controls are provided for maintenance operations and as backup to automatic operations.

During normal operation, demineralized water is delivered to systems supplied by the DWS through piping from the DWS pumps. Up to two pumps are available during normal operation, with the third in standby. One of the two normally operating pumps may be turned off during periods of low demineralized water demand. Makeup water is received from the UWS, processed in the DWT skid, and delivered to the DWST. The standby DWS pump starts automatically on low header pressure.

Chemical analyzer detection of degraded DWT water effluent quality notifies plant operators of ineffective demineralized water treatment and the need for maintenance or other action. Upon detection of degraded water quality in the DWST, the distribution valve to the plant is closed. The inlet to the DWT skid from the pump recirculation is opened to treat the water from the DWST. The DWST can be bypassed allowing operation to continue with water coming directly from the DWT skid. This allows the DWST to be cleaned up separately.

For low DWST level events, the DWT skid is placed in operation. If that does not stop the level decrease, the DWS pumps are stopped. For high DWST level events, the water supply from the DWT skid is isolated.

The DWS is not required for mitigation of design basis events. The DWS provides plant support during abnormal conditions by providing additional makeup water to the spent fuel pool cooling system to compensate for inventory loss and to the condenser for emergency fill. During these situations, the operators monitor the DWST water level to ensure availability for use.

As a means of detecting backflow from contaminated systems into the DWS, the DWS incorporates radiation monitors on the headers that supply water from the DWS to systems that are normally contaminated. Samples from the DWS are routinely taken to check for contamination (refer to Table 9.3.2-4.)

9.2.3.3 Safety Evaluation

The DWS has no safety-related or risk significant functions. The design and layout of the DWS include provisions that ensure that a failure of the system will not adversely affect the functional performance of safety-related systems or components, consistent with GDC 2 and GDC 4. The DWS is not required to function during or after a natural phenomenon event or other events that result in the generation of missiles, pipe whipping, or discharging fluids. Portions of the system that are in proximity to Seismic Category I SSC are designed to Seismic Category II standards.

General Design Criterion 5 was considered in the design of the DWS. The DWT skid, DWST, and DWS pumps are shared by up to 12 NPMs. The DWS tank is sized for full 12 module demineralized water demand. The DWS has no safety related or risk significant functions, and therefore the DWS has no functions that are impacted if there is an accident in one module coincident with the shutdown and cooldown of the remaining modules.

The highest RG 1.26 quality group classification of the DWS is Quality Group D. In general, the DWS is a Seismic Category III system because the system is not required to continue operating after a seismic event, and failure of its SSC is not expected to affect the operability of Seismic Category I SSC or the occupants of the control room. Any portions of the DWS whose structural failure could adversely affect the function of Seismic Category I SSC are Seismic Category II in accordance with Section 3.2.

The DWS does not normally contain radioactive materials but does interface with systems that contain radioactive materials. The DWS incorporates backflow preventers to minimize the probability of contaminating the DWS distribution system. Samples are taken from the DWS routinely to check for contamination. These system features and operating measures provide protection against the spread of contamination in accordance with 10 CFR 20.1406.

9.2.3.4 Inspection and Testing

Inspections and testing are specified and performed based on the applicable codes, manufacturing standards and vendor requirements.

Maintenance and periodic testing are conducted to verify system components, instrumentation, controls, and communications are functioning properly.

9.2.3.5 Instrumentation Requirements

The DWS instrumentation signals are provided to the module control system (MCS) and the plant control system (PCS) and displayed in the main control room. The DWS is designed to allow for normal operation to be performed remotely from the main control room. The operators are able to remotely monitor a wide range of DWS system status conditions in the main control room from the main control room operator workstation displays, allowing diagnosis of problems from the main control room. The DWS process variables monitored by the MCS and PCS are also available locally.

9.2.3.6 References

9.2.3-1 American Society of Mechanical Engineers, *Power Piping,* ASME Code for Pressure Piping, B31, ASME B31.1, New York, NY.

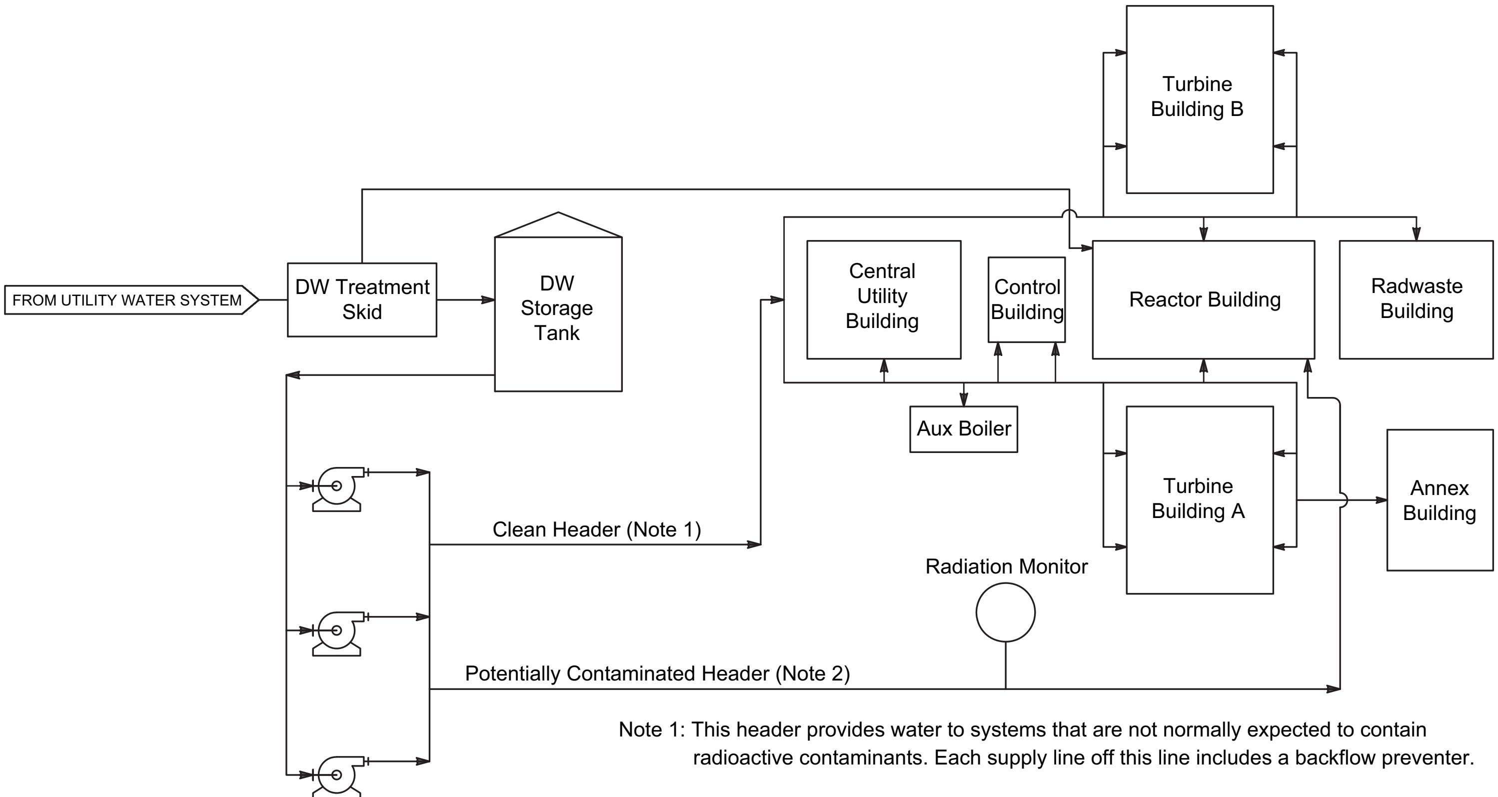
Table 9.2.3-1: Demineralized Water System Major Component Design Values

Demineralized Water Storage Tank	
Tank capacity	150,000 gallons
Design temperature	150°F
Design pressure	Atmospheric
DWS Pumps	
Number	3
Flow capacity	300 gpm
Motor horsepower	30 hp
Design temperature	150 °F
Design pressure	150 psig

Table 9.2.3-2: Demineralized Water System Monitoring Parameters

Monitoring Parameter	Inlet	Effluent
Sodium	--	Continuous monitoring
Chloride	--	Grab sample
Sulfate	--	Grab sample
Silica	--	Continuous monitoring
Total organic carbon	--	Grab sample
Conductivity	Grab sample	Continuous monitoring
Dissolved oxygen	--	Continuous monitoring
Pressure	Continuous monitoring	Continuous monitoring
Flow	Continuous monitoring	Continuous monitoring

Figure 9.2.3-1: Demineralized Water System Diagram



Note 1: This header provides water to systems that are not normally expected to contain radioactive contaminants. Each supply line off this line includes a backflow preventer.

Note 2: There are two headers of this type, one on either side of the RXB. These headers provide water to the following:

* CVCS makeup pumps.
* Boric acid supply tank - flushing & tank fill.
* Spent fuel pool cooling system for pool makeup.
* Pool cleanup system demineralizer.
* Containment evacuation system sample vessels.
* Liquid radioactive waste managed system degasifier vacuum pump seal.

9.2.4 Potable and Sanitary Water Systems

The potable water system (PWS) provides potable water for human use and sanitary water collection throughout the plant for treatment and discharge. Potable water is supplied for usage via the potable water supply distribution system. Sanitary water is water discharged from restrooms, showers, or sinks.

9.2.4.1 Design Bases

This section identifies the PWS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The PWS serves no safety-related functions, is not credited for mitigation of design basis accidents, and has no safe shutdown functions. General Design Criteria (GDC) 2, 4, and 5 were considered in the design of the PWS. The PWS is not required to function during or after a natural phenomenon event or other events that result in the generation of missiles, pipe whipping, or discharging fluids. Portions of the system that are in proximity to Seismic Category I SSC are designed to Seismic Category II standards. The PWS has no function in the orderly shutdown of an NPM or the ability to maintain the NPM shut down. There are no safety-related, risk-significant or safe shutdown functions in the PWS that are shared between NuScale Power Modules. See Section 9.2.4.3 for the safety evaluation. The PWS is designed to protect the integrity of the control room envelope (CRE).

GDC 60 was considered in the design of the PWS. The PWS has no interconnections to systems having the potential for containing radioactive material.

9.2.4.2 System Description

The PWS provides potable water for human use and consumption and provides for the collection and treatment of sanitary water.

The PWS provides piping, valves, and other control components to distribute potable water to final use locations. Potable water usage includes drinking fountains, kitchen/breakroom facilities, sinks, showers, water closets, and emergency eyewash/shower stations. Water heaters are installed, as appropriate, to provide hot water to end users. Potable water system component materials are compatible with Federal safe drinking water regulations. During normal operation, the PWS distribution network maintains a minimum system pressure to preclude leakage into the system. Any connection to or from other water systems is accomplished using isolation devices, such as backflow preventers or air gaps, between the PWS and interfacing systems to prevent system cross-contamination. Overall, potable water capacity is based on the anticipated number of on-site personnel for a 24-hour period during normal operations.

COL Item 9.2-2: A COL applicant that references the NuScale Power Plant design certification will describe the source and pre-treatment methods of potable water for the site, including the use of associated pumps and storage tanks.

Piping, valves, and other components are provided to collect sanitary waste from sanitary waste drains and distribute it to collection and treatment facilities. Overall, sanitary waste capacity is based on the anticipated number of on-site personnel for a 24-hour period during normal operations.

The PWS provides water to, and accepts waste water from, the CRE. Each PWS supply and return line to or from the CRE includes a passive isolation device (loop seal) located inside the CRE. If a line is damaged by a seismic event, it is isolated by the loop seal to protect the control room from inleakage of atmospheric radioactive contaminants. Each applicable line is designated Seismic Category II from the outer wall of the CRE up to and including the loop seal.

COL Item 9.2-3: A COL applicant that references the NuScale Power Plant design certification will describe the method for sanitary waste storage and disposal, including associated treatment facilities.

9.2.4.3 Safety Evaluation

The PWS serves no safety-related functions or cooling function, is not credited for mitigation of design basis accidents, and has no safe shutdown functions.

Consistent with GDC 2 and Regulatory Guide 1.29, the following portions of the PWS are designated Seismic Category II:

- portions of the PWS in proximity to safety-related SSC that could render the safety-related SSC inoperable
- for each supply and return line that penetrates the control room envelope (CRE), the PWS isolation device (loop seal) inside the CRE and the piping between the loop seal and the CRE outer wall.

The remainder of the PWS is Seismic Category III. Seismic, quality and other design classifications for the components in the PWS are identified in Section 3.2.

The PWS does not provide service directly to the Reactor Building or the radwaste building. Since the PWS is not routed in these buildings, leakage from the PWS will not contribute to flooding in these buildings. Potable water is supplied to the Control Building. The PWS piping penetrating the control room envelope and habitability boundary is provided with isolations to control the potential for flooding in the envelope in the event of a line break and loss of system pressure. Leakage or spillage is collected and maintained away from sensitive components and equipment. Additional information pertaining to the impact of environmental effects associated with flooding is provided in Section 3.4. These design features are consistent with GDC 4.

The design of the PWS satisfies GDC 60 with provisions to prevent radioactive materials from contaminating and being released to the environment from the PWS. The PWS piping is not interconnected with other system piping that conveys radioactive materials. Additionally, the PWS is separated from other non-radioactive plant water systems by the installation of backflow prevention measures, such as reduced pressure backflow prevention devices or air gaps, where appropriate.

The PWS is designed consistent with the requirements of 10 CFR 20.1406 to minimize contamination of the facility by the design provisions described above for preventing radiological contamination of the PWS.

9.2.4.4 Inspection and Testing Requirements

The PWS is inspected and tested for leak-tightness in accordance with governing codes specific to the site, and to demonstrate the ability of the PWS to supply potable water and for treatment of sanitary waste drainage water as designed, during normal plant operation.

9.2.4.5 Instrumentation Requirements

Instrumentation such as valve position switches, pressure gauges, and temperature sensors are located throughout the system. PWS equipment and instruments are monitored and controlled by the plant control system. Instrumentation is available for monitoring PWS operation in the main control room. Radiation monitors are included as part of the utility water system, refer to Section 9.2.9.

9.2.5 Ultimate Heat Sink

The ultimate heat sink (UHS) is a set of safety-related pools of borated water that consists of the combined water volume of the reactor pool (RP), refueling pool (RFP), and spent fuel pool (SFP). The UHS pools are located below grade in the Reactor Building (RXB). Up to twelve NuScale Power Modules (NPMs) are located in the RP and share the combined volume of water. The RFP provides a location for refueling of an NPM, allows the transfer of spent fuel assemblies to the fuel storage racks in the SFP, and loading of spent fuel storage casks. The UHS is sized such that active cooling systems are not required for accident conditions; the combined volume of water in the UHS pools provides sufficient cooling for greater than 72 hours without additional makeup water. The UHS is provided with a qualified makeup line that can provide additional water to the UHS and with redundant water level instrumentation.

Figure 9.2.5-1 provides the basic layout of UHS pools. Figure 9.2.5-2 provides the UHS qualified makeup line design details. Refer to Table 9.2.5-1 for UHS parameter values.

9.2.5.1 Design Bases

This section identifies the UHS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The UHS serves several safety functions that include the following: providing a cooling medium for the decay heat removal system, the containment vessels, and the spent fuel assemblies stored in the storage racks; providing borated water for reactivity control during refueling; and providing radiation shielding for the spent fuel assemblies and NPMs. The UHS pool level is a nonsafety-related input to the plant protection system. General Design Criteria (GDC) 2, 4, 5, 45, 46, 61, and Principal Design Criteria (PDC) 44 were considered in the design of the UHS.

Consistent with GDC 2 and 4, the UHS is designed to remain functional by withstanding the effects of natural phenomena and the dynamic effects of missiles resulting from equipment failures.

Consistent with GDC 5, the UHS is a shared system that is capable of providing sufficient cooling to dissipate the heat from an accident in one unit and permitting the simultaneous and safe shutdown of the remaining units, and maintaining them in a safe shutdown condition.

PDC 44 and GDCs 45 and 46 were considered in the UHS design. The UHS design permits inspections and tests that verify its continued performance, integrity, and safety. The pools that comprise the UHS are accessible for periodic inspections. Functional testing to assure structural leak tight integrity is accomplished by maintaining pool level and monitoring for leaks through the pool leak detection system. These inspections and tests verify system integrity and operability as a whole. The UHS requires no active components to perform the required safety functions.

Consistent with GDC 61, the UHS is designed to ensure adequate safety under normal and postulated accident conditions and has the capability to permit appropriate periodic inspections and testing of components, provides suitable radiation shielding, provides appropriate containment, confinement and filtering capabilities, provides for the removal of residual heat of components, and provides for the prevention of a significant reduction in the pool water inventory under accident conditions.

Section 6.2.2 provides additional discussion on the containment vessel heat removal safety function.

9.2.5.2 System Description

9.2.5.2.1 General Description

The plant design features two functional heat sinks. During normal operation, the normal heat sink is via the power conversion system where the condenser transfers heat to the circulating water system as discussed in Section 10.4.1. The remainder of this section is devoted to the safety-related heat sink, the ultimate heat sink.

The UHS includes the reactor pool, RFP, and SFP (Figure 9.2.5-1) and is located below ground within the RXB. Pool areas are open to each other with a weir wall partially separating the SFP from the RFP area. The dry dock area is not considered in this volume; it is assumed that the dry dock gate is closed and no credit is taken for the water volume.

Table 3.2-1 identifies the components included in the UHS system and provides their safety, seismic, and quality group classifications. Table 3.2-1 also provides this information for the structures related to UHS but not part of the UHS system. As described above, the UHS includes the reactor pool, RFP, and SFP, but the structural components forming these three UHS-related pools are not part of the UHS system. That is, the internal reinforced concrete walls and floors of the RXB that form the UHS pool are part of the "RXB, Reactor Building" in Table 3.2-1. The pool liner for the UHS pool in the RXB are part of "RBCM, Reactor Building Components" in Table 3.2-1. The RXB, including the concrete forming the UHS pools, and UHS pool liner meet Seismic Category I requirements to withstand the SSE without loss of UHS pool water retention capability.

The UHS will remove the decay heat from each NPM, maintaining the core temperature at low levels after a loss-of-coolant accident resulting in the initiation of the emergency core cooling system (ECCS), provide sufficient cooling to the stored spent fuel assemblies in the SFP, and maintains them covered in water under operational scenarios. The UHS will also accommodate the combined heat loads from NPMs, refueling activities, and spent fuel during normal and accident conditions assuming a single failure for at least 72 hours without operator actions or electrical power (AC or DC).

The UHS pool liner has the function to prevent potential pool inventory leakage from the SFP, reactor pool, and RFP. The pool liner design prevents inventory leakage and ensures the cooling of the spent fuel assemblies and NPM is maintained during required modes of operation. The liner is a 304L, or equivalent, stainless steel that is nominally 0.25 in thick and covers the pool floor and walls up to the 100 ft elevation. Section 3.8.4 provides a more detailed description of the pool liner.

The UHS has a makeup line that is designed to meet Regulatory Guide 1.26, Quality Group C; Regulatory Guide 1.29 Seismic Category I; and American Society of Mechanical Engineers BPVC Section III requirements, and is protected from external natural phenomena. The UHS makeup line is furnished with a standard fire protection connector that facilitates hookup of emergency sources of water for the water supply. The UHS makeup line is routed to the SFP. Water added to the SFP will ensure that stored fuel is kept covered and then supplement the water inventory in the RP and RFP. Water is added to the SFP to a level that tops the weir height to provide water inventory to cover fuel in an open reactor vessel in the refueling stand.

The dry dock is an area adjacent to the RFP provided for inspection and maintenance of the upper portion of an NPM during refueling. The dry dock is also used for the preparation, decontamination, and testing of a cask for removing spent fuel assemblies from the RXB. The dry dock gate separates the dry dock from the pools in the RXB to allow for draining of water from the dry dock without lowering the water level in the adjacent pools. The dry dock water volume is not part of the UHS.

The UHS removes the heat generated within the NPM during refueling and accident conditions. During normal operation, heat transferred to the containment vessel is removed by the UHS, which is in turn cooled by the reactor pool cooling system. The heat generated from an open core being refueled is also removed by the UHS, and in turn by the reactor pool cooling system. See Section 6.2.1 and 3.8.2 for additional information on the containment vessel.

The UHS removes the heat rejected by the decay heat removal system during operational phases, including off-normal conditions. Two decay heat exchangers are connected to each NPM below the normal water level of the UHS pool. See Section 5.4.3 for additional information on the decay heat removal system.

The reactor pool cooling system removes heat from the UHS during normal and refueling operations. Pool water suctions from the UHS are located in the RFP area. The reactor pool cooling system pumps remove water from the warmer upper pool area of the UHS, pump the warmer water to the heat exchangers, and return the cooled water to the reactor pool. See Section 9.1.3 for more information on the reactor pool cooling system.

The UHS removes the heat generated by the spent fuel stored in the SFP during normal plant operation as well as refueling activities. During normal operation, the SFP cooling system removes the spent fuel decay heat from the UHS. In addition, the SFP cooling system maintains the pool water level during normal operations. See Section 9.1.2 for more information on the spent fuel storage and Section 9.1.3 for the SFP cooling system.

The SFP weir is designed to maintain a minimum of 10 feet of water over spent fuel stored in the storage racks. The structural components forming the UHS are the pool walls and floors and are considered part of the RXB structure. The functional and code requirements, and associated bases, relevant to the pool structural components are described in Section 3.8.4.

UHS water surge control is provided by the pool surge control system (PSCS) during dry dock operations. For additional information, refer to Section 9.1.3.

The UHS water is circulated through the pool cleanup system to remove impurities to maintain water quality and reduce radionuclide contaminants. Water removed from the pools by the PSCS, spent fuel cooling system, or reactor pool cooling system can be routed for cleanup in the pool cleanup system filters and resin beds and returned to the pools. Refer to Section 9.1.3 for additional information.

Leakage of UHS pool water is collected by the pool leakage detection system to provide appropriate containment and confinement of radioactivity, and minimize contamination. Leakage from a pool liner results in flow out of the leakage detection channels. The channels are routed to collect and quantify pool leakage. Refer to Section 9.1.3 for additional information.

The concentration of radionuclides in the UHS water is monitored by the process sampling system. Refer to Section 9.3.2 for additional information on process sampling.

9.2.5.2.2 Normal Operation

The UHS pool water level, temperature, and quality are maintained within an operational control band to provide assurance that water is available to provide personnel and public safety during normal plant operation. Level is maintained through interface with the SFP cooling system. Temperature is maintained through interface with the SFP cooling and the reactor pool cooling systems. The heat load evaluation in the UHS for normal operation with power available for the pool cooling systems is presented in Section 9.1.3. UHS parameters are provided in Table 9.2.5-1.

Dry dock operations maintain water level in the dry dock to match the pool level prior to opening the dry dock gate. The PSCS maintains the level in the dry dock without affecting the UHS level. The PSCS operation is discussed in Section 9.1.3.

9.2.5.2.3 Operation During Abnormal and Accident Conditions

During abnormal conditions, when electric power is available, the reactor pool cooling and SFP cooling systems remove the heat transferred from the NPMs and spent fuel to the UHS. The heat that is rejected through the decay heat removal system or the containment vessel is removed by the reactor pool cooling system via the UHS water. For an abnormal condition where one NPM is cooled in this manner, the UHS pool water temperature would initially increase above the normal operating temperature shown in Table 9.2.5-1. With AC power available, the active pool cooling systems operate to return the water temperature to the normal operating value.

During an event where loss of electric power occurs, the volume of water already in the pool provides the inventory for the necessary heat removal. Upon loss of power, the reactor pool cooling and SFP cooling systems shut down. The UHS water expands as it heats and eventually begins to boil. Heat continues to be removed from the pool through boiling and evaporation, removing enough heat to maintain the spent fuel and fuel in the NPMs sufficiently cool to prevent fuel damage. The design is such that UHS water boil-off will continue to remove heat from the power modules and spent fuel for greater than 30 days without the need for operator action, makeup water, or electric power.

Section 9.2.5.4 describes the evaluation of the capability of the UHS to cool the NPMs and the spent fuel following an accident or transient, including a loss-of-coolant accident (LOCA) in an NPM. As shown in the evaluation, without electrical power to supply normal pool cooling and makeup systems, the large UHS water volume provides sufficient time for actions to restore UHS water level using defense-in-depth design provisions. These defense-in-depth design provisions include: the makeup water connection and associated piping that provides a pathway for makeup water, and connection capability to the fire protection system.

The level of water over the spent fuel is monitored and in the event that level continues to drop, the qualified makeup line is used to add water to the pool. The qualified makeup line provides a connection outside the RXB for a source of water to fill the SFP area and the UHS pool. The weir assures that water is available to cover the spent fuel first, before adding water to the rest of the pool complex.

To prevent over-pressurization in the UHS area of the RXB during abnormal conditions, credit is taken for an over-pressurization vent (OPV) included in the RXB system (see Section 3.8.4). Until the building pressure reaches the set point of the rupture disk, the Reactor Building HVAC system (RBVS) will filter and control the release of airborne radioactive material from inside the RXB, including from pool water evaporation for loss of normal power supply (see Section 9.4.2). Section 15.0.3 addresses the radiological consequences of the UHS pool boiling.

9.2.5.3 Refueling Operations

The NPMs are located in the reactor pool during power operations, and one is moved by the RXB crane to the RFP to perform refueling and maintenance operations. The upper reactor vessel and upper containment vessel are placed in the module inspection rack located in the dry dock for inspections. Spent fuel is moved from the open reactor vessel, which is staged in the RFP, through an open passage over the weir wall into the SFP where the fuel storage racks are located.

The dry dock temporarily houses an upper NPM for inspection, testing, and maintenance. The PSCS controls the water level in the dry dock to provide access to the various components for inspections and maintenance. The dry dock gate is closed and the water volume separated from the UHS to allow level adjustment in the dry dock.

The boron concentration in the UHS pool, including the SFP, is maintained at a level that will preclude criticality during refueling operations (refer to Table 9.1.3-2). The UHS contains the minimum boron concentration for reactivity control of fuel during the refuel evolution when the reactor vessel is open to the pool. Boron concentration in the UHS is monitored. The SFPCS has the ability to add boron to the UHS along with the option to add boron directly to the pool manually. Boron concentration reduction is performed when necessary by using the SFPCS to add low boron concentration water while bleeding off pool water to the liquid radioactive waste system.

Water level in the UHS is capable of maintaining core cooling during refueling operations. The volume of water is able to perform the function of ultimate heat sink without the need to transfer the heat to a secondary system.

While the upper NPM is in the dry dock for inspections, radiologically activated equipment located on the lower sections of the module will be shielded by water in the dry dock. The water level in the dry dock is adjusted to provide radiation shielding depending on the work being performed.

9.2.5.4 Safety Evaluation

The UHS is a passive system and does not require electric power (AC or DC) to remove heat. Following a postulated accident and the assumed onset of a station blackout, makeup water could be added through the qualified UHS makeup line from outside of the RXB using nonsafety-related equipment to stabilize pool water inventory. However, no credit is needed for pool water additions for more than 30 days as shown by the following evaluation of the boil off of the initial UHS pool water inventory.

An accident in one NPM concurrent with a loss of AC power is assumed to result in a shutdown of up to 11 NPMs (as a result of loss of power). For these conditions, a total of 12 NPMs are assumed to be isolated from the feedwater and main steam systems, and transferring heat to the UHS. The evaluation of UHS pool water boil off does not credit the active pool cooling systems or the RXB ventilation, except for passive steam release, allowing energy from the NPMs and spent fuel to heat up and boil the water in the UHS.

Without the addition of makeup water, a reduction in UHS water level would result from an extended unavailability of the reactor pool cooling and SFP cooling systems (e.g., initiated by an extended loss of AC power). Boiling of the water in the UHS pools is evaluated assuming a prolonged unavailability of these systems. For these conditions, UHS water temperature and level would initially increase, and UHS water level would then decrease as a result of pool water evaporation and boiling.

The normal operating range of the water level in the UHS pools is provided in Table 9.2.5-1. At the upper end of this range, the volume of the water in the UHS is more than 6.4 million gallons. The water level in UHS prior to the start of the evaluation of UHS pool water boiling is assumed to be at the lower end of this range and is the minimum value allowed by Technical Specifications before actions must be taken as a Limiting Condition for Operation. The volume of water in the UHS pools for this lower water level is more than 6.3 million gallons.

The water temperature in UHS prior to the start of the analysis of pool water boiling is conservatively assumed to be 140 degrees F. This temperature corresponds to the upper end of the normal operating range for UHS pool water temperature and is the maximum value allowed by Technical Specifications before actions must be taken as a Limiting Condition for Operation.

The heat loads for this evaluation are assumed to be from the 12 NPMs and the stored spent fuel assemblies. No other heat loads or systems are cooled by the UHS. The decay heat loads for the NPMs and spent fuel are calculated using American National Standards Institute (ANSI)/American Nuclear Society (ANS) 5.1 (Reference 9.2.5-1) and the total cumulative heat energy cooled by the UHS is presented in Table 9.2.5-2 as a function of time.

Prior to the start of the evaluation of UHS pool water boiling, 12 NPMs are assumed to be in operation at their normal operating power level of 160 MWt per NPM. An accident is assumed to occur in one NPM with a coincident loss of AC power and the shutdown of 11 NPMs. Based on a conservative approach to modeling the transfer of sensible heat from the metal and the water in an NPM to the UHS water, the total heat rejected from the NPM with the assumed accident is limiting for any type of accident. That is, the sensible heat in the NPM is addressed in the analysis by converting the energy associated with the cooling of the metal and water from the reactor operating temperature down to boiling, and adding this energy to the UHS pool water at the start of the evaluation. This is equivalent to assuming that the containment system isolation valves close immediately at the start of the assumed accident, which is consistent with the inadvertent main steam system isolation valve (MSIV) closure event analyzed in Section 15.2.4.2. This approach is conservative because the MSIVs are designed to close within 5 seconds and during this closure time some energy would transfer from the water in the reactor coolant system to the steam generators and then to the secondary side of the unit before the MSIVs close. Accident sequences in Chapter 15 without closure of the MSIVs would lose even more energy to the secondary side and are not limiting for UHS pool cooling capacity.

Use of this approach for cooling of sensible heat is also applied to the 11 NPMs assumed to shut down at the start of the accident due to a loss of electric power. The sensible heat load for each of the other 11 NPMs is the same as for the NPM with the accident because there is the same assumed transfer of metal and water sensible heat from each shutdown NPM to the UHS water. With the above assumptions, the sensible heat from each of the 12 NPMs enters the UHS water through the decay heat removal system or ECCS, and is not cooled by the secondary side of the plant.

In addition to the sensible heat, the decay heat load from each NPM is also cooled through the decay heat removal system or ECCS. The heat load to the UHS from each NPM is based on the rate of decay heat generation determined using ANSI/ANS 5.1 (Reference 9.2.5-1).

The heat input to the UHS from the 12 NPMs for the conditions described above is the maximum that could occur for 12 NPMs during plant operations including one NPM in refueling and 11 NPMs at full power operations. For a plant with one NPM in refueling operations at the time of an accident, the total heat load to the UHS would be less than the limiting case with 12 units in operation. Once the NPM to be refueled starts the normal shutdown sequence, the unit is continually cooling and has less and less energy available to transfer to the UHS at the start of the assumed accident. The limiting case is 12 NPMs operating at the start of an accident in one unit.

For the analysis of a pool water boil off, the decay heat load to the UHS pool also includes the heat added by the stored spent fuel assemblies. Each NPM has a 24-month refueling cycle; therefore, for a 12-NPM plant, a staggered schedule with a refueling every 2 months is assumed. As described in Section 9.1.2, the SFP can contain 1,404 stored spent fuel assemblies, or 18 years of stored spent fuel. For this analysis, the decay heat from those assemblies plus an additional 13 freshly off-loaded spent fuel assemblies is assumed.

The cumulative heat energy transferred to the UHS over time from these conditions is presented in Table 9.2.5-2. The analysis of UHS pool water boil off without makeup or active cooling addresses the limiting total heat load into the UHS from the NPMs and stored spent fuel.

Other assumptions for this evaluation include the following. As the pool heats up and boils, evaporated water is assumed to not return to the pool. No credit is assumed for heat dissipation into the surrounding pool liner, walls, and building. Evaporation from the pools to the RXB atmosphere is not considered before the pool reaches the boiling temperature. A sensible heat of 9.2E+08 BTU from the metal and water starting at normal operating conditions in 12NPMs is assumed to be added to the water in the UHS pool before the pool water begins to boil.

The large UHS water volume provides sufficient time for actions to restore UHS water level using defense-in-depth design provisions. The UHS level that provides 30 days of water without additional makeup or active cooling systems is listed in Table 9.2.5-1. Table 9.2.5-2 provides the times for the UHS to start boiling and to boil down to various levels.

The UHS is designed to support up to 12 NPMs with no impairment of its ability to perform required safety functions. The UHS has sufficient capacity to remove the heat energy from a design basis accident and decay heat in one unit and to achieve an orderly shutdown and cooldown of the remaining units. Water makeup to the UHS is not required to achieve the UHS safety functions.

The UHS design assures heat transfer from the containment vessels and spent fuel to the UHS under normal operating and accident conditions as an inherent consequence of the UHS physical configuration. Each containment vessel is partially immersed in the UHS, and each spent fuel assembly is submerged. Thus, the UHS provides passive cooling to transfer heat from components without reliance on active components or reliance upon AC or DC electrical power. There are no components that require alignment or isolation for the UHS to perform its safety functions.

The UHS conforms to the guidance of Regulatory Position C.9 of Regulatory Guide 1.13. Under normal operating conditions, the UHS is cooled by both SFP cooling and reactor pool cooling systems.

During accident conditions, the containment vessels and the stored spent fuel are cooled by the large volume of water in the UHS. ANSI/ANS 5.1 (Reference 9.2.5-1) was used to determine the decay heat load from irradiated nuclear fuel in the SFP and NPMs (Table 9.2.5-2). The pool structure and liner are designed to withstand coolant boiling conditions. The primary source of cooling is the large volume of water already present in the pools. The backup makeup system is a Quality Group C per RG 1.26, Seismic Category I makeup line that runs from a connection on the outside of the RXB to the SFP.

The UHS relies upon the RXB structural walls, the pool liner, and the weir wall to prevent a significant reduction in coolant inventory and to ensure sufficient water level is maintained for radiation protection shielding of spent fuel in the storage racks and reactor core in the RFP during refueling operations. The water volume in the UHS is contained and confined by the pool liner, which is monitored for leaks by the pool leak detection system.

As shown in Section 3.2, the SFP liner is a RXB component classified as nonsafety-related. The classification is based on Section 15.0.3, which addresses the treatment of nonsafety-related systems in design basis events. Specifically, Chapter 15 events may assume that nonsafety-related systems or components are operable when a detectable and nonconsequential random and independent failure must occur to disable the system. As described in Section 9.1.3, a failure of the liner due to leakage results in collection of the flow by the pool leakage detection system. Such a failure would be detectable, random, and could not result in an initiating event for an accident described in Chapter 15. Nor could an initiating event in Chapter 15 cause the liner to start leaking. Continued function of the liner for any of the design basis events can be assumed because postulated leakage would be nonconsequential due to the size of the water inventory in the UHS pools. Section 9.1.3 describes that sufficient time is available to preclude a loss of pool water that would create an unsafe water level in the UHS pools.

The UHS will protect NPM cores from damage by removing the sensible and decay heat from each reactor and reactor core, maintain the core temperature at acceptably low levels after a loss-of-coolant accident resulting in the initiation of the ECCS, provide sufficient cooling to the stored spent fuel assemblies and maintain them covered in water under operational scenarios. The UHS will also accommodate the rejected combined heat loads from NPMs, refueling activities, and spent fuel assemblies during normal and accident conditions assuming a single failure, and perform its safety functions and maintain the plant in a safe state for at least 72 hours without operator actions or electrical power (AC or DC).

Section 6.2.1 provides additional discussion on the containment vessel heat removal safety function.

Since the UHS is a shared system, it is capable of performing its safety functions without significant impairment by providing sufficient cooling to dissipate the heat from an accident in one unit and permitting the simultaneous and safe shutdown of the remaining units, and maintaining them in a safe shutdown condition. Periodic inspection and testing of relevant components are conducted as described in Section 9.2.5.5.

The UHS is protected against natural phenomena and conforms to the guidance of Regulatory Positions C.1, C.2, and C.6 of Regulatory Guide 1.13. The UHS cooling water is contained in a pool designed to withstand design basis seismic forces and is protected against other external natural phenomena by the RXB. Flooding is discussed in Section 3.4, Water Level (Flood) Design. The design approach to resist geologic forces such as earthquake is discussed in Sections 3.7 and 3.8.

The UHS is protected from the effects of turbine missiles, as described in Regulatory Guide 1.13, Regulatory Position C.3, without loss of the UHS safety functions specified in Section 9.2.5.1. Section 3.5.1 provides additional detail on protection from turbine missiles.

The UHS is designed to withstand environmental and dynamic effects, including the effects of postulated missiles, pipe whip, and discharging fluids that may result from equipment failures and from events and conditions that may occur within the RXB but outside the UHS boundary. Additionally, the physical location of the UHS within the RXB ensures that the effects of equipment failures and events, and conditions that may occur outside the NPM have no reasonable likelihood of adversely impacting UHS safety functions.

The UHS is below grade and contains two heat sources (i.e. stored spent fuel and power modules). The RXB is serviced with a nonsafety-related heating ventilation and air conditioning system (see Section 9.4.2) that controls the environment. The resident heat sources in the UHS, the fact that it is below grade, and the controlled environment within the RXB prevents the UHS from reaching freezing temperatures.

A Safe Shutdown Earthquake (SSE) event can generate waves in the UHS. An analysis of sloshing determined that an SSE generates a maximum wave height of less than three feet. The top of the normal SFP water level range is at 94′ building elevation or six feet lower than the operating floor at the 100′ building elevation. The UHS pool level provides approximately six feet of freeboard space from the normal pool level operating level for accommodation of sloshing waves or overfill conditions. Normal pool level control is monitored to initiate draining excess volume to the PSCS storage tank.

The design of the dry dock gate meets Seismic Category II design requirements consistent with Section 3.2.1.2 and the design guidance of Regulatory Guide 1.29. A failure of the gate during an SSE does not reduce the functioning of a Seismic Category I pool liner or RXB walls that form the UHS pools. For an SSE, the failure of the dry dock gate with an empty dry dock results in lowering the water level in the UHS pools by approximately 12 feet.

9.2.5.5 Inspection and Testing Requirements

To assure the integrity and capability of the UHS heat removal and shielding functions, the UHS design permits the inspection of important components, such as the pool water level instrumentation, the pool liner, and the outside surfaces of the containment vessels. Section 6.6 provides additional information related to the inspection of the containment vessel exterior. Verification of the pool water level ensures adequate water inventory to provide sufficient cooling for the necessary loads.

Table 9.2.5-1 lists the minimum water levels. The integrity of the UHS is monitored by the pool leak detection system for evidence of liner leaks. The liner welds are inspected during power operation or shutdown for leak tightness.

9.2.5.6 Instrumentation Requirements

The instrumentation provided for the UHS is discussed below.

9.2.5.6.1 Temperature Instrumentation

The reactor pool cooling system and SFP cooling system temperature instrumentation is used to monitor the UHS. Temperature instrumentation located in the pool is Seismic Category I. Bulk UHS water temperature is monitored via the inlet to the cooling water systems heat exchangers. Heat exchanger outlet temperature will monitor the cooled water returned to the pools. Temperature monitors are also provided at each module bay. With the forced circulation pool cooling systems removing water at one end of the pool while returning the water at an opposing end it is expected that mixing will occur which should result in the inlet temperatures of the heat exchanger being representative of the bulk pool temperature.

9.2.5.6.2 Level Instrumentation

The UHS water level instrumentation is Seismic Category 1.

Water level instrumentation for the SFP part of the UHS is provided to monitor water level from the normal UHS level to the top of the fuel storage rack in the SFP. Water level instrumentation is also provided in the RP and RFP.

Water level instrumentation in the UHS is powered under normal and off-normal operational scenarios by the plant electrical distribution system and is battery backed. Remote power connections for the electrical distribution system are provided to enable repowering the equipment from outside the plant.

UHS primary and backup level instrument channels are qualified for temperature, humidity, and radiation levels consistent with the pool water at saturation conditions for an extended period.

The UHS pool level instrumentation mounting protects it from natural phenomena. To ensure redundancy, instruments are physically separated and mounted at opposite ends of the pools. Since the UHS communicates with pool areas while the water is above the weir, this provides multiple areas to monitor pool level. The location for each of the instruments provides assurance that a single event will not cause damage to all of the level instruments.

The UHS level information is displayed in the main control room and remote shutdown station. Alarms alert the operator of these parameters during both normal and post-accident conditions. UHS Level instrumentation provides level information for post-accident monitoring.

Figure 9.2.5-2 shows the relative location of the level instrumentation.

Level instrumentation meets the Fukushima recommendations for separation and redundancy. See Chapter 20.1 for additional information on level instrumentation.

9.2.5.7 References

9.2.5-1 American National Standards Institute/American Nuclear Society, "Decay Heat Power in Light Water Reactors," ANSI/ANS 5.1-2014, LaGrange Park, IL.

Table 9.2.5-1: Relevant Ultimate Heat Sink Parameters

UHS Parameter		
Level	**Building Elevation (ft)**	**Pool Level (ft)**
Normal operating level range	{{ Withheld - See Part 9 }}	68-69
Minimum level assumed for reactor building crane operation[1]	{{ Withheld - See Part 9 }}	66
Minimum level for 30 day coverage for DHRS[2]	{{ Withheld - See Part 9 }}	63.4
Minimium level for SFPCS and RPCS suction penetrations[3]	{{ Withheld - See Part 9 }}	60
Minimum level for long term cooling[6]	{{ Withheld - See Part 9 }}	55
Minimum level for FHA scrub[4]	{{ Withheld - See Part 9 }}	52
Spent fuel pool weir wall	{{ Withheld - See Part 9 }}	20
Minimum level to support radiation shielding[5]	{{ Withheld - See Part 9 }}	20
Top of spent fuel rack	{{ Withheld - See Part 9 }}	10
Reactor pool and spent fuel pool floor	{{ Withheld - See Part 9 }}	0
Temperature	**Temperature (°F)**	
Minimum operating	65	
Normal operating	100	
Maximum operating	110	

Notes:

[1] Maximum Reactor Building crane lifting capacity is calculated assuming a pool level of 66 ft and a pool temperature of 140 degrees F for calculating water density.

[2] ANSI/ANS 5.1-2014 is used to calculate decay heat for up to 12 NPMs and stored spent fuel assemblies with a pool water starting temperature of 140 degrees F.

[3] Penetration height for SFPCS and RPCS suction piping in the SFP and RFP level assures suction capability for coolant pumps.

[4] Level for iodine scrubbing includes: weir height + 8 ft damaged fuel + 1 ft weir clearance + 23 ft scrub

[5] ANSI/ANS 57.2-1983 maximum radiation dose of 2.5 mrem/hr

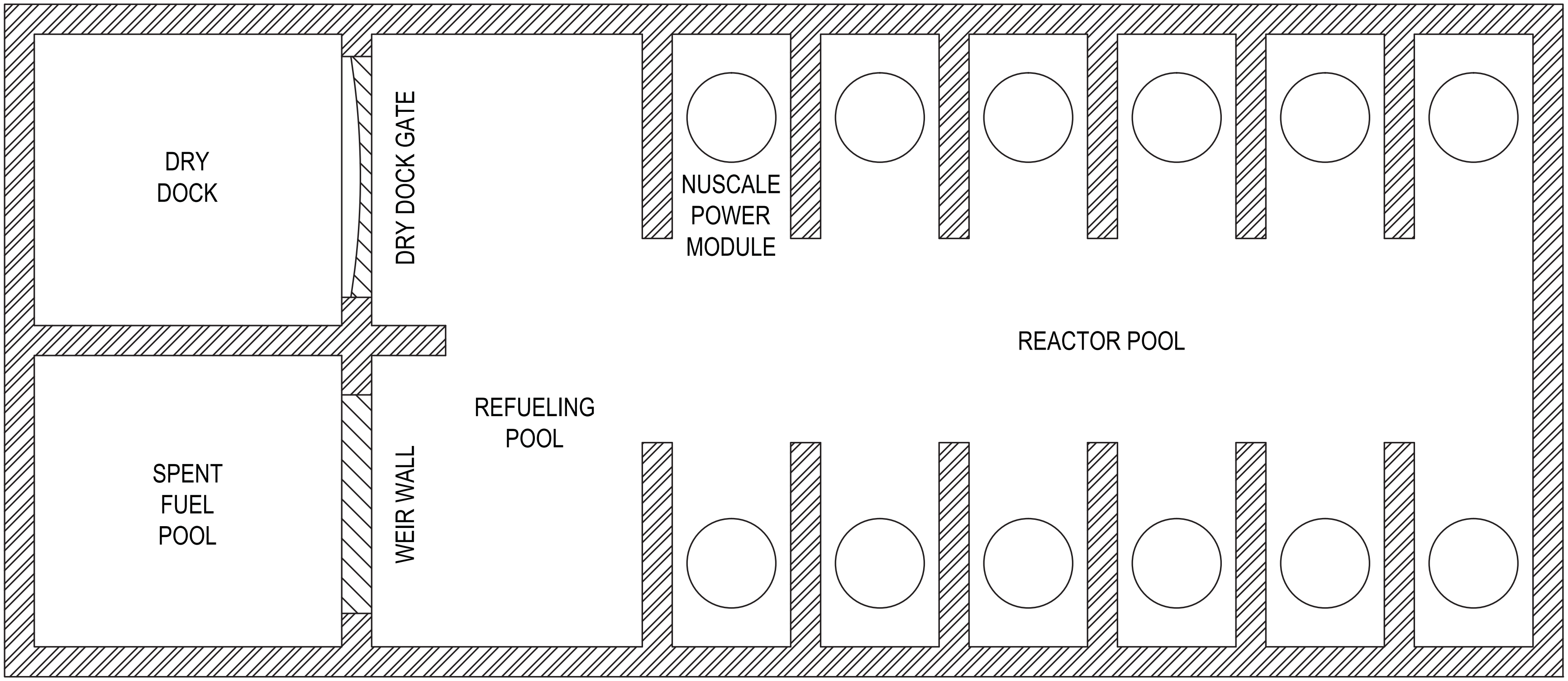
[6] The operational analytical limit for UHS minimum depth for heat removal is 55 ft. The Technical Specification minimum UHS level of 65 ft only credited for establishment of the initial CNV wall temperature assumption in the containment response analysis and is not credited for containment heat removal purposes.

Table 9.2.5-2: Ultimate Heat Sink Heat Loads: Boil Off Evaluation Results

Description	Cumulative Energy (BTU)	Cumulative Time (Days)	Pool Elevation (ft)
Time to UHS boiling	3.72E+09	2.55	68
Boil off to top of DHRS	2.02E+10	40.72	45.82
Boil off to top of SFP weir	3.95E+10	119.23	20.00
Boil off to top of spent fuel rack	4.05E+10	139.26	10.00

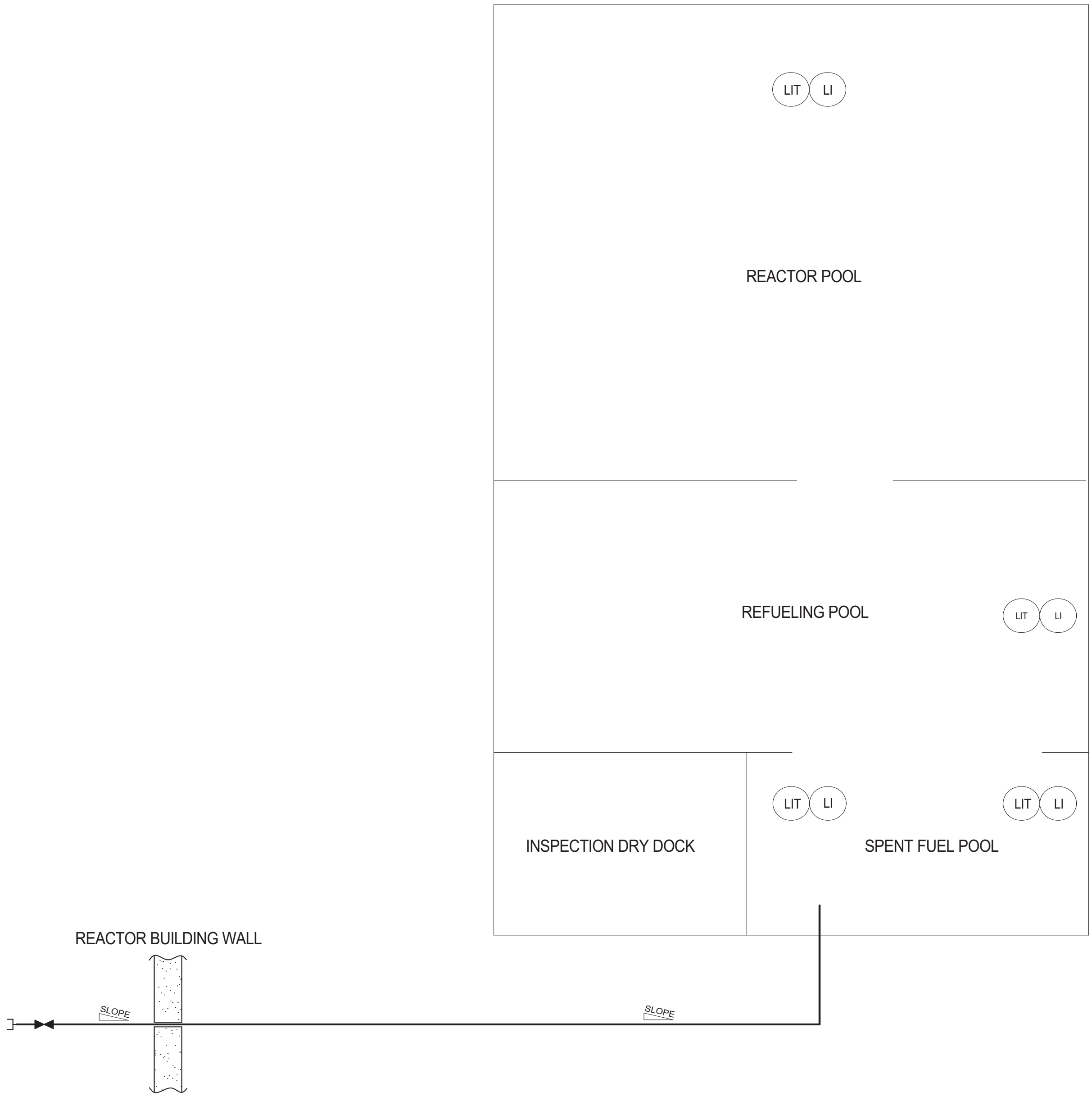
Notes:
Initial conditions and assumptions are described in Section 9.2.5.4

Figure 9.2.5-1: Ultimate Heat Sink Configuration



NOTE: NOT TO SCALE

Figure 9.2.5-2: Ultimate Heat Sink Qualified Makeup Line and Instrumentation Diagram



9.2.6 Condensate Storage Facilities

The design uses a condensate storage tank (CST) to support each NuScale Power Module's condensate and feedwater system. Each CST includes the tank, piping, valves, tank level, instrumentation, vents, drains, and piping connections to the hotwell and from the condensate header. Makeup water is provided automatically from the demineralized water system into the CST. Condenser hotwell makeup water is controlled by the hotwell level control system and provided by gravity flow from the CST. Excess water in the hotwell is controlled by transferring condensate to the CST (see Figure 9.2.6-1).

The CST does not serve a safety function and it does not interface with other systems that could adversely affect safety-related or augmented quality systems. The CST is not an essential source of cooling water to prevent or mitigate the consequences of accidents or to shut down the reactor and maintain it in a safe-shutdown condition. The CST does not provide makeup water to systems that remove heat from the reactor if normal heat removal methods fail or are unavailable.

The CSTs are constructed of stainless steel in accordance with API 620 (Reference 9.2.6-1). Each CST has a capacity of less than 10,000 gallons and is located outside of its Turbine Generator Building. There are no nearby SSC that are important to safety. Therefore, failure of a CST will not result in damage to an SSC that is important to safety.

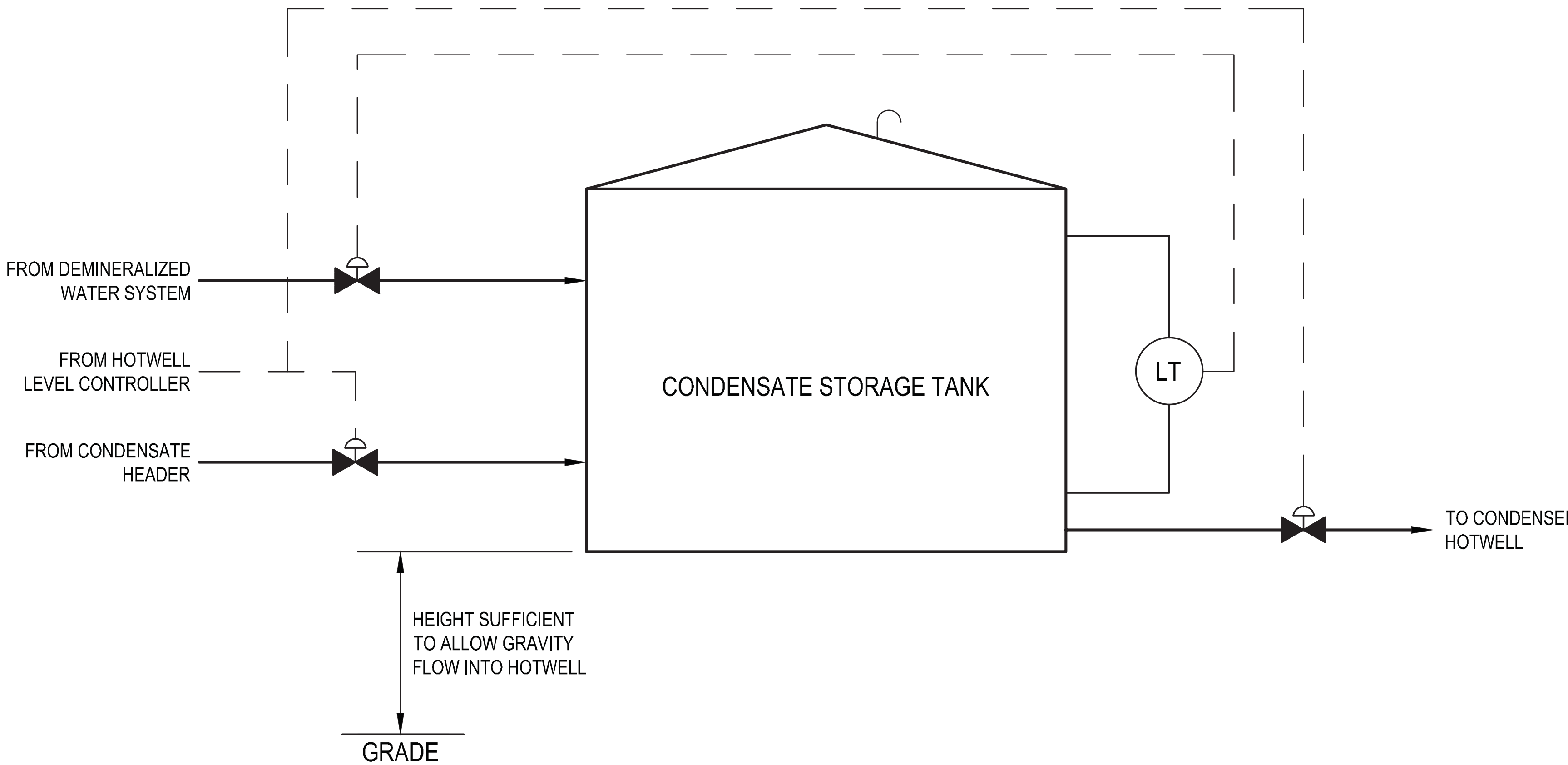
In accordance with Regulatory Guide 1.143, CST instrumentation includes a high level alarm that provides visual or audible indication locally and in the MCR. In addition, a low level alarm is provided. These alarms give an early indication of a potential tank overfill or of a significant tank leak. The condensate storage facility is designed and constructed to permit periodic inspection of piping. These design features assist in minimizing the spread of contamination in accordance with Regulatory Guide 4.21.

The condensate and feedwater system is described in Section 10.4.7.

9.2.6.1 References

9.2.6-1 American Petroleum Institute, "Design and Construction of Large Welded Low Pressure Storage Tanks," API 620, 12th edition, November 2014, Washington, DC.

Figure 9.2.6-1: Condensate Storage Facility



9.2.7 Site Cooling Water System

The principal function of the site cooling water system (SCWS) is to transfer heat from plant auxiliary systems to the SCWS cooling towers, which provide the normal heat sink.

9.2.7.1 Design Bases

This section identifies the SCWS functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The SCWS is not a safety-related or risk-significant system and has no system functions that support engineered safety features. The SCWS is not required to operate during or after a design basis event. No systems cooled by the SCWS are safety-related. The SCWS is capable of providing sufficient cooling water to the interfacing system heat exchangers to support power operation for all expected operating conditions using site characteristics with a one percent annual exceedance.

General Design Criteria (GDC) 2, 4 and 5 were considered in the design of the SCWS. Consistent with GDC 2, the SCWS complies with the requirements of Regulatory Guide 1.29. The portions of the SCWS whose structural failure could adversely affect the function of Seismic Category I structure, systems, and components (SSC) are Seismic Category II. Consistent with GDC 5, there are no safe shutdown functions in the SCWS that are shared between the NuScale Power Modules. See Section 9.2.7.3 for the safety evaluation.

GDC 60 was considered in the design of the SCWS. Consistent with 10 CFR 20.1406, the SCWS is designed to meet the requirements as it relates to minimization of contamination of the facility.

9.2.7.2 System Description

9.2.7.2.1 General Description

The SCWS supplies cooling water for services in all the modules for the entire plant. The SCWS supplies and returns are routed to equipment in the Reactor Building, Central Utility Building, north and south Turbine Generator Buildings, and Auxiliary Boiler Building.

The SCWS provides cooling water to the following plant auxiliary systems:

- condenser air removal system
- chilled water system
- reactor component cooling water system
- reactor pool cooling system
- spent fuel pool cooling system
- auxiliary boiler blowdown cooler

- process sampling system chillers
- condensate and feedwater sample coolers
- main steam sample coolers
- turbine generator heat exchangers, lube oil, and governor
- instrument air compressors and coolers

The major components of the SCWS include the SCWS pumps and associated piping, the cooling tower and associated basin, and traveling screens. Figure 9.2.7-1 shows the SCWS process piping and components. Table 9.2.7-1 provides the SCWS equipment design data.

SCWS Pumps and Piping

[[Three 50-percent capacity vertical wet pit]] pumps take suction from intake bays at the cooling tower and discharge into a network of piping that supplies cooling water to the various services around the plant. Each pump can be isolated to ensure system function, control system leakage, and allow system maintenance. The main SCWS pipe is located below grade.

Cooling Tower and Basin

The cooling tower consists of rectangular banks [[of three cells]]. Each cell includes a motor-driven mechanical draft fan, and isolation valves. The cooling tower is constructed of nonflammable (nonwooden) materials. The cooling tower superstructure and basin are concrete and are designed to ACI 318 (Reference 9.2.7-2) standard.

The cooling towers are located away from Seismic Category I or II structures, and safety-related components. If structural failure of the cooling towers occurred, no Seismic Category I or II structures or safety-related systems or components would be impacted.

[[Traveling Screens

Traveling screens and associated trash rakes are located at the entrance of the individual pump intake bays. The continuously moving screens are designed to filter large particles or debris from the cooling tower basin water, preventing debris from entering the individual pump bays where the SCWS pumps draw suction. Trash rakes are provided to prevent large debris from entering the SCWS pumps.]]

9.2.7.2.2 System Operation

Normal Operations

[[Two 50-percent]] site cooling water pumps are in operation to provide full flow through the SCWS to support operation of up to 12 NuScale Power Modules. The number of cooling tower cells in operation is dependent upon system demand and the ambient wet bulb temperature. Fans are placed in operation as required to obtain the required cold water design temperature. During cold weather, a portion of the SCWS water flow is diverted to freeze-protection spray headers on the cooling tower to de-ice the central cooling tower spray baffles, and a portion of the flow to the cooling tower may be diverted directly to the basin via the bypass valve to maintain system temperature above a desired minimum at partial loads.

Under normal plant operating conditions, environment conditions (e.g., ambient temperature, humidity, radiation, noise) allow personnel access to SCWS equipment for operation, inspection, maintenance, and testing.

[[During system startup or shutdown, SCWS pump motors and cooling tower fans are manually started and stopped. The idle SCWS pump automatically starts upon trip of an active pump. During normal power operation, the standby pump is started automatically on low system pressure.]]

The proper concentration of chemicals is applied to maintain desired pH and biocide concentrations per the SCWS chemistry analysis. Control valves provide for system blowdown to a specified area as necessary to help regulate chemistry.

Off-Normal Operations

The site cooling water system is connected to the plant backup power supply system in case of loss of normal power.

For services in the Reactor Building, there is a potential for radioactive contamination in the SCWS in the event of heat exchanger leakage. Radiation detectors are provided in the SCWS outlet of the reactor pool cooling system heat exchangers, spent fuel pool cooling system heat exchangers and the reactor component cooling water system heat exchangers to detect the presence of radiation in the SCWS.

The SCWS is provided with low system pressure monitoring at various points and with isolation valves so that large leaks which could impact safety-related equipment may be identified and isolated promptly.

System Shutdown

In the event of a plant wide shutdown, the SCWS is not required for safe shutdown of the plant.

[[For shutdown, pumps are shut down in sequence, and equipment and piping may be drained to the cooling tower basin. Headers may be drained or pumped via the supply header bypass line to the cooling tower basin using a portable pump if required.]]

9.2.7.3 Safety Evaluation

The SCWS does not perform safety-related or risk-significant functions. The SCWS does not provide cooling to safety-related or risk-significant components. During normal and off-normal conditions, sufficient redundancy exists to remove heat from the serviced systems.

The SCWS design is consistent with GDC 2. The SCWS is located sufficiently far from Seismic Category I or II structures, or safety-related components. The SCWS is Seismic Category III. A description of the seismic design for SSC is provided in Sections 3.7 and 3.8. Also consistent with GDC 2, since the SCWS serves no safety-related or risk-significant function, failure of SCWS due to the effects of natural phenomena such as tornadoes, hurricanes, floods, and externally generated missiles will not adversely impact safety-related or risk-significant functions.

Consistent with GDC 4, the SCWS is provided with the ability to promptly identify and isolate large leaks which could impact safety-related equipment.

The SCWS design is consistent with GDC 5. The SCWS does not have safety-related or risk-significant functions that are shared between modules. The components in the SCWS that are shared among modules do not impair other systems' ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units. SCWS components can be isolated on failure and do not affect the operation of other units.

The SCWS design is consistent with GDC 60. The SCWS is designed to reduce the potential for radioactive effluent release by maintaining the process fluid at a higher pressure than potentially contaminated interfacing systems. System drains within the isolation boundary are directed to the liquid radwaste system. The SCWS design provides radiation monitoring and sampling to ensure the operators are alerted to abnormal conditions. Component isolation within the SCWS is a manual process and an operator action in response to an abnormal plant condition. Sampling capability is provided within the isolation boundaries of monitored components to confirm alarmed conditions and allow sampling of process fluid prior to maintenance.

The SCWS design satisfies 10 CFR 20.1406 requirements relating to minimization of contamination of the facility. Further discussion of the facility design features to protect against contamination is provided in Section 12.3. The SCWS provides cooling water to the tube side of heat exchangers with systems that contain, or could contain, radioactive material. The SCWS is monitored to detect leakage of radionuclides into the system. Provisions are also provided to safely drain isolated sections of the piping that could possibly become contaminated to the radioactive waste drain.

Fire protection is addressed in Section 9.5. The safety, risk significance, seismic, quality, and other design classifications for the SCWS structures, systems and components is provided in Table 3.2-1. The SCWS is classified as Quality Group D per RG 1.26, Seismic Category III, and is located sufficiently far from Seismic Category I or II structures, or safety-related components to preclude adverse interactions.

9.2.7.4 Inspection and Testing Requirements

The SCWS components are inspected and tested as part of the initial testing and startup program in accordance with Regulatory Guide 1.68 as described in Section 14.2.

SCWS design provides for inservice valve testing and inspection, and components are periodically tested and inspected in accordance with the maintenance program.

Inspection and testing demonstrates effective management of fouling and degradation mechanisms to maintain acceptable system performance and integrity.

COL Item 9.2-4: A COL applicant that references the NuScale Power Plant design certification will provide details on the prevention of long-term corrosion and organic fouling in the site cooling water system.

9.2.7.5 Instrumentation Requirements

Control and monitoring of the common portions of the SCWS water system is performed through the plant control system. Module-specific control and monitoring associated with the individual heat exchangers is performed through the module control system. Instrumentation includes low system pressure at various points in the system so that sudden large leaks which could impact safety-related equipment may be promptly identified. Appropriate alarms and displays are available in the main control room. There are no instruments or controls associated with safety-related functions in the SCWS.

9.2.7.6 References

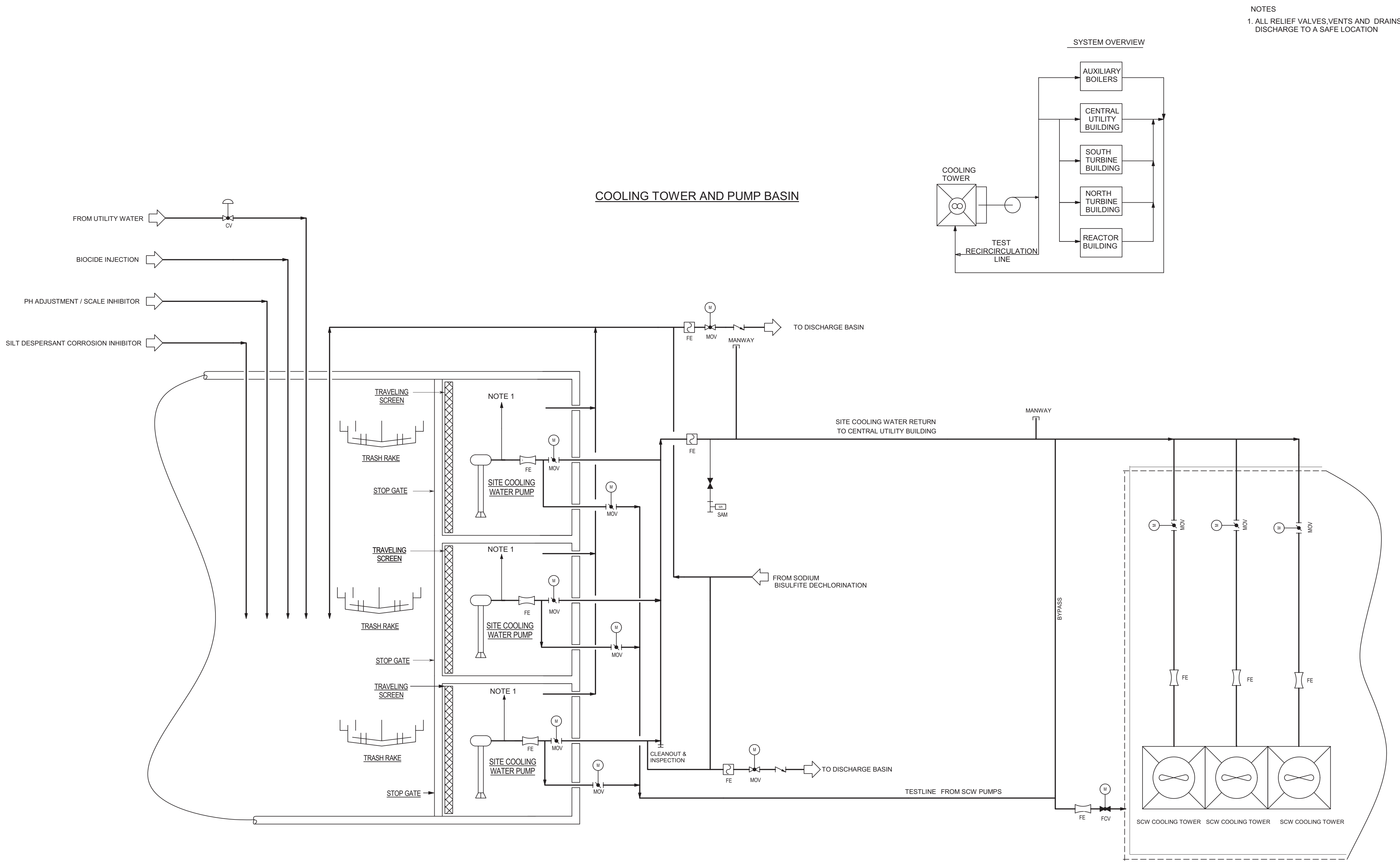
9.2.7-1 Not used.

9.2.7-2 American Concrete Institute, "Building Code Requirements for Structural Concrete," ACI 318, Farmington Hills, MI.

Table 9.2.7-1: Site Cooling Water System Equipment Design Data

Description	Technical Data
Site Cooling Water Pumps	
[[Quantity	3
Type	Vertical wet pit type
Flow rate (max).	24,000 GPM each (50% capacity)
Motor brake horsepower	1500 HP
Cooling Tower - Three Cells (Two Cell Tower plus Spare Cell)	
Type	Mechanical draft, induced
Flow maximum (GPM) over 2 cells	48,000 (design flow plus margin)
Number of cells	3 (2 active)
Fan motor (horsepower)	300 each, three fans required.
One percent annual exceedance non-coincident wet bulb temperature	80 °F
Cold water temperature	90 °F
Travelling Screens with Motors with Trash Rakes	
Flow (GPM)	24,000 each maximum (design flow plus margin)]]

Figure 9.2.7-1: [[Site Cooling Water System Diagram]]



9.2.8 Chilled Water System

The chilled water system (CHWS) is a nonsafety-related closed loop cooling system comprised of two subsystems; a primary system, and a standby system dedicated to the normal control room HVAC system (CRVS).

The purpose of the primary CHWS is to distribute a sufficient quantity of chilled water to the heating, ventilation, and air conditioning (HVAC) equipment chilled water coils, condensers in the liquid radioactive waste system (LRWS), and gas coolers in the gaseous radioactive waste system (GRWS). Specifically, the primary CHWS provides cooling for the normal CRVS, Radioactive Waste Building HVAC system (RWBVS), and Reactor Building HVAC system (RBVS). The CHWS does not directly cool any individual reactor systems.

The purpose of the dedicated standby CHWS for the CRVS (also referred to as the 'CRVS standby CHWS') is to provide a sufficient quantity of chilled water to the CRVS chilled water coils when the nonsafety backup power supply system (BPSS) is activated. The dedicated standby CHWS allows the CRVS to operate on BPSS power without requiring the primary CHWS to be energized.

9.2.8.1 Design Bases

This section identifies the CHWS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The CHWS serves no safety-related functions, is not credited for mitigation of design basis accidents, and has no safe shutdown functions. No structures, systems, or components (SSC) cooled by the CHWS are safety-related. General Design Criteria (GDC) 2, 4, and 5 were considered in the design of the CHWS. The CHWS is not required to function during or after a natural phenomenon event or other events that result in the generation of missiles, pipe whipping, or discharging fluids. Portions of the system that are in proximity to Seismic Category I SSC are designed to Seismic Category II standards. Consistent with GDC 5, the components in the CHWS do not have a safety function or a function for shutting a unit down or maintaining a NPM in a safe shutdown condition. Operation of the CHWS does not interfere with the ability to operate or shut down a unit. The CHWS provides cooling to HVAC systems and to radioactive waste systems, but does not provide cooling to individual nuclear power modules. See Section 9.2.8.3 for the safety evaluation. The safety, risk significance, seismic, quality, and other design classifications for CHWS structures, systems and components are provided in Table 3.2-2.

Consistent with PDC 44, the CHWS is not safety-related and serves no safety-related or risk-significant SSC; therefore, there are no provisions for heat transfer from safety-related SSC under normal and accident conditions. Consistent with GDC 45, the CHWS is not safety-related and does not perform safety-related functions during normal operations, anticipated operational occurrences, and accident conditions; therefore, no specific provisions are included in the design of the CHWS for periodic inspection. Consistent with GDC 46, the CHWS is not safety-related and therefore periodic pressure and functional testing of the system is not required.

The CHWS is designed to be a closed loop, non-radioactive system. The design of the CHWS provides protection against the spread of contamination in accordance with 10 CFR 20.1406(a).

9.2.8.2 System Description

9.2.8.2.1 General Description

Table 9.2.8-1 provides design parameters for the CHWS. Figure 9.2.8-1 show the CHWS process piping and components.

The primary CHWS consists of three 50 percent chillers (two operating, one standby) and three 50 percent pumps (two operating, one standby), all piped in parallel and coupled together. Any of the three chillers can receive flow from any of the three variable speed pumps. The primary CHWS is a variable-primary-flow system. Chilled water flow varies throughout the evaporators of the operating chillers as well as through the HVAC cooling coils.

The CRVS standby chiller does not operate during normal plant conditions. This chiller only operates when the BPSS is activated and the primary CHWS is unavailable to support the CRVS.

The makeup water supply for CHWS is provided by the utility water system (Section 9.2.9).

The primary CHWS chillers are powered from the medium voltage AC electrical distribution system. The low voltage AC electrical distribution system powers the CRVS standby CHWS chiller, valves, pumps, and other CHWS equipment loads. The normal DC power system provides power for instrumentation and control type loads of the CHWS.

The CHWS major components include pumps, chillers, expansion tanks and air separators. The pumps, chillers, expansion tanks and air separators can each be isolated to allow system inspection and maintenance. Under normal plant operating conditions, environmental conditions (ambient temperature, humidity, radiation, noise, etc.) will be such that the CHWS equipment is accessible to personnel for operation, inspection, maintenance, and testing.

The major CHWS components are located in the Central Utility Building and the top level of the Control Building. The CRVS, RWBVS, and RBVS chilled water cooling coils are located in the Control Building, Radioactive Waste Building, and the Reactor Building, respectively.

The CHWS piping and system components are primarily constructed of schedule 40 carbon steel, with copper tubes in the chiller heat exchangers. Piping is designed to meet the requirements of ASME B31.1 (Reference 9.2.8-1).

9.2.8.2.2 Component Description

Chilled Water System Pumps

The primary CHWS is served by three pumps and the CRVS standby CHWS is served by one, stand-alone pump. The CHWS pumps are variable speed electric motor-driven, centrifugal type pumps. The primary pumps are sized for 50 percent of the total CHWS capacity and two are normally operating with one in standby.

Chilled Water System Chillers

The primary CHWS consists of three chillers and the CRVS standby CHWS is served by one, stand-alone chiller.

The primary CHWS chillers are sized for 50 percent of the total CHWS capacity and two are normally operating with one in standby. The primary chillers each consist of an evaporator section, which provides chilled water to the respective HVAC components, and a condenser section cooled by the site cooling water system.

The CRVS standby CHWS chiller provides chilled water to the respective CRVS chilled water coils. Heat is removed via a remote air cooled condensing unit located outdoors. Refrigerant piping interconnects the outdoor remote condensing unit to the indoor evaporator and compressor.

Chilled Water System Expansion Tanks

The CHWS expansion tanks accommodate thermal expansion of water in the system. The tanks also provide adequate net positive suction head for the pumps and reduce water hammer. One expansion tank is provided for the primary CHWS and one expansion tank is provided for the CRVS standby CHWS. Both of the tanks are bladder style tanks, providing system pressurization control with a minimum exposure to air in the system. The expansion tank bladders are removable for inspection or replacement.

Chilled Water System Air Separators

The CHWS air separators are provided to reduce degradation caused by air in the system. The presence of oxygen increases corrosion on pump seals and valves, and increases the chance of corrosion deposits forming on piping components. Furthermore, the formation of gas bubbles causes blocked terminal units, difficulty in balancing system flow, noise, and insufficient pump performance. One of the air separators will serve the primary CHWS and one will serve the CRVS standby CHWS.

9.2.8.2.3 System Operation

Normal Operations

During normal plant operation, the primary CHWS is continuously operating with two-out-of-three chillers and two-out-of-three pumps. The remaining chiller and pump are on standby. Any of the three chillers can receive flow from any of the three pumps. The two operating chillers and two associated pumps will automatically adjust flow and cycle on and off to meet the chilled water demand of the system. The chillers and pumps operate in combination which results in the greatest efficiency for the system. The pumps operate to maintain a target differential pressure at a specific point in the system. A two-way control valve regulates the amount of water passing through the bypass line in response to the chilled water required by the system. At low loads, the bypass control valve delivers the water necessary to maintain the minimum evaporator flow limit of the operating chiller.

In the event of a failure of either operating primary CHWS pump or chiller, the respective pump or chiller on standby will start automatically.

The CRVS standby chiller does not operate under normal plant operations. This chiller is only operated when the auxiliary AC power source portion of the nonsafety BPSS is activated and the primary CHWS is unavailable to support the CRVS. In this case, the CRVS standby chiller and associated pump provide a sufficient quantity of chilled water to the CRVS chilled water coils to meet the demands of the CRVS. Once the site power is restored and the primary CHWS is available, the chilled water demand for the CRVS will transfer from the CRVS standby system back to the primary CHWS.

The CHWS provides water to condensers in the LRWS and gas coolers in the GRWS. Design features prevent radioactive contaminants in the LRWS and GRWS from entering the CHWS:

- The shell side of the LRWS condensers is exhausted by a vacuum pump thus maintaining the LRWS pressure at a vacuum and eliminating any driving force into the CHWS.
- In the GRWS gas coolers, CHWS pressure is higher than GRWS pressure eliminating any driving force into the CHWS.

Off-Normal Operations

Off-normal operations of the CHWS may be caused by system leaks or loss of onsite power. In the event of a system leak, the leakage will be isolated by system valves and maintenance will be carried out to correct the problem.

In the event of loss of onsite power, the BPSS will activate and, in turn, the CRVS standby CHWS will be activated to provide a sufficient quantity of chilled water to the CRVS chilled water coils. The CHWS is not required to operate during or following a design basis accident. If an accident occurs in a NuScale Power Module, the CHWS continues to operate, but is not required to mitigate an event. In the event of a plant wide shutdown, the CHWS is not required for safe shutdown of the plant.

9.2.8.3 Safety Evaluation

The CHWS does not perform safety-related or risk-significant functions. The CHWS does not provide cooling to safety-related or risk-significant components.

Consistent with GDC 2, the portions of the CHWS whose structural failure could adversely affect the function of Seismic Category I SSC or personnel serving a safety-related function are classified as Seismic Category II. All other CHWS equipment is classified as Seismic Category III.

During normal and off-normal conditions, sufficient redundancy exists to remove heat from the serviced systems. During and after an accident, the CHWS is not relied upon to remove heat from safety-related systems.

Consistent with the Regulatory Guide 4.21, Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning, the design of the CHWS and its interfaces with other systems prevents contamination from entering the CHWS.

9.2.8.4 Inspection and Testing Requirements

Preoperational testing will be in accordance with applicable codes and manufacturer recommendations. Refer to Section 14.2 for a description of the preoperational test requirements.

In-service inspections and routine maintenance are specified and performed based on the manufacturer standards and the preventative maintenance schedule of the plant.

9.2.8.5 Instrumentation Requirements

The CHWS is monitored and controlled by the plant control system. Instrumentation is provided to automatically modulate flow and control supply water temperature to meet both chilled water demand for the system and also operate with the pump and chiller in combination which results in the greatest efficiency for the system.

The CHWS also has remote operation capability and instrument indications to operate the system safely during both normal operation and off-normal conditions that would deem the CHWS equipment physically inaccessible to operating personnel. All essential automatically actuated components have the capability to be operated from the main control room and the remote shutdown station.

9.2.8.6 References

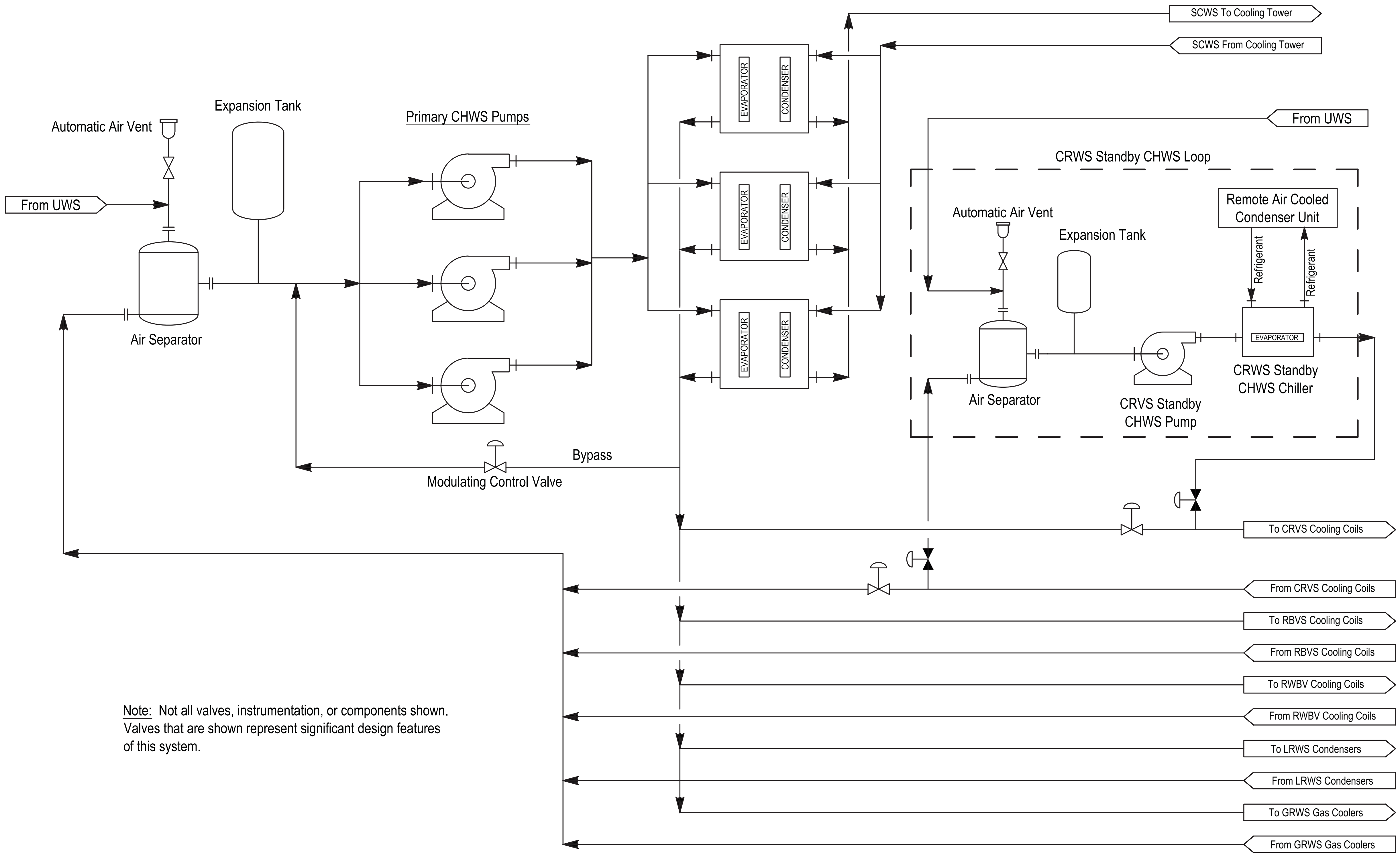
9.2.8-1 American Society of Mechanical Engineers, *Power Piping,* ASME Code for Pressure Piping, B31, ASME B31.1, New York, NY.

Table 9.2.8-1: Chilled Water System Equipment Design Data

Description	Technical Data
Primary Pumps	
Quantity	3
Type	Electric motor-driven, centrifugal
Variable/constant speed	Variable
Duty cycle	50%
Capacity	1500 gpm
Motor horsepower	100 HP
CRVS Standby Pump	
Quantity	1
Type	Electric motor-driven, centrifugal
Variable/constant speed	Variable
Duty cycle	100%
Capacity	200 gpm
Motor horsepower	5 HP
Primary Chillers	
Quantity	3
Type	Water-cooled, centrifugal
Variable/constant speed	Constant
Capacity	1200 tons
Power	750 kW
Evaporator	
Evaporator entering water temperature	56 °F
Evaporator leaving water temperature	40 °F
Evaporator flow rate	1450 gpm
Condenser	
Condenser entering water temperature	90 °F
Condenser leaving water temperature	102 °F
Condenser flow rate	3000 gpm
CRVS Standby Chiller	
Quantity	1
Type	Helical-rotary screw
Variable/constant speed	Variable
Capacity	156 tons
Power	268 kW
Evaporator	
Evaporator entering water temperature	56 °F
Evaporator leaving water temperature	40 °F
Evaporator flow rate	195 gpm
Condenser (See Note)	
Ambient air temperature	115 °F
Number of fans	16 (2 sets of 8)
Total fan power	326 kW
Primary Expansion Tank	
Type	Bladder style
CRVS Standby Tank	
Type	Bladder style
Air Separators	
Velocity	6 ft/s

Note: The remote air cooled condensing unit for the 150 ton standby chiller is located outside.

Figure 9.2.8-1: Chilled Water System Diagram



Note: Not all valves, instrumentation, or components shown. Valves that are shown represent significant design features of this system.

9.2.9 Utility Water Systems

The utility water system (UWS) provides the distribution of clarified water to the fire water tank, demineralized water system, potable water system, reactor building, control building, annex building, radioactive waste building, turbine building, central utility building, and other plant users. The UWS also supplies raw water that has not been clarified to the two circulating water system cooling tower basins and site cooling water system cooling tower basin for makeup water purposes. The water supplied by the UWS does not provide cooling functions. Raw water is the source of water for the UWS.

9.2.9.1 Design Bases

This section identifies the UWS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The UWS serves no safety-related functions, is not credited for mitigation of design basis accidents, and has no safe shutdown functions. General Design Criteria (GDC) 2, 4, and 5 were considered in the design of the UWS. The UWS is not required to function during or after a natural phenomenon event or other events that result in the generation of missiles, pipe whipping, or discharging fluids. Portions of the system that are in proximity to Seismic Category I SSC are designed to Seismic Category II standards. Consistent with GDC 5, there are no safe shutdown functions in the UWS that are shared between NuScale Power Modules.

The utility water system provides the single point liquid effluent release to the environment. GDCs 60 and 64 were considered in the design of the UWS. Compliance with the requirements of GDC 60 is afforded by employing means to control the release of liquid effluent above predetermined limits to the environment through the single point liquid effluent release point by providing the ability to isolate the source of the liquid effluent. Compliance with the requirements of GDC 64 is afforded by providing a liquid effluent radiation monitor for the purpose of monitoring the effluent discharge from the UWS basin during normal operations and anticipated operational occurrences.

Compliance with the requirements of 10 CFR 20.1406 is presented in Section 12.3.

9.2.9.2 System Description

The UWS is comprised of two 100% capacity raw water pumps, two 100% capacity utility water transfer pumps, a single utility water storage tank, a single fire water transfer pump, and three 100% capacity utility water supply pumps. Figure 9.2.9-1 presents a simplified diagram of the UWS. Pumps are specified with separate vent connections unless pump is self-venting. Slow closing check valves are selected for UWS service to minimize water hammer effects. Vents are located in high points in order to ensure that the utility water lines are able to be maintained full. The source of water for the UWS is dictated by the site and as such chemical treatment of the water prior to distribution is predicated upon the chemical composition of the source as well as plant water chemistry requirements.

COL Item 9.2-5: A COL applicant that references the NuScale Power Plant design certification will identify the site-specific water source and provide a water treatment system that is capable of producing water that meets the plant water chemistry requirements.

Above ground UWS piping is lined or coated, or both, carbon steel and designed to ASME B31.1 (Reference 9.2.9-1). Valve material(s) are chosen based upon system service and design conditions. The UWS underground piping is reinforced or pre-stressed, or both, concrete pressure piping and designed to the American Water Works Association standards.

During normal operations, the raw water pumps supply water to the circulating water and site cooling water cooling towers. The utility water transfer pumps operate automatically to keep the utility water storage tank filled. The firewater transfer pump is operated as necessary to provide makeup water to the fire protection system water storage tank. The three utility water supply pumps are used to supply various users. Water from the UWS is used for maintenance activities such as general wash downs in areas including the Reactor Building, the Radioactive Waste Building, and the Turbine Generator Buildings.

In the event of loss of normal AC power, one of the two available raw water pumps can be powered by the auxiliary AC power source in order to maintain the water level in the cooling tower basins.

The UWS is the single point liquid effluent release path to the environment and it is sampled and monitored for radiation. An off-line radiation monitor provides continuous indication of effluent parameters. An alarm is provided in the main control room and the waste management control room via the plant control system when predetermined system thresholds are exceeded. The alarms and indications ensure that operators are alerted to abnormal conditions to allow appropriate mitigating actions. In addition, dilution flow is monitored to ensure sufficient in-plant effluent dilution factors and dilution factors beyond the point of discharge. A flow transmitter provides dilution flow information to the liquid radioactive waste system. The liquid radioactive waste system is isolated when there is inadequate dilution flow to meet necessary dilution factors. Refer to Section 11.5 for a discussion pertaining to radiation monitoring of the UWS discharge and Section 11.2 for a discussion pertaining to liquid effluent release evaluation and characteristics.

9.2.9.3 Safety Evaluation

The UWS serves no safety-related or risk significant functions. It is not credited for mitigation of design basis accidents and has no safe shutdown functions.

The design and layout of the UWS includes provisions that ensure that a failure of the system will not adversely affect the functional performance of safety-related systems or components. The highest quality group classification of the UWS is Quality Group D per RG 1.26 as identified in Table 3.2-1. The UWS is classified as a Seismic Category III system because the system is not required to continue operating after a seismic event, and failure of its SSC will not affect the operability of Seismic Category I SSC or the occupants of the control room.

The GDC 5 was considered in the design of the UWS. The UWS pumps and storage tank are shared by up to 12 Nuclear Power Modules. The UWS has no safety related or risk significant functions, and therefore the UWS has no functions that are impacted if there is an accident in one module coincident with the shutdown and cooldown of the remaining modules.

The design of the UWS satisfies GDC 60 and GDC 64 with provisions to control and monitor the release of radioactive liquid effluent to the environment through the single point liquid effluent release point. An off-line radiation monitor with capability to take samples that are representative of the liquid effluent stream is located in the discharge line to the environment. Any radiation detected in the single point liquid effluent by the off-line radiation monitor is indicative of an abnormal occurrence and operators are responsible for taking appropriate mitigating action. The supply portion of the UWS piping is not interconnected with other system piping that conveys radioactive materials. The collection portion of the UWS is comprised of the discharge basin which is where potentially radioactive effluent is mixed with non-radioactive effluent prior to discharge to the environment.

The UWS is designed consistent with the requirements of 10 CFR 20.1406 to minimize contamination of the facility by employing the design provisions described above for preventing radiological contamination of the UWS.

9.2.9.4 Inspection and Testing Requirements

Preoperational and startup testing of the UWS is performed in accordance with the information presented in Section 14.2.

In-service inspections and testing are specified and performed based on the applicable codes, manufacturing standards and vendor requirements. Maintenance and periodic testing are conducted to verify that system components, instrumentation, and controls, are functioning properly.

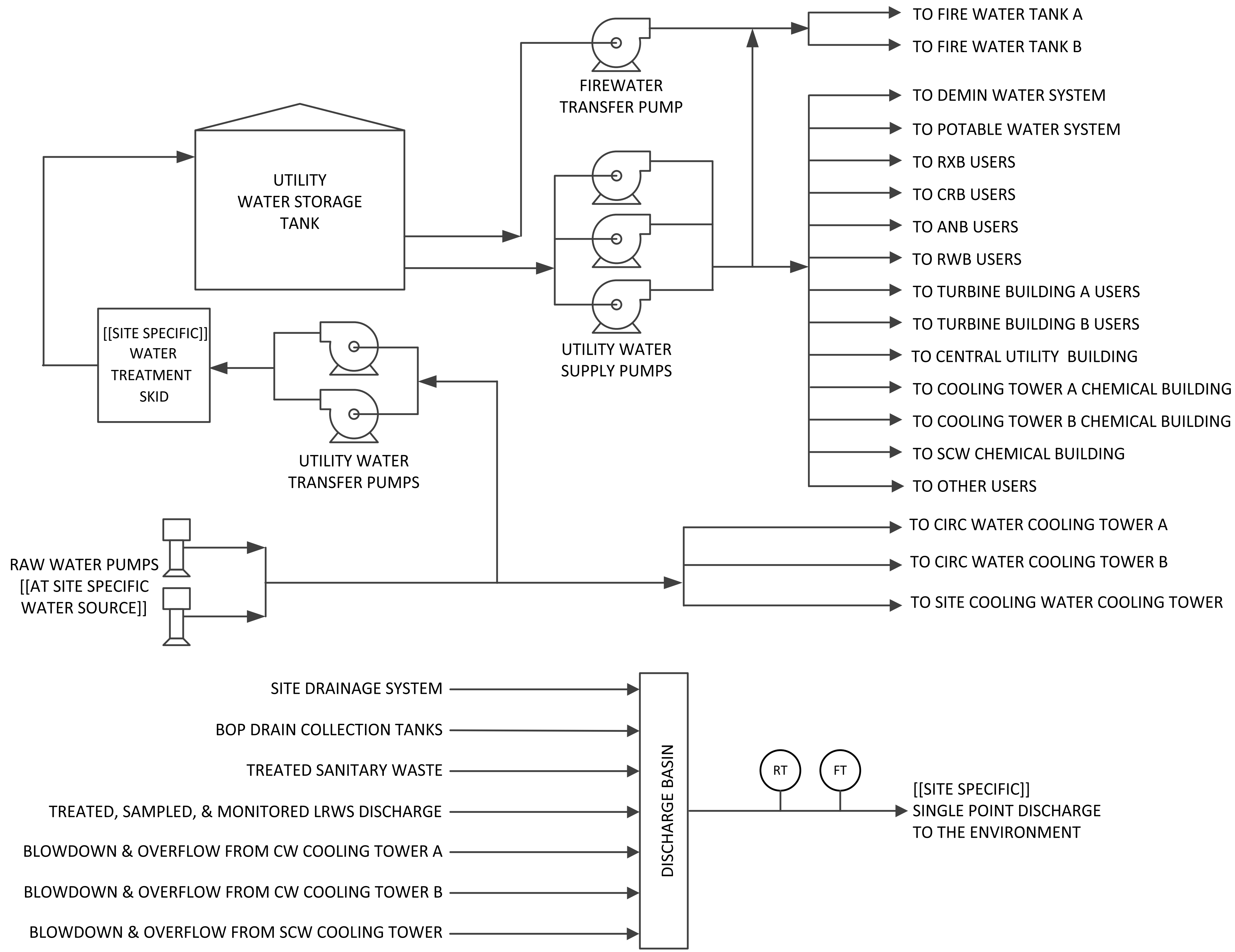
9.2.9.5 Instrumentation Requirements

Instrumentation providing information such as valve position, pump discharge pressure, pump flow, tank level, effluent discharge flow, and effluent radiation level are located at various points in the system. UWS equipment and instruments are monitored and controlled by the plant control system. Instrumentation is available for monitoring UWS operation in the main control room.

9.2.9.6 References

9.2.9-1 American Society of Mechanical Engineers, *Power Piping,* ASME Code for Pressure Piping, B31, ASME B31.1, New York, NY.

Figure 9.2.9-1: Utility Water System Diagram



9.3 Process Auxiliaries

9.3.1 Compressed Air Systems

The compressed air systems (CASs) includes the instrument air system (IAS), service air system (SAS) and the nitrogen distribution system (NDS).

The primary function of the IAS is to supply and distribute dry, filtered, oil-free compressed air to valve operators located throughout the plant and to the SAS.

The primary function of the SAS is to provide dry, filtered, oil-free compressed air for pneumatically-powered tools, operating equipment, various miscellaneous loads for maintenance and testing purposes, as well as for supporting the operation of radioactive waste processing equipment and containment draining following refueling outages.

The primary function of the NDS is to provide clean, pressure-regulated nitrogen gas for blanketing, purging, diluting, inerting, and pressurizing various plant systems and components.

9.3.1.1 Design Bases

This section identifies the CAS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The CASs do not perform safety-related functions nor do they provide compressed air or nitrogen to actuate or control equipment that requires supplied compressed air or nitrogen to perform safety-related functions during normal operations, transients, or accidents. Refer to Section 3.2 for more information on the classification of structures, systems, and components (SSC) associated with the CAS.

General Design Criteria (GDC) 2 was considered in the design of the CAS. Those portions of the CAS in which failure due to a safe shutdown earthquake could reduce the functioning of a Seismic Category I SSC to an unacceptable safety level or could result in incapacitating injury to occupants of the control room are designed and constructed to preclude such failure. These SSC are classified as Seismic Category II per Section 3.2.1.2 and meet the design guidance of Regulatory Guide 1.29 to ensure that there are no deleterious interactions with a Seismic Category I SSC.

General Design Criterion 4 was considered in the design of the CAS. Those portions of the CAS in which failure due to environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents could reduce the functioning of safety-related or risk significant plant feature to an unacceptable safety level or could result in incapacitating injury to occupants of the control room are designed and constructed to preclude such failure. These SSC are protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.

General Design Criterion 5 was considered in the design of the CAS. Even though the CAS is a shared system, an event in one NuScale Power Module (NPM) will not affect the ability of the CAS to support the unaffected NPMs.

Design of the IAS is based on compliance with the criteria specified in ANSI/ISA S7.3-R1981 (Reference 9.3.1-1) related to minimum instrument air quality standards. Moisture separators and dryer packages are specified to ensure that the instrument air supplied is dry in accordance with the quality standards of Reference 9.3.1-1.

The NuScale Power Plant design is a passive design. No compressed air is required for loss of offsite power or station blackout to achieve safe shutdown, including the closing of containment isolation valves. The IAS does not support safety-related functions pertaining to provision of compressed air to actuate or control equipment necessary for core cooling and decay heat removal or maintaining containment integrity following station blackout. See Section 8.4 for the blackout coping analysis (10 CFR 50.63).

9.3.1.2 System Description

9.3.1.2.1 General Description

Instrument Air System

The IAS is composed of the compressed air supply subsystem, the dryer subsystem, and the distribution subsystem. The IAS is composed of three 50-percent capacity trains. Two trains are normally in operation for 100 percent capacity and the third train serves as a backup. Each train is interconnected to the other to support the availability and reliability of the IAS. The primary function of the IAS is to supply and distribute dry, filtered, oil-free compressed air to air-operated valves throughout the plant and to the SAS during all modes of plant operation. The IAS is located in the Central Utilities Building. Figure 9.3.1-1 provides a flow diagram of the IAS and SAS.

Compressed Air Supply Subsystem

The compressed air supply subsystem is composed of the intake air filters, compressors, intercoolers, aftercoolers, moisture separators, air receivers, and associated piping and valves.

Air at atmospheric conditions is drawn through the intake air filters. The intake air filters remove particulates and other contaminants prior to the air entering the compressors. The air is compressed, which increases the temperature of the air. The hot air passes through the intercoolers to reduce the temperature and volume to be compressed in succeeding stages, liquefy condensable vapors, and save power. The air then flows to the aftercoolers where cooling and condensation take place. The air enters the moisture separators for final water removal before going to the air receivers for storage and pressure surge buffer.

Dryer Subsystem

The compressed air flows from the air receivers to the dryer subsystem for treatment. The dryer subsystem contains pre-filters, air dryers, after-filters, and instrumentation and controls. The purpose of the dryer subsystem is to remove remaining entrained moisture present in the air stream to ensure the air quality standards of Reference 9.3.1-1 are achieved.

Distribution Subsystem

The distribution subsystem consists of piping and valves for delivery of dried, clean, oil-free compressed air to the end users. The distribution piping is stainless steel.

Service Air System

The SAS configuration is composed of the accumulator and the distribution header. The primary function of the SAS is to provide dry, filtered, oil-free compressed air for pneumatic-powered tools, operating equipment, and various loads for maintenance and testing purposes, as well as for supporting the operation of mobile radwaste processing equipment. In addition, the SAS supports the containment evacuation system by providing air to the vacuum pumps for the purging operation as described in Section 9.3.6.2.1. The IAS supplies the SAS with dry, filtered, oil-free compressed air. The SAS is located in the Central Utilities Building. The SAS delivers air to ring headers located in the Turbine Generator Building, Radioactive Waste Building, Reactor Building, and Annex Building. The SAS end users receive air from branch lines that tie into the ring header. Figure 9.3.1-1 provides a flow diagram of the SAS.

Nitrogen Distribution System

The primary function of the NDS is to provide a continuous supply of high purity nitrogen for the NPM. A flow diagram of the NDS is depicted on Figure 9.3.1-2.

The NDS is composed of a bulk liquid nitrogen storage system connected to the NDS distribution header and consists of a storage tank, vaporizer, and control manifold. The bulk liquid nitrogen system is designed, fabricated, installed and secured in accordance with NFPA 55, Chapter 8 (Reference 9.3.1-2).

The NDS distribution header consists of two reducing stations associated piping, and valves segregated for high pressure and low pressure distribution of nitrogen gas to various end users throughout the plant. The gas pressure can be further reduced at each end-user system, as required.

A list of major CAS components and associated design parameter values is provided in Table 9.3.1-1.

9.3.1.2.2 Component Description

Instrument Air System Intake Air Filters

The intake air filters remove dust and dirt particles from the air intake to prevent damage and wear to the compressor parts. Fine, dry-type filters equipped with pressure drop monitoring devices are used for greater filtering efficiency.

Instrument Air System Compressors

The compressors are oil-free, rotary-screw compressors. The compressor is an electric-motor driven, continuous-duty, two-stage rotary compressor. It is a self-contained air compressor package, pre-piped, wired, and base-plate mounted.

Instrument Air System Intercoolers and Aftercoolers

The water-cooled intercoolers reduce the air temperature before it enters the next stage to reduce the work of compression and to increase efficiency. The primary function of the water-cooled aftercoolers is to remove water vapor rather than to lower the temperature of the compressed-air stream.

Instrument Air System Moisture Separators

Because large amounts of water are typically removed from the air in an aftercooler, moisture separators function to remove additional moisture in the air stream between the aftercoolers and the air receivers. Automatic drain traps are piped to the moisture separators to remove the separated moisture.

Instrument Air System Air Receivers

The IAS air receivers serve as storage to reduce the impact of sudden pressure changes during peak periods, thereby preventing frequent compressor loading and unloading. Each air receiver is sized to provide approximately a ten minute supply of air to the appropriate common header during a compressor shutdown scenario. The receivers are equipped with automatic drain traps and blowdown valves to drain condensate produced from cooling the air in the tanks.

Instrument Air System Pre-filters and After-Filters

The pre-filters are installed upstream of the dryers to protect the dryers from moisture and hydrocarbons which will damage the desiccant. The after-filters are installed downstream of the dryers to remove particulates in accordance with quality standards for distribution.

Instrument Air System Dryers

The dryers are regenerative heatless twin-drying towers comprised of American Society of Mechanical Engineers code welded pressure vessels and desiccant. The dryers have automatic cycling capability controlled by an electronic controller.

Airflow is directed through alternate drying vessels by pneumatically operated valves.

Service Air System Accumulator

The SAS accumulator buffers the system from high demand due to the large intermittent loads for the Reactor Building, such as draining the containment vessel using the containment evacuation system and the containment flooding and drain system.

Service Air System Distribution Header

The SAS distribution header is composed of stainless steel piping and associated valves. The end-user header is equipped with a reducing station to supply service air at a lower pressure to the end users. The air pressure can be further reduced at each end-user system, as required.

Bulk Liquid Nitrogen Storage Tanks

The tanks are designed for cryogenic liquids and are designed as a tank within a tank. The inner vessel contains the product and is American Society of Mechanical Engineers coded. The tank is stainless steel or functional equivalent. The annular space between the inner and outer vessels is insulated and under vacuum to minimize heat transfer to the stored product.

The tank is equipped with a pressure relief system consisting of an active and a reserve pressure relief path for redundancy. The pressure relief valve opens at the tank maximum allowable working pressure and safely vents gas to the atmosphere. The pressure relief valve closes after relieving excess pressure.

Vaporizer

The vaporizers are plate-type heat exchangers which exchange heat with ambient air, thereby requiring no external power. These ambient air vaporizers are arrays of many-finned aluminum tubes arranged to provide the required flow requirements. The vaporizers are sized to match NDS requirements to prevent low-temperature gas from entering the distribution header.

Control Manifold

The control manifold is designed to prevent over-pressure and low temperature hazards. The control manifold includes a pressure-reducing station to reduce pressure.

9.3.1.2.3 System Operation

Instrument Air System Normal Operations

The IAS is normally in operation. Any of the three available compressors can be started with a selector switch mounted locally or from the control room. Two compressors are in the primary mode with their respective train isolation valves open. The compressor in the standby train is started to pressurize its air receiver. Once the receiver is pressurized, the train isolation valve is closed and the compressor is placed in standby mode. The IAS operates continuously during all modes of plant operation. The IAS is normally left in service during a plant shutdown.

Instrument Air System Off-Normal Operations

If an equipment high differential pressure, high dew point or low header pressure is detected, the standby train isolation valve will open, placing the standby train in service. The train with the originating trouble signal will stop. Standby train changeover is quick enough to prevent pressure transients in the system and the air receivers provide additional attenuation of the transient.

Activation of the low-low pressure signal in the IAS distribution header, or trip of an operating compressor without an immediate automatic start of the standby compressor, causes the service air supply function of the IAS to isolate by closing the affected train isolation valve, to maintain air pressure for the rest of the IAS. This control is performed through the plant control system (PCS) and the condition is alarmed in the main control room. The air receivers contain an adequate supply of air without compressor operation to maintain the IAS in an operable condition until the standby compressor starts.

Service Air System Normal Operations

During normal operation all portions of the SAS are pressurized. Portions of the SAS may be isolated for maintenance. The SAS remains in operation during all modes of plant operation, including outages. The system is normally left in service during plant shutdown.

Service Air System Off-Normal Operations

The SAS has the capability to be isolated from the IAS in the event of IAS pressure transients. The SAS has an accumulator sized to provide a 10-minute supply of air during periods when the SAS is isolated from the IAS.

Nitrogen Distribution System Normal Operations

During normal plant operations, the NDS supplies nitrogen to the chemical analysis lab, the liquid radioactive waste system degasifiers, the containment evacuation system, and the gaseous radioactive waste system charcoal guard beds and absorber tanks. The CVCS is supplied with nitrogen for pressurization of the reactor pressure vessel during startup and shutdown operations. The main steam system is supplied with nitrogen during refueling or when a NPM is in shutdown.

From the storage tanks, liquid nitrogen is transferred to the vaporizer where it is converted to gas. The gas is pressure-regulated to 250 psig in the first reducing station and to 100 psig in the second reducing station (within the NDS low-pressure header).

Nitrogen at 250 psig is delivered through the high-pressure header where the pressure is regulated with a pressure-control valve to meet the end user requirements. This pressure-control valve is located in the high-pressure header before it branches off to the NPM.

Nitrogen at 100 psig is delivered to the rest of the users through the low-pressure header. Pressure is further reduced as necessary, by the end users, by the use of pressure regulators or pressure-control valves.

Nitrogen Distribution System Off-Normal Operations

The NDS is equipped with pressure-relief valves, and pressure building and economizer circuits that automatically activate in the event of system or component failures. The system is equipped with low-temperature monitoring and a shut-off valve to protect the NDS distribution header from cryogenic liquid in the event of vaporizer failure. The shut-off valve activates and isolates the cryogenic liquid supply when low temperature is detected. The system contains dual low-temperature protection systems in series for redundancy.

The first reducing station contains pressure-relief valves to ensure protection of the system during all modes of operation.

The second reducing station is equipped with redundant pressure regulators, a high-flow and low-flow switch, a high-pressure switch, and a relief valve.

In the event the regulator fails open, the corresponding relief valve opens to protect the system.

In the event the regulator fails closed, the other pressure regulator continues to maintain system pressure.

9.3.1.3 Safety Evaluation

The compressed air system, which is composed of the instrument air, service air, and nitrogen distribution systems, is nonsafety-related, nonrisk-significant and not required to perform a safety-related function. The CAS does not support safety-related pneumatic components nor does it provide compressed air required to actuate or control equipment that performs safety-related functions during normal operations, transients, or accidents.

The CAS is designed, fabricated, and tested to quality standards commensurate with its nonsafety-related design functions. Design of the IAS is based on compliance with the criteria specified in Reference 9.3.1-1 related to minimum instrument air quality standards.

Moisture separators and dryer packages are specified to ensure that the instrument air supplied is dry in accordance with the quality standards of Reference 9.3.1-1. To maintain air quality that consistently meets Reference 9.3.1-1 dew point criteria, a heatless regenerative dryer is utilized in the IAS. IAS and SAS after-filter effluent used to support plant operations meets the 3 micron maximum particulate size limit as specified in Reference 9.3.1-1.

If an outside air source or temporary air source is used to supply compressed air to the IAS or SAS, the air quality will meet the minimum requirements specified for the IAS and compliance with Reference 9.3.1-1 is maintained.

General Design Criterion 2 was considered in the design of the CAS. Those SSC for which continued function is not required, but for which failure due to natural phenomena such as earthquake, tornadoes, hurricanes, floods, tsunami, and seiches could reduce the functioning of a safety-related or risk-significant plant feature to an unacceptable safety level or could result in incapacitating injury to occupants of the main control room are designed and constructed to preclude such failure. The CAS is designed as Seismic Category III; however, where a component in the CAS could adversely interact with a Seismic Category I SSC because of a safe shutdown earthquake, the CAS component is designed as Seismic Category II in accordance with Section 3.2.1.2 and the guidance in Regulatory Guide 1.29.

General Design Criterion 4 was considered in the design of the CAS. Those portions of SSC for which continued function is not required, but for which failure due to environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents could reduce the functioning of a safety-related or risk-significant plant feature to an unacceptable safety level or could result in incapacitating injury to occupants of the main control room, are designed and constructed to preclude such failure. These SSC are appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit. Internally-generated missile protection is discussed in Section 3.5. Seismic criteria and analysis are discussed in Section 3.7.

General Design Criterion 5 was considered in the design of the CAS. The CAS is designed such that there is no compromise of the ability of systems and components to perform their safety-related functions for each unit regardless of CAS equipment failures or other events that may occur in other units. Unacceptable effects of equipment failures or other events occurring in the NPM will not propagate to unaffected units.

The IAS is shared by up to twelve NPMs. The instrument air subsystem is composed of three 50-percent trains to ensure system availability. Two trains are available to provide 100 percent combined capacity, and the third train is in standby serving as a backup to support air supply needs in the event of abnormal or maintenance evolutions. Each IAS air receiver is sized for a capacity based on a 10-minute supply of air to the appropriate common header during a compressor shutdown scenario. Each train is interconnected to the other to support the availability and reliability of the IAS.

Each compressor train is powered from a separate electrical supply bus and can be started or stopped from its local control panel. In the event of loss of normal AC power, instrument air compressors can be powered by the auxiliary AC power source.

The IAS is designed to be manually cross-connected between the compressors. The compressors are interconnected to support availability in the event of failure or maintenance of a compressor. Manual cross-connects between compressor and process components across trains are not necessary for the IAS design.

The SAS provides compressed air that is shared by up to 12 NPMs; however, it is a nonsafety-related system which is not required for equipment to perform safety-related functions during normal operations, transients, or accidents. The SAS does not compromise the ability of systems and components to perform safety-related functions for the unaffected units.

The NDS is a nonsafety-related, Seismic Category III bulk liquid nitrogen storage and distribution system. The primary function of the NDS is to provide a continuous supply of nitrogen to the NPM. Nitrogen gas is used for purging, blanketing, inerting, and pressurizing various plant systems and components. The NDS interfaces with the CVCS which has components that perform a safety-related and risk-significant function. Where the NDS could adversely affect a Seismic Category I SSC in the chemical and volume control system because of a safe shutdown earthquake, the NDS is designed to be seismically supported in order to preclude such an interaction.

In addition, the NDS is equipped with pressure-relief valves, and pressure-building and economizer circuits that automatically activate in the event of system or component failures. The system is equipped with a low-temperature monitoring system and shut-off valve to protect the NDS distribution header from cryogenic liquid in the event of vaporizer failure. The shut-off valve activates and isolates the cryogenic liquid supply when low temperature is detected. The NDS contains dual low-temperature protection systems in series for redundancy.

No compressed air is required for loss of offsite power or station blackout to achieve safe shutdown, including the closing of containment isolation valves. The CAS does not support safety-related functions pertaining to maintaining the ability to actuate or control equipment necessary for core cooling and decay heat removal or maintaining containment integrity following station blackout. Refer to Section 8.4 for the station blackout coping analysis (10 CFR 50.63).

The IAS and SAS provide air and the NDS provides nitrogen in support of radioactive waste management system operations. The radioactive waste management systems are equipped with double isolation valves where they interface with the CAS to preclude contamination. Where there is a risk of high radiation at system interfaces, shielding, pipe and valve galleries or labyrinth pathways are incorporated into pipe routes and layouts, as needed. "As low as reasonably achievable" design reviews are performed to determine the need for shielding where necessary.

The IAS provides compressed air to the fire protection system for operation of pneumatically-actuated valves. Each compressor train is powered from a separate electrical supply bus. In the event of an electrical bus failure, trains of the IAS are designed to be manually cross-connected between the compressors. The NDS is used in support of fire protection of the gaseous radioactive waste system charcoal guard beds.

9.3.1.4 Inspection and Testing

The IAS piping is visually inspected for pressure boundary integrity. The SAS can be visually inspected, is tested for operability during normal use, and can be tested periodically at connections for pneumatic tools. Compressor gauges, pressure indicators, and temperature indicators are provided for periodic testing. Other compressor testing requirements for operability are per manufacturer's recommendations. Dew point monitors, automatic drain valves and traps, filter differential-pressure sensors and system-pressure sensors are provided for periodic testing of the system.

Maintenance of the IAS ensures air cleanliness which meets the requirements of Reference 9.3.1-1. Sampling points are located before and after each dryer subassembly to maintain compliance with the standard. Dew point monitors, automatic drain valves and traps, filter differential-pressure sensors and system-pressure sensors are provided for periodic testing of the system. Valves in the line supplying the SAS allow for isolating portions of the system for maintenance.

The NDS is inspected and tested in accordance with ASME B31.1 (Reference 9.3.1-3) for piping and valves.

9.3.1.5 Instrumentation and Control

Instrumentation

The IAS instrumentation provides the necessary inputs for control, operation, and performance status monitoring of the system. The compressor package includes a local control panel that provides annunciation for alarm conditions.

Each air dryer is equipped with a dew point monitor that provides local indication of air dryer performance and a standard analog output signal for PCS monitoring. The PCS monitors a general trouble alarm from each air dryer. If an equipment high differential pressure, high dew point or low header pressure is detected, the isolation valve on the standby train will open, placing the standby filter dryer train and its associated standby compressor in service.

The IAS provides inputs to the PCS for air receiver pressure and temperature in each train, common air header pressure and temperature, moisture content at the outlet of each train, and air filter differential pressure in each train. Instrumentation is provided to measure air flow to the IAS end users. Valve position is provided for valves under PCS control.

For the NDS, pressure indication is provided on the bulk liquid nitrogen storage tanks, on the pressure-reducing station between the vaporizers and the connection point to the NDS distribution header, and on the NDS low-pressure distribution header.

Pressure indication is provided to measure the pressure in the tank and to verify pressure supplied to the NDS is at the desired level.

Flow indication is provided on the NDS distribution header to ensure system flowrate requirements are met.

Temperature indication is provided downstream of the vaporizer to ensure no liquid nitrogen enters the NDS distribution header.

Tank level indication is provided for the bulk liquid nitrogen storage tanks. The tanks are the main source of nitrogen storage for the NDS.

Control

Local control of the air compressor is provided by a local control panel mounted on the compressor package. The type of capacity control is a variable speed control. Automatic start of the backup compressor is required to maintain system pressure under conditions of high demand such as a leak, blowoff valve malfunction, operation of an intermittent demand, low receiver pressure or low header pressure. This prevents a loss in system pressure which could cause pneumatic actuators to go to their fail safe position.

The compressor control interface provides the capability to start and stop each IAS compressor from the main control room via the PCS. Each compressor has the option of primary or standby mode where two compressors supplying the system are in primary mode and the third compressor is in standby mode starting only during system pressure loss or other initiating event. A second configuration has the compressors switch primary and standby assignments automatically based on predetermined parameters such as run time. In either configuration, the compressor selected as the primary compressor will run continuously in the modulate operating mode. The other compressor will remain in standby, in the unloaded operating mode unless service is required to support the primary compressor.

In the modulate operating mode, receiver pressure is maintained constant by the local compressor controls changing motor speed. The standby compressor controls are in automatic thereby enabling it to be started and stopped by a pressure signal from the air receiver if the primary compressor is running but cannot maintain adequate pressure. Each compressor can be started or stopped from its local control panel independent of the PCS.

For the NDS, controls are provided that allow for the automatic response to low-pressure and high-pressure alarms as well as low temperature, flow rate and tank level. Automatically operated valves are normally actuated from the main control room via the PCS, but are designed with the capability of local manual operation.

9.3.1.6 References

9.3.1-1 American National Standards Institute/Instrument Society of America, ANSI/ISA-S7.3-1976, Reaffirmed 1981, "Quality Standard for Instrument Air."

9.3.1-2 National Fire Protection Association, “Compressed Gases and Cryogenic Fluids Code,” NFPA 55, 2013 Edition, Washington, D.C.

9.3.1-3 American Society of Mechanical Engineers, *Power Piping*, ASME Code for Pressure Piping, B31, ASME B31.1, New York, NY.

Table 9.3.1-1: Major Instrument Air System, Service Air System, and Nitrogen Distribution System Components and Design Parameters

Component Description	Design Parameter	Value
IAS Compressors		
	Quantity	3
	Type	rotary, screw
	Capacity, each (SCFM)	825
	Capacity, each (horsepower)	250
	Design pressure (psig)	200
	Design temperature	150°F
	Heat exchangers - water cooled	shell and tube
IAS Air Receivers		
	Quantity	3
	Type	vertical, cylindrical
	Capacity, each (cu ft)	2,350 for ten minutes
	Design pressure (psig)	200
	Code	ASME BPVC Section VIII, Division 1
	Material	carbon steel, painted
IAS Pre-filters		
	Quantity	3
	Type	Coalescing
IAS Dryers		
	Quantity	3
	Type	Heatless desiccant/regenerative
	Capacity, each (SCFM)	825
	Operating dew point (°F)	-40
	Code	ASME BPVC Section VIII, Division 1
IAS After-Filters		
	Quantity	3
	Type	Centrifugal
	Maximum operating pressure (psig)	150
	Design temperature (°F)	150
	Filtration particle size	3 microns maximum
IAS Moisture Separators		
	Quantity	3
	Type	Centrifugal
	Design pressure (psig)	200
	Design temperature (°F)	150
SAS Accumulator		
	Quantity	1
	Type	vertical, cylindrical
	Capacity, each (cu ft)	830
	Design pressure (psig)	200
	Design temperature (°F)	150
	Code	ASME BPVC Section VIII, Division 1
	Material	carbon steel, painted
Cryogenic Tank		
	Type	Vertical, Cylindrical
	Maximum allowable working pressure	500 psig
	Maximum operating pressure	450 psig
	Capacity (each tank)	67,000 SCF
	Quantity	Four (4)

Table 9.3.1-1: Major Instrument Air System, Service Air System, and Nitrogen Distribution System Components and Design Parameters (Continued)

Component Description	Design Parameter	Value
	Material	Stainless steel
	Code	ASME Section VIII, Division 1
Vaporizer		
	Type	Vertical, Plate Heat Exchanger
	Heat source	Ambient
	Design pressure	500 psig
	Material	Aluminum
	Code	ASME Section VIII, Division 1

Figure 9.3.1-1: Instrument Air and Service Air System Diagram

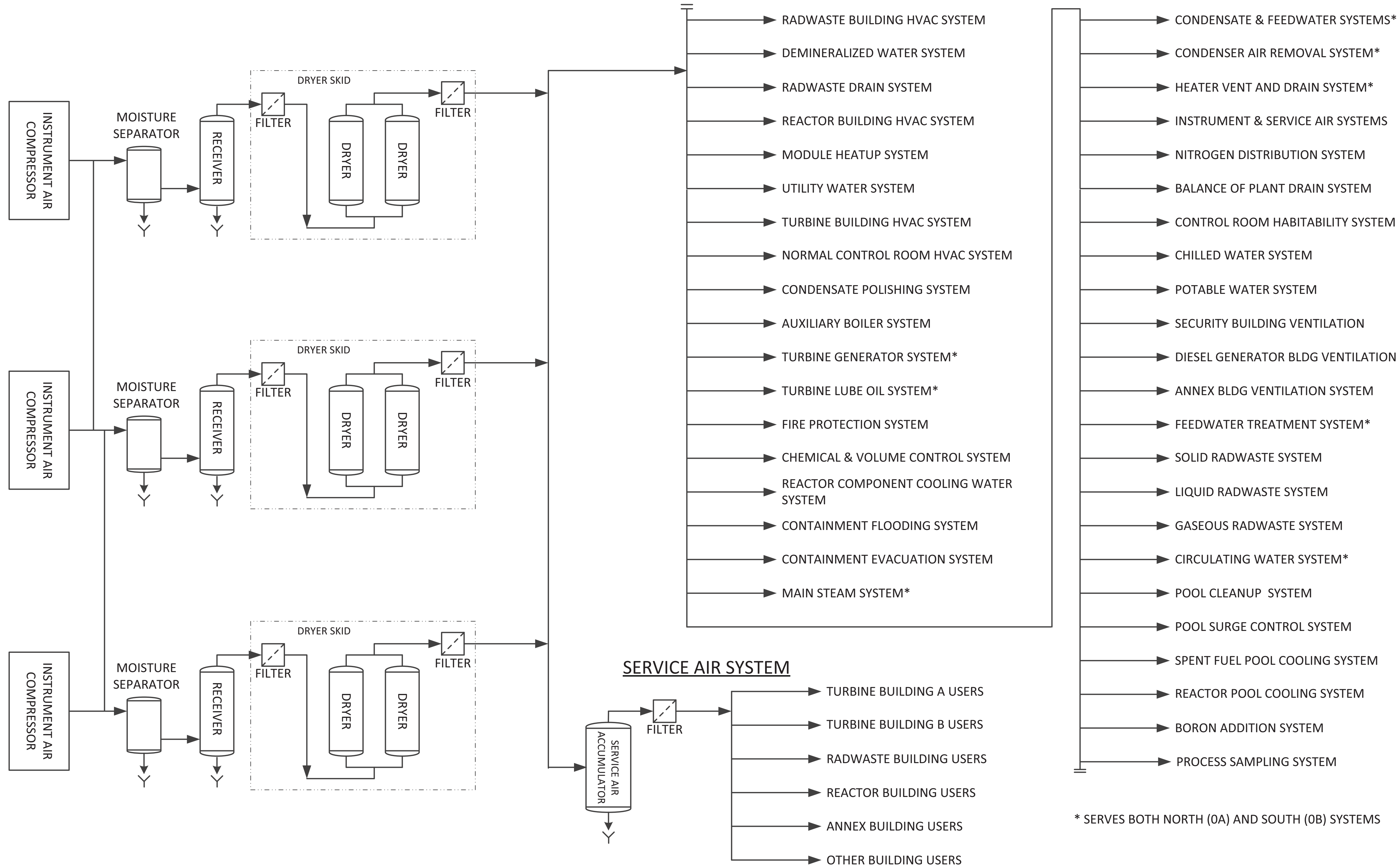
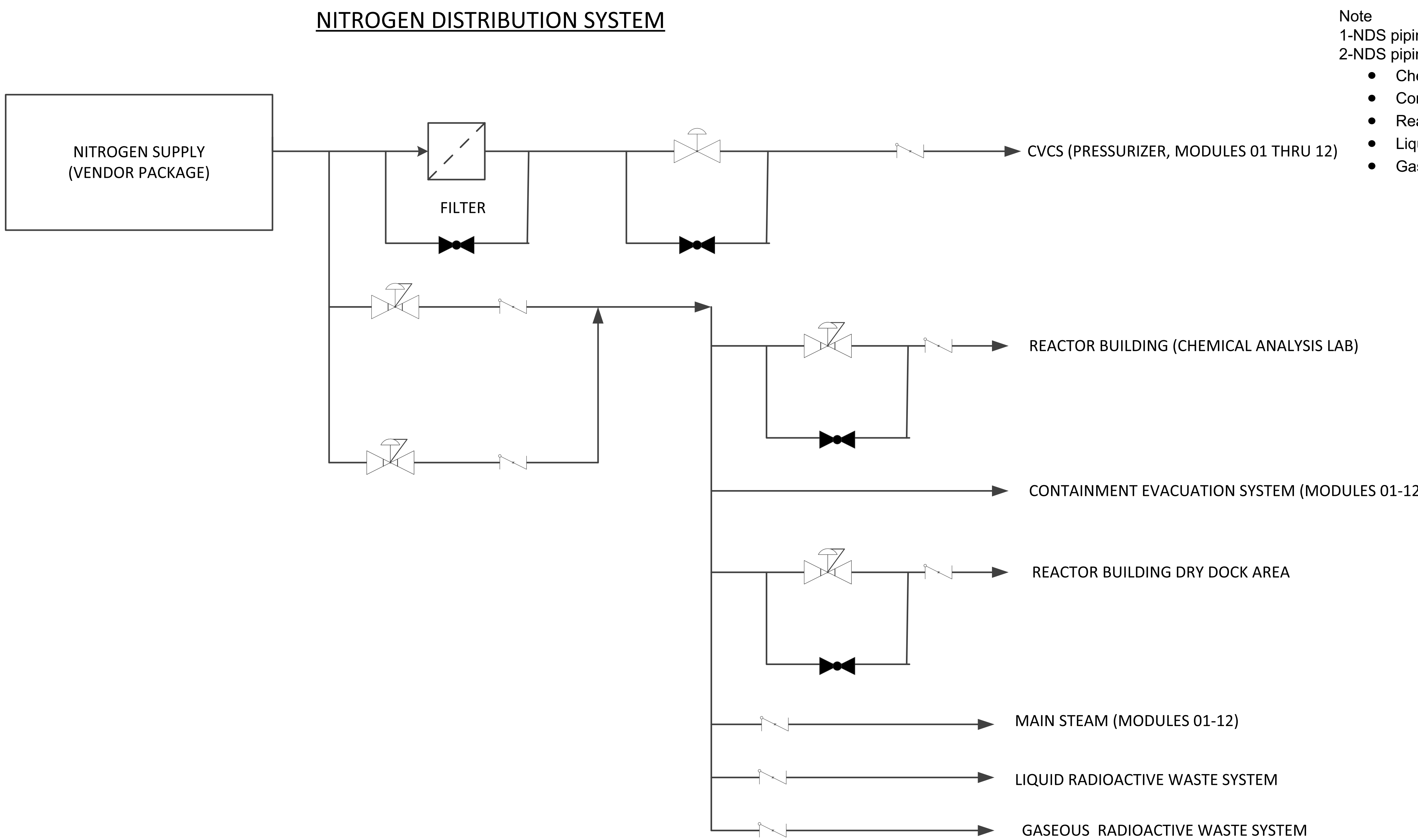


Figure 9.3.1-2: Nitrogen Distribution System Diagram



Note
1-NDS piping directed to CVCS is high pressure piping.
2-NDS piping directed to the following end users is low pressure piping.

- Chemical Analysis Lab
- Containment Evacuation System (Modules 01-12)
- Reactor Building Dry Dock Area, Main Steam (Modules 01-12),
- Liquid Radioactive Waste System
- Gaseous Radioactive Waste System

9.3.2 Process Sampling System

The function of the process sampling system (PSS) is to provide the means to obtain representative liquid and gaseous samples from various primary and secondary process streams and components for monitoring and analyzing the chemical and radiochemical conditions. The PSS capability is used during normal plant operations and following accident conditions without the need for a dedicated post-accident sampling system.

9.3.2.1 Design Bases

This section identifies the PSS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The PSS does not have any safety-related function. By using connections to the chemical and volume control system (CVCS) and the containment evacuation system (CES), the PSS does not use separate containment penetrations; thus, there are no containment isolation valves (CIVs) or containment isolation functions associated with the system. See Section 9.3.2.3 for the safety evaluation.

Consistent with GDC 1, structures, systems, and components (SSC) shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. A quality assurance program shall be established and implemented in order to provide adequate assurance that these SSC will satisfactorily perform their safety functions. Appropriate records of the design, fabrication, erection, and testing of SSC shall be maintained by or under the control of the nuclear power unit licensee throughout the life of the unit.

Consistent with GDC 2, SSC shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The PSS conforms to the Seismic Category II design requirements in Section 3.2.1.2 and meets the guidance of Regulatory Guide 1.29 when needed to ensure that a failure of plant sampling system SSC will not result in incapacitating injury to occupants of the control room and will not cause failure of Seismic Category I SSC that are required to withstand a safe shutdown earthquake.

Consistent with GDC 4, SSC shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. The PSS is compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents.

Consistent with GDC 5, SSC shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

Consistent with GDC 13, instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary (RCPB), and the containment and its associated systems. Sampling of the reactor coolant and other process systems enables the PSS to provide information on variables that can affect the fission process, the integrity of the reactor core, and the RCPB during normal modes of operation.

Consistent with GDC 14, the RCPB shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. The PSS supports ensuring the integrity of the RCPB by sampling reactor coolant to ensure that water chemistry parameters are within predetermined values to preclude affecting the RCPB.

Consistent with GDC 26, the PSS is used to verify the boron concentration necessary for the control of core reactivity changes by sampling reactor coolant and the contents of the boric acid storage tanks of the boron addition system (BAS).

General Design Criteria 41 is not applicable to the PSS. The containment design does not use a containment spray system or a containment atmosphere cleanup system to mitigate the consequences of postulated accidents. Therefore, sampling of the chemical additive tank is not applicable to the design.

Consistent with GDC 60, the nuclear power unit design shall include means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences. The PSS supports the capability to control the release of radioactive materials to the environment.

Consistent with GDC 63, appropriate systems shall be provided in fuel storage and radioactive waste systems and associated handling areas to detect conditions that may result in loss of residual heat removal capability and excessive radiation levels and to initiate appropriate safety actions. The PSS supports detecting conditions that may result in excessive radiation levels in the fuel storage and radioactive waste systems.

Consistent with GDC 64, means shall be provided for monitoring the containment atmosphere, spaces containing components for recirculation of loss-of-coolant accident fluids, effluent discharge paths, and the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents. The PSS supports the capability to monitor the post-accident containment atmosphere, and the capability to sample and analyze for radioactivity that may be released during normal operations, and anticipated operational occurrences.

Consistent with 10 CFR 50.34(f)(2)(xvii)(c) and 10 CFR 50.44(c)(4) the PSS design provides equipment capable of continuous monitoring of hydrogen and oxygen concentration in the containment atmosphere. The equipment used for monitoring hydrogen is reliable and capable of continuously measuring the concentration of hydrogen in the containment atmosphere following a significant beyond design basis accident for accident management and provides indication in the MCR.

Consistent with 10 CFR 50.34(f)(2)(xxvi), the PSS design contains provisions for leakage detection, and to control leakage to levels as low as practical, to minimize exposures to workers and the public and to maintain control and use of the system during an accident (Item III.D.1.1 in NUREG-0737).

COL Item 9.3-1: A COL applicant that references the NuScale Power Plant design certification will submit a leakage control program for systems outside containment that contain (or might contain) accident source term radioactive materials following an accident (including systems and components used in post-accident hydrogen and oxygen monitoring of the containment atmosphere). The leakage control program will include an initial test program, a schedule for re-testing these systems, and the actions to be taken for minimizing leakage from such systems to as low as practical.

Consistent with 10 CFR 20.1101(b), the PSS design supports keeping radiation exposures as low as reasonably achievable (ALARA). Consistent with 10 CFR 20.1406, the PSS design supports minimization of contamination of the facility and the environment, minimizing generation of radioactive waste, and facilitating eventual plant decommissioning.

9.3.2.2 System Description

9.3.2.2.1 General Description

The PSS is designed to collect representative liquid and gaseous samples from various plant systems using the following sampling system features:

- the primary sampling system
- the containment sampling system (CSS)
- the secondary sampling system (SSS)
- local grab sample provisions

The PSS is operable during normal operations, including at power, shutdown, and startup. The system has the ability to obtain samples at the normal system operating temperatures and pressures from various locations. These samples can be in the form of continuously analyzed samples or grab samples. The PSS obtains samples that are representative of the process or vessel under evaluation. For sampling of process streams, sample points are located in a turbulent flow zone which minimizes particulate dropout and re-entrainment in sample piping. For sampling of tanks, the sample points are at the tank recirculation loop to ensure sediments or solid particulates are distributed uniformly in the fluid mixture. The PSS design criteria ensure representative samples from gaseous process streams and tanks are in accordance with American National Standards Institute/Health

Physics Society, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities," ANSI/HPS N13.1-2011 (Reference 9.3.2-1).

As indicated in Section 1.9, there are no generic letters, unresolved safety issues, or relevant operating experience insights for this system. The relevant Three Mile Island requirements are discussed above and in Section 9.3.2.3 (Item III.D.1.1 in NUREG-0737).

Primary Sampling System

The plant design does not employ sample lines which penetrate the containment vessel (CNV) and the reactor pressure vessel to directly obtain reactor coolant samples from the reactor coolant system (RCS). Instead, the required reactor coolant samples are drawn from sample lines connected to the CVCS process piping located outside of the CNV as shown on Figure 9.3.4-1. A primary sampling system for each NuScale Power Module (NPM) monitors and collects reactor coolant samples from its respective CVCS to verify primary chemistry.

The major components of the primary sampling system include: sample coolers, sample chiller temperature control units, continuous sample analysis panels, semi-continuous ion chromatography panels, grab sample panels, pressurized sample collector, primary sample return pump, and associated valves including pressure reduction and temperature control valves. Sharing of primary sampling system equipment between operating units is limited to ion chromatography units shared between NPMs and shared plant cooling water systems for direct sample cooling and cooling of shared chiller units.

Table 9.3.2-1 summarizes the primary sampling system sample points and the analysis capability of the installed continuous sample panels.

Containment Sampling System

During normal operation, the containment vessel is monitored for hydrogen and oxygen gas concentration using the containment sampling system. From a sample point downstream of the discharge of the CES vacuum pumps condenser for each CNV, the CSS sample pump draws the sample gas through in-line hydrogen and oxygen monitors and returns the sample gas to the CES. The in-line hydrogen and oxygen monitors provide continuous gas concentration indication to the MCR. Grab sampling capability is provided from the off-line CES radiation monitor as described in Section 11.5. The analysis of grab samples provides an independent indication of process hydrogen and oxygen content to validate in-line monitor indication and serves as a redundant means to determine process gas concentration in the event that in-line hydrogen and oxygen monitoring is unavailable. The CSS also provides post-accident hydrogen and oxygen monitoring of containment atmosphere following significant beyond design basis accidents.

Table 9.3.2-2 summarizes the CSS sample point and the analysis capability of the CSS. A diagram of the CSS is provided in Figure 9.3.2-1.

Secondary Sampling System

The SSS provides a means for monitoring and collecting fluid samples in the steam cycle systems. The systems serviced by the SSS are the condensate and feedwater system, the main steam system (MSS), and the auxiliary boiler system (ABS). Emphasis is placed on continuous monitoring of the secondary system condensate pump discharge, condensate polisher effluents, feedwater, and main steam. The SSS also includes grab sample capability for diagnostic sampling.

The SSS has both module-specific and shared components. The SSS is comprised of the following major components: sample coolers, sample chiller temperature control units, sample panels, ion chromatography analysis panels, and associated valves including pressure reduction and temperature control valves. The SSS sample panels are located in the Turbine Generator Building.

Sharing of SSS equipment between operating units includes four ion chromatography units, each shared between the condensate polishing system sample streams for three modules and shared plant cooling water systems for direct sample cooling and cooling of the shared chiller units.

Table 9.3.2-3 summarizes the SSS sample points and the analysis capability of the installed continuous sample panels.

Local Sample Points

For systems not being serviced by equipment of the primary sampling system, CSS, or SSS, local sample points are provided. Local sample points employ locally-installed sampling equipment such as an inline sampler for grab sample collection, local analyzers for continuous sampling and analysis, and local sample panels. Local sampling points, as listed in Table 9.3.2-4, are provided for various auxiliary process systems. Local sampling equipment (e.g., in-line sampler, local analyzer, etc.) is considered to be a component of the system to which it is connected.

9.3.2.2.2 Component Description

Sample Coolers

The primary and secondary sampling systems are equipped with two stages of sample coolers cooled by plant cooling water systems (first stage cooling) or chilled water systems (second stage cooling) depending on the sample stream temperature. Sample streams over approximately 100 degrees Fahrenheit get first stage cooling and additional second stage cooling when the sample stream is directed to an analysis panel or ion chromatograph panel. Some of the sample streams in the secondary system may receive cooling from only the chilled water supplied sample coolers.

The sample coolers are tube-in-shell design. The sample flows through the tube side and cooling water flows through the shell. Cooling water for the first stage coolers is supplied from the reactor component cooling water system (RCCWS) for the primary sampling system and the site cooling water system (SCWS) for the SSS.

Sample Chiller Temperature Control Units

Second stage sample coolers are supplied with chilled water from temperature control units in order to ensure the sample temperature required by the analysis equipment.

The refrigerant systems for the temperature control units are cooled by RCCWS in the primary sample system and SCWS in the SSS. The temperature control units are shared equipment, each cooling sample streams for up to six modules.

Sample Panels

Each PSS subsystem typically consists of sample panels needed to support sampling activity. Grab sample provisions are included with some sample panels to permit safe collection of grab samples from plant fluids for laboratory analysis. The sample panels used for grab sample collection of reactor coolant are equipped with a vent hood and enclosure due to potential for exposure to airborne radiologically contaminated materials and the potential chemical hazards of these samples. The vent hood exhaust is connected to the ventilation duct of the Reactor Building HVAC system. Sample sinks are also provided to accommodate potential spills and to drain excess grab samples. Before samples are taken, sample lines are purged for enough time to ensure a representative sample is procured from the process or vessel. After purging, the sample stream can be directed to the grab sample line above the sink for collection in a container. Pressurized reactor coolant samples can be routed to the pressurized sample collector, which allows grab samples to be collected in pressurized sample vessels and taken for further analysis in the laboratory.

The sample panels of the SSS include the capability to perform online analysis, and some panels also include capability to collect grab samples. Sinks are provided at the SSS sample panels with grab sampling capability. The secondary system samples are expected to be non-radioactive during normal operation; therefore, the vent hood enclosure is not provided for the secondary system grab sample panel. While primary-to-secondary leakage is a potential concern for contamination of the secondary system, the process radiation monitors located on the main steam lines as shown on Figure 10.3-1, as well as radiation monitors on the condenser air removal system (CARS) as described in Section 11.5, provide capabilities of detecting primary-to-secondary leakage and alerting the operators to abnormal conditions and to manually isolate the secondary systems upon detection of high radioactivity on the secondary side.

Pressurized Sample Collector

The pressurized sample collector is used to collect pressurized samples of the reactor coolant for analysis of radioactivity and hydrogen. The pressurized sample collector is included as part of the primary sampling system sample panel. The pressurized sample collector includes a sample vessel designed to withstand the reactor coolant design pressure and temperature.

Primary Sample Return Pump

Purged samples and samples from the primary sampling system analyzers are returned to the CVCS process loop. A primary sample return pump is provided at the common return line. There is one pump to support primary sampling of each NPM.

Valves

The PSS includes remotely operated sample line isolation valves. These valves are equipped with position indication and are controlled from the main control room (MCR) or at local valve control panels with either module control system (MCS) or plant control system (PCS) providing applicable control functions. Manual valves are locally controlled by personnel performing sampling activities. The semi-continuous sampling function associated with the shared ion chromatography units is accomplished with programmable manifold valves.

9.3.2.2.3 System Operation

Normal Operations

For normal sampling at power, the primary sampling system performs continuous and semi-continuous sampling and analysis of reactor coolant discharge from the RCS. Additionally, grab samples are collected from the various sample locations in the CVCS process loop. Normal sample points of the primary sampling system are provided in Table 9.3.2-1.

During normal operation, the containment vessel is monitored for hydrogen and oxygen gas concentration using the containment sampling system. From a sample point downstream of the discharge of the CES vacuum pumps condenser for each CNV, the CSS sample pump draws the sample gas through in-line hydrogen and oxygen monitors and returns the sample gas to the CES. The in-line hydrogen and oxygen monitors provide continuous gas concentration indication to the MCR. In addition, grab sampling capability is provided from the off-line CES radiation monitor as described in Section 11.5. Normal sample points of the CSS are provided in Table 9.3.2-2.

For sampling at power, the SSS collects samples from the ABS, condensate and feedwater system, and the MSS. Emphasis is placed on continuous monitoring of the secondary system hotwells, condensate pump discharge, condensate polisher effluents, feedwater, and main steam. The SSS also includes grab sample capability for diagnostic sampling. Normal operation sample points of the SSS are provided in Table 9.3.2-3.

Local sample points are provided for systems not being serviced by the primary sampling system, the CSS, or the SSS. These local sample points for normal operation sampling are provided in Table 9.3.2-4. The frequency for sample collection and required analyses for these local process sample points are addressed in the primary, secondary, and ancillary chemistry program and procedures.

Off-Normal Operations

The NuScale design supports an exemption from 10 CFR 50.34(f)(2)(viii) that requires capability for obtaining and analyzing post-accident samples of reactor coolant and containment atmosphere. The PSS design includes capability to monitor hydrogen and oxygen in containment atmosphere following significant beyond design-basis accident for combustible gas control and accident management in compliance with 10 CFR 50.44(c)(4). Off-normal operations of the PSS, therefore, are to support post-accident hydrogen and oxygen monitoring of containment atmosphere.

Since the PSS connects outside of CNV, post-accident hydrogen and oxygen monitoring with PSS requires opening the CES and CFDS CIVs. If post-accident hydrogen and oxygen monitoring must be performed while containment isolation conditions exist, overriding the containment isolation signal (CIS) is required via operator action outside the MCR.

The CIV hydraulic actuator design and control as described in Section 6.2.4.2.2 are utilized in opening the CIV. Design features of the CIV hydraulic actuators and hydraulic control skids ensure that the valves can be re-opened following the design basis event. The hydraulic cylinder on the actuator applies force to open the CIV. The hydraulic cylinders are pressurized by the hydraulic control skid. The hydraulic pump drivers on the CIV hydraulic control skids are powered by the ELVS, which has a backup power source if normal AC power source is not available. The hydraulic control skids are also designed with a set of accumulators to support a limited number of reopenings of the CIVs after a design basis event without reliance on AC power.

Containment Gas Post-Accident Monitoring

The PSS design has capabilities for monitoring of hydrogen and oxygen inside containment post-accident for combustible gas control. CNV structural integrity is not challenged by combustion events propagated by combustible gas concentrations generated within the first 72 hours of any design basis or beyond design basis event, and no mitigating actions are required during this period. As a result, monitoring of hydrogen and oxygen concentrations in the CNV to inform mitigating actions is not required prior to 72 hours after initiation of an event. Initiation of hydrogen and oxygen monitoring is consistent with the survivability of the associated equipment, as described in Section 19.2.3.

Post-accident hydrogen and oxygen monitoring of containment gas can be initiated when plant conditions are amenable to opening the CES and CFDS CIVs, and do not exceed design limitations of the associated CES and CFDS piping and components. The design pressure and temperature of the CES and CFDS piping and components that are part of the combustible gas (i.e., hydrogen and oxygen) monitoring path are 250 psig and 550 degrees F. The component pressure boundaries of the CES, PSS and CFDS that are part of the combustible gas monitoring path are designed to withstand combustion events, as described in FSAR Table 3.2-1.

To initiate post-accident hydrogen and oxygen monitoring, the CES and CFDS CIVs are opened to establish the containment gas flow paths to the hydrogen and oxygen monitor located outside the containment and return the gas back to the containment after monitoring. The containment gas released from the CNV is routed from the CES to the containment sampling system that is equipped with online hydrogen and oxygen monitoring equipment. The gas is then returned to the CNV via the containment sampling system effluent discharge line connected to the CFDS return line to CNV as shown on Figure 9.3.6-2. Returning the gas back to the CNV eliminates releasing effluent to the environment.

The CES piping is sloped to allow condensed liquid to drain back the CNV and the CES sample line piping is heat traced to prevent the build-up of condensate within the containment gas monitoring lines and analyzer to ensure monitoring capability under accident conditions. The heat trace of CES sample line is powered by the ELVS, which has a backup power source if the normal sources of AC electrical power are unavailable.

COL Item 9.3-2: Not used.

9.3.2.3 Safety Evaluation

The PSS has no safety-related or risk-significant functions and is not required to prevent or mitigate the consequences of a design basis accident, to shut down the reactor and maintain safe shutdown conditions, or to maintain the integrity of the RCPB.

Consistent with GDC 1, process sampling system SSC are designed, fabricated, erected, and tested to appropriate quality standards such that their failure does not impact the function of safety-related or risk-significant systems. The quality group classification of the PSS sample line isolation valves and piping which directly interface with the system being sampled is equivalent to the quality classification of the system to which each sampling line and component is connected. The highest quality group classification of PSS components is Quality Group D conforming to RG 1.26. PSS piping conforms to American Society of Mechanical Engineers (ASME) B31.1 (Reference 9.3.2-2).

General Design Criteria 2 was considered in the design of the PSS. The primary sampling system and the CSS components are located inside the Seismic Category I Reactor Building (RXB). No portions of the PSS or components are safety-related or required to perform a safety-related or risk-significant function. The PSS does not connect to any Seismic Category I piping. The PSS connects to the CVCS and CES on the portions of these systems that are not designed to Seismic Category I requirements. The PSS piping and components downstream of the sample line isolation valve are designed to Seismic Category III, but are upgraded to Seismic Category II (see Section 3.2.1.2) if the routing of PSS piping or the location of components is determined to result in a condition where failure of process sampling system SSC could adversely impact Seismic Category I SSC.

The PSS does not employ sample lines which penetrate the CNV and the reactor pressure vessel; therefore, there is no containment isolation function associated with the system. There is no physical interaction of process sampling system SSC with safety-related SSC. Process sampling system failure does not adversely affect the integrity of safety-related systems.

General Design Criteria 4 was considered in the design of the PSS. The PSS and its components are designed to accommodate the effects of the environmental conditions associated with normal operation and shutdown. Even though the PSS has no safety-related or risk-significant functions, the primary sampling system and the CSS portions of the PSS are expected to operate after design basis accidents; therefore, these PSS subsystems are also designed to withstand postulated accident environmental conditions to ensure that the post-accident monitoring function of the system can be performed.

General Design Criteria 5 was considered in the design of the PSS. The sharing of the PSS components between power modules does not affect the ability of the SSC to perform required safety functions, including in the unlikely event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

Sharing of the PSS components across NPMs has been minimized to the extent practical. The shared components are downstream of CIVs to ensure that SSC ability to perform safety functions is not impaired. Shared functions are described in Section 9.3.2.2.

The PSS design satisfies GDC 13 in that sampling of reactor coolant enables the PSS to provide information on variables that can affect the fission process, the integrity of the reactor core, and the RCPB during all normal modes of operation. The PSS is relied upon to collect water and gaseous samples from the RCS and associated auxiliary systems during normal modes of operation.

The PSS design satisfies GDC 14 as it relates to ensuring integrity of the RCPB by sampling reactor coolant for chemicals that can affect the RCPB. Sampling and analysis of reactor coolant samples verify that key chemistry parameters, such as chloride, hydrogen, and oxygen concentrations, are within prescribed limits and that impurities are properly controlled, providing assurance that the many mechanisms for corrosive attack are mitigated and will not adversely affect the RCPB.

The PSS design satisfies GDC 26 by allowing verification of the boron concentration necessary for the control of core reactivity changes by sampling the reactor coolant and the content of the boric acid storage tanks of the BAS.

Principal Design Criteria 41 is not addressed by the PSS design since the containment design does not use a containment spray system or a containment atmosphere cleanup system to mitigate the consequences of postulated accidents. Therefore, sampling of the chemical additive tank is not applicable to the design.

The PSS design satisfies GDC 60, as it provides the capability to control the release of radioactive materials to the environment by sampling effluents. The PSS includes local grab sample points incorporated into the designs of systems which have effluent release paths to the environment permitting effluent sample analysis prior to release. Additionally, PSS sample line isolation valves which contain reactor coolant are designed to fail closed to control the potential release of radioactive materials to the environment.

Provisions are made in the design of the PSS to route the samples back to the system of origin or to the applicable radioactive waste system as appropriate to control the release of radioactive material.

The PSS design limits the potential reactor coolant loss from the rupture of a sample line. A failure of a sample line would result in a loss of flow to either a continuous analyzer or a grab sample panel which would be observed by plant personnel. In addition, a break in a sample line would result in activity release that might actuate the fixed area radiation monitors located in the containment sampling system equipment area and the primary sampling system equipment area, as described in Table 12.3-10. The three PSS sample points to the CVCS are each provided with two fail-closed isolation valves. These isolation valves are downstream of the environmentally qualified CIVs associated with the CVCS discharge line and are also downstream of the CVCS module isolation valves as shown on Figure 9.3.4-1. The PSS line sizes range from 3/4" to 3/8" which further restricts the break flow of a sample line outside containment.

The PSS design satisfies GDC 63 by allowing the detection of conditions that may result in excessive radiation levels in the fuel storage and radioactive waste systems. The PSS includes sampling capability of the spent fuel pool and reactor pool water via local sample points in the pool cooling and cleanup system. The PSS also includes sampling capability via local sample points for the radioactive waste management systems. This enables analyses to be performed to detect conditions in the fuel storage and radioactive waste systems that could result in excessive radiation levels and excessive personnel exposure.

The PSS design satisfies GDC 64 as it provides the capability to monitor the post-accident containment atmosphere, and to sample and analyze for radioactivity that may be released during normal operations and anticipated operational occurrences.

The PSS design satisfies 10 CFR 50.34(f)(2)(xvii)(c) by providing capability to monitor hydrogen and oxygen concentration in containment atmosphere during operation and during beyond design-basis conditions. The monitor is a nonsafety-related instrument that sends output signal to the MCS to provide readout in the main control room.

The PSS design satisfies 10 CFR 50.34(f)(2)(xxvi) (Item III.D.1.1 in NUREG-0737), as it relates to including provisions for leakage control and detection to levels as low as practical to prevent unnecessarily high exposures to workers and the public and to maintain control and use of the system post-accident. The PSS design includes provisions for leakage control and detection. Flow and pressure instrumentation on the sample lines can provide indication of potential leaks. Radiation monitoring capabilities are provided for detecting excessive radiation level resulting from system leakage. The sample line can be isolated upon detection of high radiation by the CVCS or CES process radiation monitor located upstream of the sample line as shown in

Figure 9.3.4-1 and Figure 9.3.6-1 respectively. Excessive radiation level detected by the fixed area radiation monitor located in the primary sampling system or the containment sampling system equipment areas described in Table 12.3-10 can also provide indication of system leakage that warrants system isolation for leakage control.

The PSS design satisfies the requirements of 10 CFR 50.44(c)(4), as the equipment design attributes conform to RG 1.7 regulatory position C.2. It provides the ability to monitor containment hydrogen and oxygen using an in-line monitor for both normal and accident conditions. In addition grab sampling provisions are provided on the CES off-line radiation monitor to validate in-line monitor indication and serve as a redundant means to determine process gas concentration in the event that in-line hydrogen and oxygen monitoring is unavailable.

The PSS design features and configuration support ALARA program goals and objectives with regard to minimizing dose and contamination. The PSS design ensures that the ALARA requirements of 10 CFR 20.1101 and contamination minimization requirements of 10 CFR 20.1406 are addressed.

The PSS sample panels are located in rooms or areas of the RXB that facilitate controlling the spread of contamination. The PSS primary sampling system and CSS components are located in areas classified as a low radiation zone. Based on PSS equipment locations in the RXB, additional shielding design beyond what is provided by the building structures is not needed for normal operation.

Any sampling components that contain potentially radioactive fluids, such as sample coolers, isolation valves, and associated piping, are located in shielded compartments or away from the sample panel to the extent practical to minimize the source volume exposed at the sample panel. Personnel exposure to radioactive fluids is minimized by the use of vent hoods, valve arrangement, sample vessel connections, and control of the sample pressure during operation by proper valve lineup. Personnel exposure to radioactive gases is minimized by maintaining air flow through the vent hood. The PSS is also designed for high, continuous purge flow for quick, accurate sample collection to minimize personnel exposure at the operating location.

Reactor coolant samples during normal operations are routed to sample stations located in the centralized hot lab for grab sample collection and analysis. This design feature minimizes potential spills of samples while transporting the grab samples to the lab. A counting room is provided in the RXB next to the hot lab to perform routine radiochemical analyses on samples containing radioactive material collected from air, water, surfaces, and other sources within the plant and the surrounding environment. Local sample points associated with potentially radioactive systems are also minimized to the extent practical to reduce manual operations in radiological work areas, and subsequently reduce dose and minimize contamination.

The potential for radiological contamination from the PSS to interfacing non-radioactive systems is reduced by including radiation monitoring, isolation capability and backflow prevention. Potential radiological contamination from the PSS to the RCCWS is minimized by providing radiation monitors in the RCCWS downstream of sample coolers to alert the control room if there is a leak of radioactive fluid into the RCCWS. Water systems (i.e., SCWS and demineralized water system) supplying the secondary PSS equipment are also provided with isolation valves and check valves where applicable to prevent backflow that may result in radiological contamination in the event of primary-to-secondary leakage.

Radioactive waste is minimized in the PSS by returning the continuous reactor coolant sample process fluid back to the CVCS (i.e., system being sampled) instead of being routed to LRWS. For the CSS, continuous gaseous sampling is returned to the CES system process flow path. On the secondary side, clean samples discharged from the online analyzers are sent back to the main condenser. Samples which may have reagents added for online sample analysis are sent to the balance-of-plant drain system.

The PSS design also includes provisions to contain potential spills by locating the grab sample lines directly over the sample sink. The sinks are drained to the appropriate plant drain collection systems (i.e., the radioactive waste drain system (RWDS) or the balance-of-plant drain system depending on the location of the sample sink). The PSS drains from the sample sinks are hard piped to the RWDS. For the chemistry hot lab and other locations where sample panels are located in the RXB, the floors are sloped to direct leakage or spills to the drain hubs leading to an RWDS sump. This design approach prevents spread of contamination and contains the leakage or spills.

The PSS components which are expected to be in contact with radioactive fluid, such as sample line piping, tubing and sample coolers, are constructed of stainless steel to reduce corrosion. The use of proven materials and welded construction for the piping and components minimizes leakage and unintended contamination of the facility and the environment.

9.3.2.4 Inspection and Testing

The PSS components are inspected and tested as part of the initial testing and startup program in accordance with RG 1.68 as described in Section 14.2.

The inservice testing requirements per the ASME Operation and Maintenance Code are not applicable to PSS components because the PSS does not have any safety-related valves or pumps.

The PSS does not have ASME Class 1, 2, or 3 components or supports. Therefore, inservice inspection requirements per Section XI of the ASME Boiler and Pressure Vessel Code are not applicable to the PSS components and supports.

Inspections, Tests, Analyses, and Acceptance Criteria are addressed in Section 14.3. Technical Specifications are addressed in Chapter 16.

9.3.2.5 Instrumentation and Controls

The PSS sample panels are equipped with applicable flow, temperature, and pressure instruments, enabling the operator to determine if the sample coolers and pressure-regulating equipment are functioning properly before samples are drawn.

The PSS is also equipped with analysis instrumentation. Information on the process stream is gathered by an analysis probe or sensing element which relays the information back to the analyzer. The analyzer continuously performs chemical analysis of the inputs from the probe and transmits the results to the applicable data acquisition system or plant computer system.

The PSS alarms are nonsafety-related alarms and are intended to trigger manual operator action. Alarms are initiated via PSS instrumentation interface with the MCS or PCS. Alarm indication is provided at the PSS panel and certain alarm signals are also sent to the MCR display.

The MCS provides the control system interface for module-specific PSS components. The PCS provides the control system interface for common or shared PSS components. Control of PSS remotely-operated sample line isolation valves is performed from the MCR. The PSS remotely-operated valves include position indicators.

9.3.2.6 References

9.3.2-1 American National Standards Institute/Health Physics Society, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities," ANSI/HPS N13.1-2011, Washington, DC.

9.3.2-2 American Society of Mechanical Engineers, *Power Piping,* ASME Code for Pressure Piping, B31, ASME B31.1, New York, NY.

Table 9.3.2-1: Primary Sampling System Normal Sample Points

Sample Points	System	Process Fluid Type	Sampling Methods	Analysis[1]
Chemical and volume control system (CVCS) suction line from RCS, upstream of CVCS purification equipment	CVCS	liquid	continuous semi-continuous[2] grab	dissolved hydrogen, dissolved oxygen, conductivity chloride, fluoride, sulfate lithium
CVCS sample point downstream of purification equipment	CVCS	liquid	grab	
CVCS injection line to RCS	CVCS	liquid	grab	

Notes:

1. Specific analyses, limits, and monitoring frequencies will be specified in plant procedures.
2. Semi-continuous (i.e., intermittent) analyses are performed by the applicable ion chromatography analysis unit provided in the hot lab.

Table 9.3.2-2: Containment Sampling System Normal Sample Point

Sample Point	System	Process Fluid Type	Sampling Methods	Analysis(1)
Containment evacuation system (CES) gas discharge (downstream of the CES condenser outlet)	CES	gas	continuous	hydrogen and oxygen

Note:
1. Specific analyses, limits, and monitoring frequencies will be specified in plant procedures.

Table 9.3.2-3: Secondary Sampling System Normal Sample Points

Sample Point	System	Process Fluid Type	Sampling Method	Analysis[1]
Condensate and feedwater system (CFWS) feedwater line to steam generators (SGs)	CFWS	liquid	continuous semi-continuous[2] grab	specific conductivity, cation conductivity, pH, hydrazine, silica, sodium chloride, sulfate pH agent, suspended solids
Condensate pump discharge line	CFWS	liquid	continuous	specific conductivity, cation conductivity, pH, dissolved oxygen
Individual condensate polisher (i.e., demineralizer) outlet	CFWS	liquid	continuous semi-continuous[2]	specific conductivity, cation conductivity, sodium, dissolved oxygen chloride, sulfate, sodium
Main steam system (MSS) line from SG 1	MSS	steam	continuous semi-continuous[2] grab	cation conductivity, specific conductivity chloride, sulfate, sodium
MSS line from SG 2	MSS	steam	continuous semi-continuous[2] grab	cation conductivity, specific conductivity chloride, sulfate, sodium
Main steam bypass line from SG 1 [3]	MSS	liquid	continuous semi-continuous[2] grab	cation conductivity, specific conductivity chloride, sulfate, sodium pH, hydrazine
Main steam bypass line from SG 2 [3]	MSS	liquid	continuous semi-continuous[2] grab	cation conductivity, specific conductivity chloride, sulfate, sodium pH, hydrazine
Auxiliary boiler system (ABS) feedwater line	ABS	liquid	grab	
ABS feedwater line	ABS	liquid	grab	
ABS steam discharge line	ABS	steam	grab	
ABS blowdown lines	ABS	steam	grab	
ABS high pressure boiler condensate collection tank	ABS	liquid	grab	

Notes:
1. Specific analyses, limits, and monitoring frequencies will be specified in plant procedures.
2. Semi-continuous sampling is performed by the applicable ion chromatography analysis unit provided as part of the SSS.
3. Main steam bypass line sample points are intended to be used during wet layup, startup, and shutdown to monitor SG water chemistry.

Table 9.3.2-4: Local Sample Points

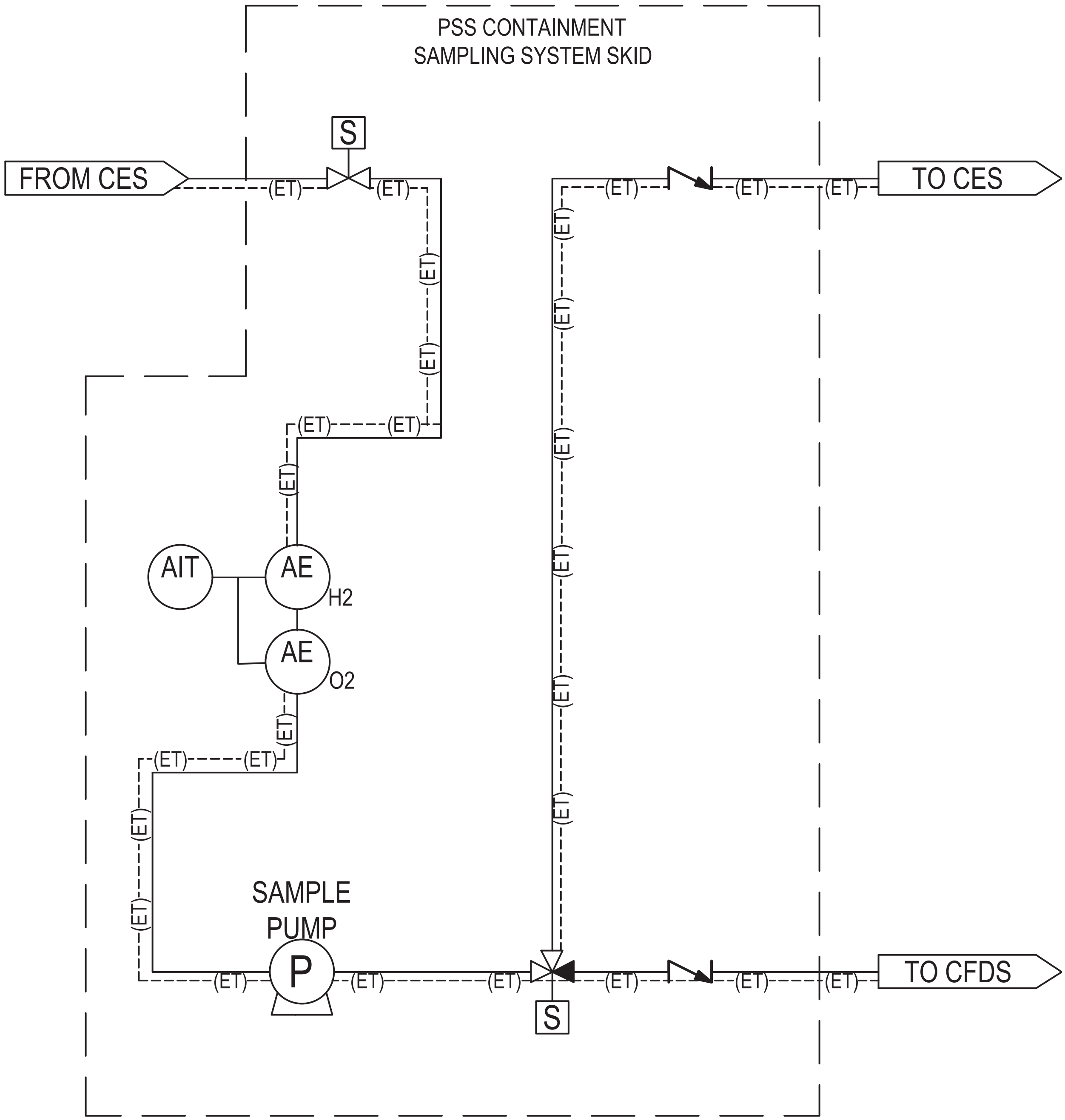
Sample Point	System	Process Fluid Type	Sampling Method	Analysis[(1)]
ABS steam discharge line (downstream of boilers)	ABS	steam	continuous	pH, cation conductivity
ABS feedwater line (at pump discharge)	ABS	liquid	continuous	pH, hydrazine, dissolved oxygen
Boron addition system (BAS) boric acid storage tank	BAS	liquid	grab	
Boric acid batch tanks	BAS	liquid	grab	
Condenser air removal system (CARS) seal water separator tank vent line	CARS	gas	grab	
CES sample vessel liquid discharge line	CES	liquid	grab	
CES particulate, iodine, and noble gas radiation monitoring skid	CES	gas	grab	hydrogen, oxygen, radionuclides
Circulating water system (CWS) cooling tower basin	CWS	liquid	grab	
CFWS high pressure feedwater heater discharge line	CFWS	liquid	continuous grab	dissolved oxygen total iron[(2)]
Main condenser hotwell	CFWS	liquid	continuous grab	sodium, cation conductivity
Combined polisher effluents	CFWS	liquid	grab	
Feedwater discharge from low pressure feedwater heater	CFWS	liquid	grab	
Feedwater discharge from intermediate pressure feedwater heater	CFWS	liquid	grab	
Demineralized water system (DWS) storage tank	DWS	liquid	grab	radionuclides
Gaseous radioactive waste system (GRWS) moisture separator discharge	GRWS	gas	continuous grab	oxygen, hydrogen
GRWS effluent release to plant exhaust	GRWS	gas	continuous grab	oxygen
Liquid radioactive waste system (LRWS) low conductivity waste collection tanks	LRWS	liquid	grab	
Low conductivity waste sample tanks	LRWS	liquid	grab	
Treated liquid waste effluent discharge line	LRWS	liquid	grab	
High conductivity waste collection tanks	LRWS	liquid	grab	
High conductivity waste sample tanks (2 sample points total; one per tank)	LRWS	liquid	grab	
Detergent waste collection tank	LRWS	liquid	grab	
LRWS low conductivity waste process skid effluent line	LRWS	liquid	grab	radionuclides, tritium
High conductivity waste processing skid effluent line	LRWS	liquid	grab	radionuclides, tritium
Upstream of module heatup system (MHS) heat exchangers	MHS	liquid	grab	
Reactor pool cooling system (RPCS) effluent to pool cleanup system	RPCS	liquid	grab	
Spent fuel pool cooling system (SFPCS) effluent to pool cleanup system	SFPCS	liquid	grab	
Pool cleanup system (PCUS) demineralizer influent	PCUS	liquid	grab	
PCUS effluent	PCUS	liquid	grab	
Pool Leakage Detection System (PLDS) at the channel drainage line	PLDS	liquid	grab	

Table 9.3.2-4: Local Sample Points (Continued)

Sample Point	System	Process Fluid Type	Sampling Method	Analysis(1)
Pool surge control system (PSCS) tank (at tank discharge line)	PSCS	liquid	grab	
Reactor component cooling water system (RCCWS) common return lines	RCCWS	liquid	grab	radionuclides, tritium
RCCWS drain lines of individual components being cooled	RCCWS	liquid	grab	radionuclides
Radioactive waste drain system (RWDS) sump tanks; one sample point per each sump tank)	RWDS	liquid	grab	
Reactor Building chemical drain tank	RWDS	liquid	grab	
Reactor Building RCCWS drain tank	RWDS	liquid	grab	
Site cooling water system (SCWS) discharge line to central utility building	SCWS	liquid	grab	
SCWS discharge lines to utility water system discharge basin	SCWS	liquid	continuous grab	conductivity, pH, chlorine, and corrosion inhibitors, radionuclides, tritium
SCWS cooling tower basin	SCWS	liquid	continuous grab	pH, total dissolved solids, chlorine radionuclides, tritium
SCWS supply lines to reactor pool cooling heat exchangers	SCWS	liquid	grab	
Upstream of filters on SCWS return lines from reactor pool cooling heat exchangers	SCWS	liquid	grab	
Downstream of filters on SCWS return lines from reactor pool cooling heat exchangers	SCWS	liquid	grab	
SCWS supply lines to SFPC heat exchangers	SCWS	liquid	grab	
Upstream of filters on SCWS return lines from SFPC heat exchangers	SCWS	liquid	grab	
Downstream of filters on SCWS return lines from SFC heat exchangers	SCWS	liquid	grab	
SCWS supply lines from RCCW heat exchangers	SCWS	liquid	grab	
Upstream of filters on SCWS return lines from RCCW heat exchangers	SCWS	liquid	grab	
Downstream of filters on RCCW return lines from reactor pool cooling heat exchangers	SCWS	liquid	grab	
Solid radioactive waste system (SRWS) phase separator tank discharge line to dewatering skid	SRWS	liquid	grab	
Turbine generator system (TGS) gland steam condenser exhaust	TGS	gas	grab	
Utility water system (UWS) discharge basin	UWS	liquid	grab	radionuclides, tritium
Utility water system (UWS) between UWS supply pump header and UWS distribution header	UWS	liquid	grab	radionuclides, tritium

Notes:
1. Specific analyses, limits, and monitoring frequencies will be specified in plant procedures.
2. Total iron is collected using integrated sampling.

Figure 9.3.2-1: Containment Sampling System Diagram



9.3.3 Equipment and Floor Drain Systems

The equipment and floor drain systems are provided to ensure that waste liquids, valve and pump leak-offs, and plant system drains are collected and directed to the correct drain system components for processing or disposal, and that excessive water accumulation and flooding is limited. The equipment and floor drainage systems are comprised of two separate, unconnected systems, the radioactive waste drain system (RWDS) and the balance-of-plant drain system (BPDS), each serving up to twelve NPMs.

9.3.3.1 Design Bases

This section identifies the required or credited functions of the equipment and floor drain systems with regard to the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The RWDS and BPDS serve no safety-related or risk-significant functions, are not credited for mitigation of a design basis accident, and have no safe shutdown functions.

General Design Criteria (GDC) 2 and 4 were considered in the design of the RWDS and BPDS. The RWDS and BPDS are not required to function during or after a natural phenomenon event or other events that result in the generation of missiles, pipe whipping, or discharging fluids. Portions of the system that are in proximity to Seismic Category I SSC are designed to Seismic Category II standards.

GDC 5 was considered in the design of RWDS and BPDS. The components in the RWDS and BPDS are shared among NuScale Power Modules (NPMs), however, failure of the shared RWDS and BPDS do not significantly impair the ability of other NPMs to perform their safety functions.

Consistent with GDC 60, the design of the RWDS and BPDS ensures the capability to control releases of radioactive materials to the environment. Consistent with 10 CFR 20.1101(b), the RWDS and BPDS design supports keeping radiation exposures as low as reasonably achievable. The RWDS and BPDS are designed to meet the requirements of 10 CFR 20.1406 as it relates to minimization of contamination of the facility.

See Section 9.3.3.3 for the RWDS and BPDS safety evaluation.

9.3.3.2 System Description

9.3.3.2.1 General Description

The equipment and floor drain systems are comprised of two separate, unconnected systems, the RWDS and the BPDS. The RWDS and BPDS collect liquid waste from equipment and floor drains. The RWDS receives both radiologically contaminated and non-contaminated liquids and transfers the liquids to the LRWS for processing. The BPDS collects and segregates normally non-radioactive liquid waste from areas associated with power-related or process-related functions outside the RCA.

The RWDS serves the radiologically controlled areas (RCA), which include the Reactor Building (RXB), the Radioactive Waste Building (RWB), and potentially contaminated areas of the Annex Building (ANB). The RWDS does not provide drainage for the reactor containment of an NPM.

The RWDS liquid wastes are segregated into:

- Low-conductivity waste (LCW) - These are generally low chemical concentration wastes (e.g., equipment drains) that can have relatively high radioactivity concentrations.
- High-conductivity waste (HCW) - These are high-conductivity drain wastes (e.g., floor drains) containing various dissolved and suspended solids that can have relatively high radioactivity concentrations.
- Chemical waste drains
- RCCW waste drains
- Detergent waste drains

The RWDS consists of five subsystems:

- The equipment drain subsystem collects RXB and RWB equipment drainage, pool leak detection drainage, and leakage in the chemical and volume control system ion exchanger cells and transfers it to the LCW collection tanks in the LRWS.
- The floor drain subsystem collects RXB, RWB and ANB (decontamination room) floor drainage and transfers it to the HCW collection tanks in the LRWS.
- The chemical waste drain subsystem collects chemical waste from the containment evacuation system and the hot laboratory and transfers it to the HCW collection tanks in the LRWS.
- The reactor component cooling water system (RCCWS) drain subsystem collects potentially contaminated liquid and stores it for recycle back to the RCCWS. The waste is sampled upon receipt and transferred to the HCW tanks in the LRWS if it is found to be contaminated.
- The detergent waste collection subsystem collects detergent waste from personnel and small equipment decontamination activities and transfers it to the detergent waste collection tank in the LRWS via gravity flow. There are no tanks or pumps in this subsystem.

The BPDS consists of three subsystems:

- The waste water sumps receive water from auxiliary boiler system (ABS) blowdown, and floor and equipment drains within the structure housing the auxiliary AC power source (AAPS), Auxiliary Boiler Building, Turbine Generator Buildings, Diesel Generator Buildings, Central Utility Building (CUB), and Fire Water Pump Buildings.

- The chemical waste sumps collect high chemical concentration effluents from condensate regeneration, demineralized water reverse osmosis, site cooling water chemical treatment, feedwater treatment, and cooling tower chemical treatment systems.
- The CRB waste water collection sump collects waste water from the floor drains in the CRB.

The majority of the BPDS is constructed of carbon steel. The BPDS chemical waste subsystem and the RWDS are constructed of austenitic stainless steel. This material handles corrosive materials and facilitates decontamination from radioactive material.

The RWDS and BPDS are composed of pumps, sumps, tanks, instrumentation, controls, and piping.

The simplified system layout of the RWDS is shown in Figure 9.3.3-1. Figure 9.3.3-2 shows the simplified layout of the BPDS. Water is pumped from the sumps of several buildings to the waste water sump tanks. At the point at which each of these lines enters the waste water sump tanks, there is an air separation between the pipe and the water level in the tank, preventing reverse flow. In addition, each of these lines includes a manual isolation valve. For the TGBs, however, flow to the waste water sump tanks is by gravity and no isolation valve is provided. Table 9.3.3-1 lists the collection areas for the RWDS and BPDS.

The design of the RWDS and BPDS directs waste liquids, valve and pump leakoffs, and component drains and vents to the proper area for processing or disposal. The RWDS and BPDS are designed to include surge capacity to support periodic maintenance activities as well as other volume increases due to other than routine operations (e.g., forced outages, runoff from firefighting activities, and decontamination activities).

Influent source streams into the BPDS that have the potential to contain radioactive material are provided with radiation monitors that support automated system functions to terminate related sump tank discharge flow and allow for manual diversion of the effluent stream to the LRWS upon detection of radioactivity that is greater than predetermined thresholds. The BPDS radiation monitors and automated functions are discussed in Section 9.3.3.5.

The RWDS and BPDS provide the capability to manually sample collected waste. The RWDS collects, accumulates, and allows sampling of both radiologically contaminated and non-contaminated liquid wastes in the RCA then transfers the waste to the LRWS for processing. The BPDS collects, accumulates, and samples liquid wastes that are normally not radiologically contaminated from buildings outside of the RCA (Table 9.3.3-1).

Capped hose connections piped to equipment drain sumps are available near large equipment in the RCA. Equipment drains use permanent connections or temporary hose connections to RWDS drain tanks to prevent the spread of airborne contamination. Cold demineralized water is available to dilute hot waste streams entering an RWDS sump to maintain the required net positive suction head on the sump pumps.

The RWDS and BPDS piping is routed to minimize the impact of radioactive liquids, concentrates, and sludge slurries, or resins on general area dose rates. This includes routing in both non-radiologically controlled areas and RCAs. A designated drain path is provided for each valve or pump which handles radiologically contaminated fluid. The RWDS floor drain piping is not routed through clean areas that are normally or periodically occupied. Where no other option exists, the piping is shielded. Shielding is designed to minimize the radiological impact upon an area resulting from the contaminated fluid source and to permit access to piping for inspection. The design and arrangement of these drains facilitate the addition of shielding or the capability for removal of drains. Provisions for flushing reduce occupational exposure. Parts of the RWDS that are not self-draining have dedicated piping to a drain collection point or sump for each valve or pump which handles radiologically contaminated fluid. Equipment containing radioactive fluids has vents and drains with capped hose connections and normally closed valves to keep them isolated from the environment.

Floor drains are provided near equipment containing normally radiologically contaminated liquids in dedicated cubicles or within curbs to manage leakage from valves, seals, and flanges. Maintainable strainers are used in floor drains. The RWDS floor drains have loop seals to prevent airborne radioactivity from moving between compartments through the drain lines. On the lower elevation where the floor drains are in the slab, loop seals are not used and the drain piping within the sump tank is brought to below the minimum tank water level to prevent airborne contaminant flow.

The RWDS valves are constructed of austenitic stainless steel to minimize contamination. Check valves are used in RWDS transfer pumps discharge lines to prevent backflow from another sump or tank. Valve designs are chosen to minimize crud traps. The RWDS uses full-port ball valves with low-leakage stem seals, with welded valve ends to minimize leakage where practical. Air-operated valves powered by instrument air are provided for on and off functions of air supply to RWDS sump pump diaphragms, and pressure control valves are provided to control air supply pressure. Manual valves are provided for maintenance purposes.

Remotely-operated BPDS shut-off valves are specified as full-port ball valves. Automated BPDS valves are controlled by the plant control system. There are isolation valves on either side of BPDS control valves with a manually-operated bypass valve.

The RWDS and BPDS piping with the potential to be contaminated is designed to minimize solids accumulation (e.g., no bottom pipe penetrations or taps). The RWDS and BPDS drain lines are sized to allow gravity draining and are sloped to minimize plugging.

The RWDS piping has welded connections with the exception that flanges may be used where frequent disassembly is required for maintenance or NPM disconnection. Threaded connections are not used for piping containing radiologically contaminated fluid. The RWDS floor drain piping is routed and sealed to prevent flow of airborne radioactivity between building rooms and compartments. The RWDS drains in areas containing combustible liquids have provisions for preventing the backflow of combustible liquids into safety-related areas through the interconnected drain systems.

The BPDS uses double-walled lines with built-in leak detection capability in the piping between the TGB sumps to the LRWS, to contain radioactive material and prevent contamination spread from buried pipe. The connections and fittings for potentially contaminated BPDS tanks are welded in order to prevent leakage.

9.3.3.2.2 Major Component Description

Sumps and Tanks

The RWDS is designed to collect, accumulate, and transfer the expected amounts of radioactive liquid wastes to the LRWS, including chemical and detergent bearing wastes. The RWDS has excess capacity which supports periodic maintenance or other volume increases greater than routine operating capacities. Redundant pumps provide backup.

The internal flooding analysis for the RXB determined that pooling from fire suppression equipment does not impact safety-related or risk-significant equipment functions with no credit taken for the floor drain system, as described in Section 3.4. There are no safety-related or risk significant SSC on the lowest level of the CRB. In the event of fire suppression system activation, the excess water is allowed to pool on the impacted floor until it can drain into the floor drain sump tank. Floor drains from upper elevations are collected and routed through individual downcomers to the nearest floor drain sump, located in the lowest elevation. This feature prevents water collected on one floor from backing up to other floors. The RWDS sumps in the RXB, though not credited to prevent flooding in the respective buildings, will attenuate to some extent the flood levels from design basis fire suppression system flows. The BPDS sump in the CRB contains a fire water removal pump rated at the maximum single zone fire suppression system flow rate.

The RWDS sumps are provided with stainless steel liners to collect any leakage from the primary tank. The liners also contain leak detection which alarms in the Waste Management Control Room (WMCR). The sumps are covered to keep out debris, with an access port to facilitate inspection and cleanout operations. The RWDS tanks are vented to the RXB or RWB ventilation system which helps prevent gaseous and airborne radioactive contaminants from leaving the sump tanks by a path other than the vent piping.

The BPDS is designed to accommodate normal drainage into each of the five sumps. Sufficient storage volume and pump-out capacity is provided in the BPDS collection tanks to process normal and infrequent operational occurrences. The two TGB waste water sumps and the CRB sump are also equipped with fire water removal pumps sized to accommodate the design basis fire suppression system flows in the respective buildings without flooding. The chemical waste collection sumps are not equipped with fire water removal pumps because the capacity of the sump pumps exceeds the potential runoff from firefighting activities.

The BPDS sumps are closed tanks. The BPDS design provides positive leakage containment that excludes precipitation, groundwater, and runoff. The waste water sumps associated with the BPDS are equipped with coalescing media. Oily waste collected in the BPDS waste water sumps is processed by a BPDS oil separator to permit oily waste collection and transport offsite.

Underground tanks in the BPDS, regardless of material, are located in concrete enclosures with leak detection for secondary containment and covers to exclude precipitation.

The RCCWS drain tank is sized to accept the RCCWS water contained in the single largest piece of equipment in the RCCWS circuit. The chemical drain tank is sized to accept waste from the process sampling system and the 12 containment evacuation systems.

Pumps

Cleanable screens are installed on pump suction lines to minimize the potential for pump damage or plugging of system piping. The RWDS chemical drain tanks are provided with air diaphragm transfer pumps. The RCA drainage, with the exception of detergent waste, is collected by various RWDS drain tanks, each having two redundant pumps. Each pump is sized to accommodate the maximum anticipated flow into the sump. Thus, each sump has one pump ready for operation (the 'primary' pump) and one pump on standby (the 'alternate' pump). The pumps automatically start and stop based on level indication. The primary pump is activated upon the tank reaching high level and the alternate pump is activated upon reaching high-high level. This provides automatic backup if one pump fails or if the inflow exceeds the capacity of one pump.

Each BPDS sump incorporates a primary and an alternate pump. In addition, each of the two waste water sumps and the control building sump include a fire water removal pump and an oily waste pump.

9.3.3.2.3 System Operation

The RWDS and BPDS operate during normal operation, maintenance, plant shutdowns, refueling, plant startup operations, and during anticipated operational occurrences.

For RWDS normal operation, liquid wastes drain by gravity to collection tanks or sumps. Sump pumps discharge the collected radiologically contaminated liquid wastes to the LRWS for further processing.

The Reactor Building RCCW drain tank and the Reactor Building chemical drain tank receive waste, but transfer to the LRWS requires operator action after sampling, analysis, and adjustment if necessary. The liquids contained in the RCCW drain tank are normally not radiologically contaminated but contain various treatment chemicals, including corrosion inhibitors that are typical of closed loop cooling water systems that could react exothermically with ion exchange resins.

The pool leak detection system (PLDS) works in cooperation with the RWDS equipment drain subsystem. The PLDS drains are not individually monitored; however, because all other drains into the equipment drain system are manually initiated, unplanned changes in sump volume can be attributed to the PLD system.

In the BPDS, building drains are collected and routed to the appropriate sump. Each sump has a primary and an alternate pump. During operation, the primary waste water sump pump automatically starts on high level and stops on low level. Liquid waste is transferred to the two BPDS collection tanks. From there, waste is sent to the utility water system for offsite discharge. The chemical waste sump pumps do not automatically start on sump high level. Instead, a sump high level alarm is sent to the plant control system. This alarm requires operator action to transfer the liquid waste to the BPDS collection tanks or make arrangements for temporary storage in the backup collection tank. This is to allow a controlled metering of chemical waste into the discharge stream. Operator action is required to pump oily waste from the waste water sumps. The BPDS non-radioactive liquid wastes are transferred from the collection tanks to the discharge basin of the utility water system (UWS). The effluent from the UWS is continuously monitored for radiation level and release rate, the UWS radiation monitors are discussed in Section 11.5. Once started, continuous availability of the RWDS and BPDS is expected for the life of the plant.

During NPM startup, a major source of drain flow to BPDS is from auxiliary boiler operation.

During plant shutdown, manual equipment draining operations and flushing of equipment to the RWDS are performed. BPDS drain flows are not expected to change much during single module refueling shutdowns. A check of tank status determines whether the tanks should be pumped down in order to be ready for the next startup. Pumping of oily waste is performed as part of the shutdown process, as necessary. The BPDS supports continuous operation.

Off-normal RWDS operation involves an abnormally high inflow rate into the sump tanks. The high in-flow rate can be indicative of equipment draining operations, a ruptured pipe or piece of equipment, an abnormally high reactor pool leak, or activation of the fire suppression system. A high-high level condition starts the standby pump. A high inflow rate when no equipment draining activity or fire alarm is taking place would be investigated to determine the source.

Off-normal BPDS operation involves higher than normal drain flow rate (e.g., fire protection system sprinklers). Each of the two waste water sumps and CRB sump contain a fire water removal pump rated at maximum expected input. These pumps automatically start upon a high-high-high level signal and automatically stop upon falling below the high-high level set point. In the event of higher than normal drain flow rates, the waste water sump pumps cycle on and off more frequently. The two BPDS collection tank levels require monitoring of discharge tank contents as the tanks are filled.

Radiologically contaminated liquid input to BPDS is an off-normal condition mitigated by automated system functions. The BPDS process radiation monitors provide continuous indication to the main and waste management control rooms. If a high radiation condition is detected an alarm initiates in the main and waste management control rooms, the associated waste water sump pumps automatically shut down and transfer to manual control, and the discharge flow path to the BPDS collection tanks automatically isolate. The radiation monitoring for the BPDS is discussed in Section 9.3.3.5. To provide an early indication of primary to secondary leakage, the high alarm setpoint is chosen for the radiation monitor that is set sufficiently low to detect abnormal conditions without causing spurious alarms in the control room. In the event of loss of power or air the sump pump discharge valves fail in their current positions. If required, the discharge flow path of the associated waste water sump pumps can be opened to the appropriate LRWS waste tank and the sump pumps can be restored to automatic operation to facilitate processing radiologically contaminated water and system flushing.

The BPDS chemical waste water sump pumps require operator action to discharge tank contents. High chemical waste content may require arrangements for temporary storage in one of the collection tanks then metering the disposal to the outfall may be required.

9.3.3.3 Safety Evaluation

The RWDS and BPDS have no safety related or risk significant functions. The design and layout of these systems include provisions that ensure that a failure of the system will not adversely affect the functional performance of safety-related systems or components.

General Design Criterion 2 was considered in the design of the RWDS and BPDS. Consistent with GDC 2, the RWDS and BPDS are not provided with specific provisions related to protection against natural phenomena other than those portions of the systems located in Seismic Category I structures. Based on their safety classification, the RWDS and BPDS are designed as non-seismic (Seismic Category III). However, in areas where portions of these systems could interact adversely with Seismic Category I SSC during a safe shutdown earthquake, the RWDS and BPDS are designed as Seismic Category II per Section 3.2.1.2 using the guidance of Regulatory Guide (RG) 1.29. The RWDS and BPDS do not have direct connections to Seismic Category I piping systems that would invoke the seismic design requirements of Staff Regulatory Guidance C.2 of RG 1.29. The RWDS and BPDS seismic and quality group classifications are identified in Table 3.2-1.

Sump tanks located in the RXB and RWB that contain radiologically contaminated liquids (equipment drains) consist of stainless steel tanks located in equally-sized, stainless steel-lined sumps in the bottom floors of the buildings. The RXB is a Seismic Category I building and the RWB is a Seismic Category II building. Thus, even if the sump tanks were to fail as the result of an earthquake, the sumps (secondary containments) would still be intact and capable of containing the liquid waste, with no adverse interaction with safety-related or risk significant equipment.

The RWDS and BPDS do not require protection against external flooding as the plant site selection criteria places the maximum external flood level at one foot below grade.

General Design Criterion 4 was considered in the design of the RWDS and BPDS. Consistent with GDC 4, the design of the RWDS and BPDS provides protection of safety-related and risk-significant SSC from the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents. The design of the RWDS and BPDS ensures that safety-related equipment functions are not impacted by undue water accumulations within the plant. The internal flood analysis provided in Section 3.4.1 evaluates the potential flooding impact on SSC due to pipe breaks, equipment failures, and fire suppression water. The RWDS and BPDS are not safety-related, single-failure proof, or seismically designed. The flood analysis takes no credit for water removal by the RWDS or BPDS. In some areas of the RXB and CRB, the flood analysis identifies the need for implementing elevated equipment mounting details, waterproof design features, or watertight doors to minimize impact from water accumulation as described in Section 3.4. Implementation of the measures identified by the internal flood analysis ensures that safety-related equipment functions are not impacted by water accumulations within the plant.

The BPDS waste water drain tanks that serve the TGBs and the CRB sump contain fire water removal pumps rated for the design basis fire suppression system flow in the respective buildings. The subsystems operate automatically without the need for operator intervention. The design of the RWDS can help mitigate the consequences of flooding from internal sources, such as pipe breaks, tank leaks, discharge from fire suppression systems, and other potential flooding sources, by providing waste collection and transfer capability. The chemical waste collection sumps do not require fire water removal pumps, as the potential flow into these sumps from firefighting activities is less than the capacity of the chemical waste water sump pumps.

General Design Criterion 5 was considered in the design of the RWDS and BPDS. Consistent with GDC 5, although the RWDS and BPDS are shared by up to 12 NPMs, in the event of an accident in one NPM, the failure of these systems to perform their nonsafety-related functions does not prevent an orderly shutdown and cooldown of the remaining NPMs.

General Design Criterion 60 was considered in the design of the RWDS and BPDS. The RWDS and BPDS design features include adequate surge capacities to support maintenance activities and runoff from firefighting and decontamination activities. These systems are designed with radiation monitoring which includes functions to automatically terminate tank discharges. These design features control the release of radioactive materials in effluents during normal operations, including anticipated operational occurrences.

The design of the RWDS and BPDS considers “as low as reasonably achievable” and minimization of contamination guidelines. Consistent with 10 CFR 20.1101(b), the design of the RWDS and BPDS supports keeping radiation exposures ALARA. To maintain the radiation exposure to operating and maintenance personnel ALARA, the RWDS and BPDS are designed to facilitate maintenance, inspection, and testing in accordance with the guidance in Regulatory Guide (RG) 8.8.

The RWDS is designed to minimize the spread of contamination. All sump tanks are fabricated from austenitic stainless steel and are located in stainless steel-lined concrete sumps. The interstitial areas between the sump tanks and the sump liners are monitored for leaks. Equipment drains provide a segregated means of collecting clean reactor coolant to prevent the spread of contamination into floor drains. Flows into the BPDS from potentially contaminated systems are monitored for radioactivity. The capacity of BPDS sumps and tanks are sufficient to prevent overflow in the event of firefighting activities. These design features demonstrate compliance with 10 CFR 20.1406 as it relates to minimization of contamination of the facility.

The RWDS is designed to receive radiologically contaminated liquids and normally non-contaminated liquids including the RCCWS drains. Equipment, floor, chemical, and detergent drains are transferred to the LRWS for treatment, storage, and disposal. The normally non-contaminated liquid from the RCCWS drains may contain corrosion inhibitors and is segregated within the RWDS. Liquid from drains related to the RCCWS are monitored by a radiation monitor located on the RCCWS drain tank as described in Section 9.3.3.5 to alert the operators to an off-normal condition within the drain tank. In addition, the provision for Reactor Building RCCWS drain tank grab sampling is located on the Reactor Building RCCW drain tank pump minimum flow line to allow for tank recirculation to obtain a representative sample. Grab sampling provides the capability to analyze the Reactor Building RCCWS drain tank contents and ensure no radioactivity is present prior to return to the reactor component cooling system, and provides a secondary method of initial detection, if the related radiation monitor is not available. The normally non-contaminated liquid is recycled back to the RCCWS; if contamination is detected greater than pre-established thresholds, the liquid is transferred to the HCW collection tanks for treatment, storage, and disposal.

The RWDS is designed to preclude the transfer of contaminated fluids to a non-contaminated drainage system for disposal.

Potential sources of BPDS contamination include 1) a primary-to-secondary steam generator tube leak, which can arrive through the condensate polishers or leaking condensate, or 2) a leak in one of the NPM heatup heat exchangers into the high pressure auxiliary steam and into the auxiliary boiler system blowdown cooler discharge.

The BPDS inputs that could introduce radiologically contaminated liquids into the system are monitored for radiation as described in Section 9.3.3.5. If a high radiation condition is detected an alarm initiates in the main and waste management control rooms, the associated waste water sump pumps automatically shut down and transfer to manual control, and the discharge flow path to the BPDS collection tanks automatically isolate. System sampling provisions located on the discharge of the BPDS sump tank pumps allow the process fluid to be recirculated to ensure a representative sample. Process sampling permits the determination of process radionuclide content and serves as a redundant means of detecting process radioactivity in the event that radiological monitoring is unavailable. The tank is sampled to determine the proper disposition of the waste, and if required, the system can transfer the liquids to the LRWS. Upon completion of the transfer, the BPDS and the inflow lines have provisions for decontamination and can be placed back into normal service.

Vents of BPDS sumps with the potential to be contaminated use HEPA filters to reduce airborne particulate contamination. The BPDS uses double-walled lines with built-in leak detection capability in the piping between the TGB sumps to the LRWS. This feature ensures containment of potentially radiologically contaminated liquids, preventing the spread of contamination from sections of piping that are buried, consistent with the requirements of 10 CFR 20.1406.

9.3.3.4 Inspection and Testing

The RWDS and BPDS are designed to permit periodic inspection and testing of important components to verify their integrity and capability. Drainage piping is hydrostatically tested. Drain system piping that conveys potentially radiologically contaminated liquids is pressure tested in accordance with ASME B31.1 (Reference 9.3.3-1). The RWDS and BPDS functionality are demonstrated by continuous use during normal plant operation.

Section 14.2 discusses testing to verify component installation and initial operation as well as integrated system testing. Inspections, Tests, Analyses, and Acceptance Criteria are addressed in Section 14.3.

9.3.3.5 Instrumentation and Controls

The RWDS and BPDS can be controlled manually or automatically. Sumps and drain tanks that are part of the RWDS and BPDS are monitored for level.

Information associated with the RWDS and BPDS operation is shown in the MCR, WMCR and locally, including tank and sump levels, temperatures, and pressures. High-high RWDS level alarms and BPDS radiation alarms are actuated in the MCR, locally, and in the WMCR.

Dual sump pumps, a primary and an alternate, are provided for each of the RWDS and BPDS sumps. For all sumps but the chemical waste collection sumps, the primary pump starts on high-level and stops on low-level. On a high-high level signal, both pumps operate and an alarm signal notifies the operator. The chemical waste water sump pumps do not start automatically.

The RWDS Reactor Building RCCWS drain tank radiation monitor provides continuous main control room indication and alarm capability. To provide an early indication of leakage from radiologically contaminated systems to the clean RCCWS, the high radiation alarm setpoint is set as low as possible without causing spurious alarms in the main control room. The radiation monitoring for the RWDS is discussed in Section 11.5.

The following BPDS process radiation monitoring instrumentation is provided for system inputs that have the potential to be radiologically contaminated.

- A single adjacent-to-line radiation monitor is located on the line downstream of the ABS blowdown coolers for the high and low-pressure boilers, prior to entering the north waste water sump tank.
- A single in-line radiation monitor is located on the north condensate regeneration skid drain line to the north chemical waste collection sump tank.

- A single in-line radiation monitor is located on the south condensate regeneration skid drain line to the south chemical waste collection sump tank.
- A single in-line radiation monitor is located on the north turbine generator building floor drain line to the north waste water sump tank.
- A single in-line radiation monitor is located on the south turbine generator building floor drain line to the south waste water sump tank.

The BPDS process radiation monitors provide continuous indication to the main and waste management control rooms. If a high radiation condition is detected an alarm initiates in the main and waste management control rooms, the associated waste water sump pumps automatically shut down and transfer to manual control, and the discharge flow path to the BPDS collection tanks automatically isolate. The radiation monitoring for the BPDS is discussed in Section 11.5.

To provide an early indication of primary to secondary leakage, the high alarm setpoint is chosen for the radiation monitor that is set as low as possible without causing spurious alarms in the MCR and WMCR. In the event of loss of power or air the sump pump discharge valves fail in their current positions.

If required, the discharge flow path of the associated BPDS waste water sump pumps can be opened to the appropriate LRWS waste tank and the sump pumps can be restored to automatic operation to facilitate processing radiologically contaminated water and system flushing.

9.3.3.6 Reference

9.3.3-1 American Society of Mechanical Engineers, *Power Piping*, ASME Code for Pressure Piping, B31, ASME B31.1, New York, NY.

Table 9.3.3-1: Equipment and Floor Drainage System - Collection Areas

Balance-of-Plant Drain System
Auxiliary boiler building
The structure housing the auxiliary AC power source (AAPS)
Turbine Generator Building
Diesel Generator Buildings
Central Utility Building
Fire Water Pump Buildings
Chemical Treatment Buildings
Condensate Regeneration Skid
Control Building
CUB Reverse Osmosis Rejects
Radioactive Waste Drain System
Chemical and volume control system
Boron addition system
Reactor Building HVAC system
Liquid radioactive waste system
Gaseous radioactive waste system
Solid radioactive waste system
Radioactive Waste Building HVAC system
Spent fuel pool cooling system
Pool cleanup system
Reactor pool cooling system
Pool surge control system
Pool leakage detection system
Containment flooding and drain system
Process sampling system via the hot laboratory
Containment evacuation system
Reactor component cooling water system
Reactor Building floor drains
Radwaste Building floor drains
Annex Building floor drains

Figure 9.3.3-1: Radioactive Waste Drain System Diagram

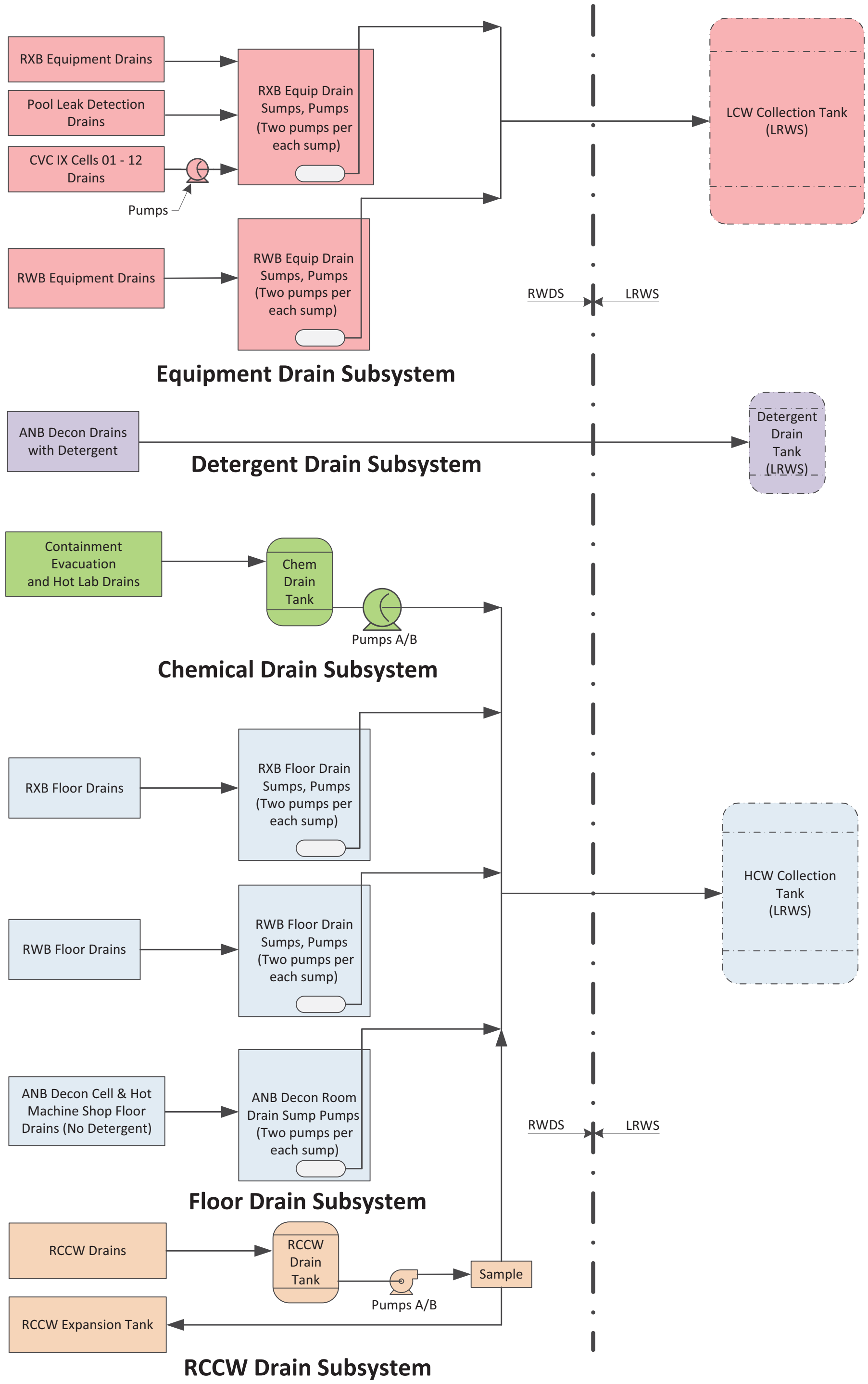
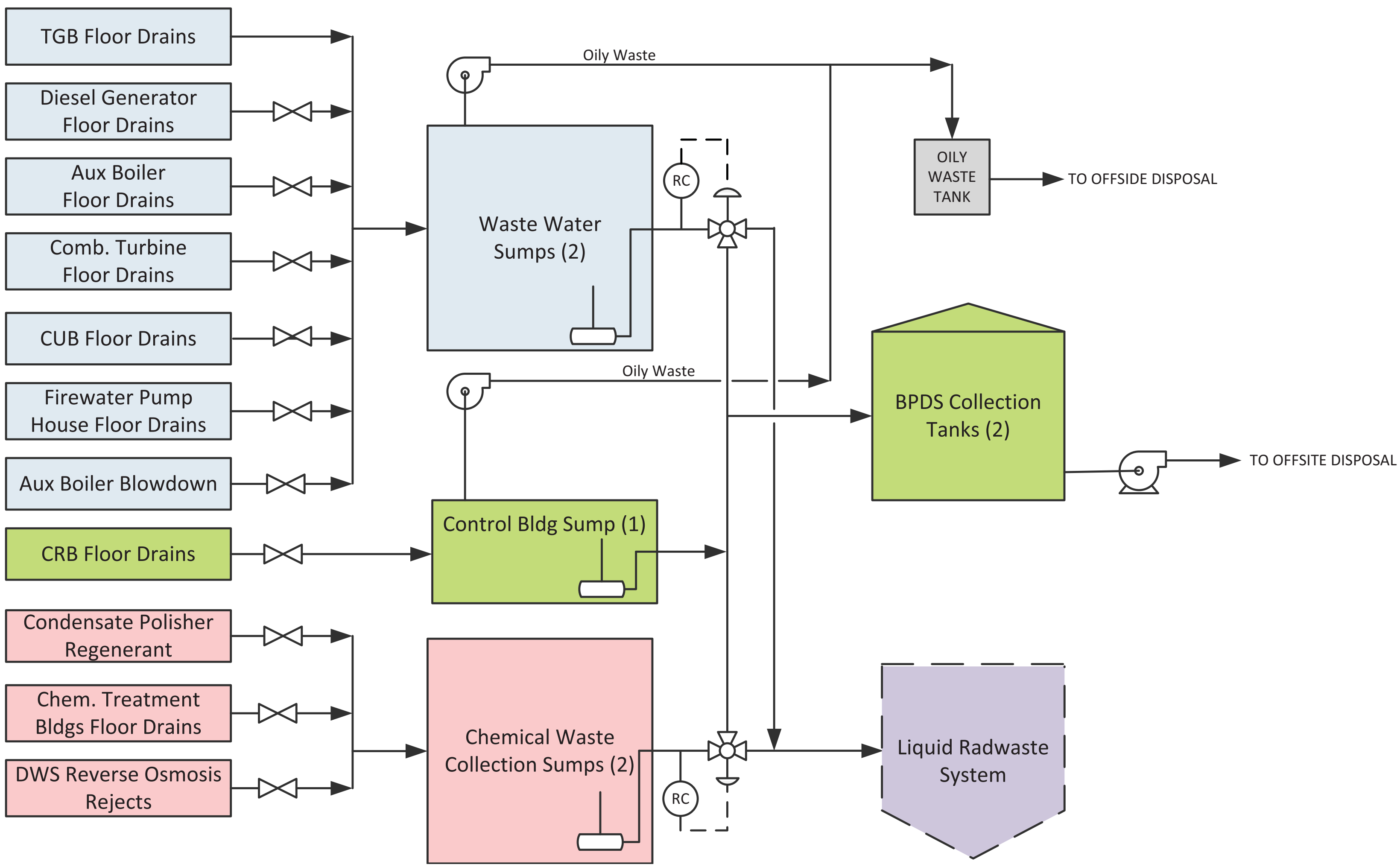


Figure 9.3.3-2: Balance-of-Plant Drain System Diagram



9.3.4 Chemical and Volume Control System

A chemical and volume control system (CVCS) is provided for each NuScale Power Module (NPM). The system purifies reactor coolant, manages chemistry of the coolant (including boron concentration), provides reactor coolant inventory makeup and letdown, and supplies spray flow to the pressurizer to reduce the reactor coolant system (RCS) pressure. A CVCS line from the reactor pressure vessel (RPV), separate from the primary CVCS circulation flow path, is provided for the removal of non-condensable gases which collect in the pressurizer vapor space. This line also permits supplying nitrogen to the RPV when utilizing a nitrogen bubble in the pressurizer vapor space during module startup.

The CVCS is used in combination with the module heatup system (MHS) during startup to raise reactor coolant temperature and to generate natural circulation flow in the RCS before nuclear heat addition. The MHS may also be used during shutdown to maintain RCS flow if decay heat is insufficient. Two MHS subsystems are provided for the plant with each subsystem serving up to six NPMs, one at a time. Figure 9.3.4-1 provides a simplified diagram of the CVCS during normal operation.

The boron addition system (BAS) is a shared system for up to 12 NPMs. The system prepares, stores, and transfers borated water for use by the CVCS or by the spent fuel pool cooling system (SFPCS) for adding boron to the spent fuel pool as needed. Figure 9.3.4-2 provides a system flow diagram of the BAS.

9.3.4.1 Design Bases

This section identifies the required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled for the CVCS, MHS and BAS. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

As described in Section 9.3.4.3, the CVCS, MHS, and BAS are not safety-related systems. However the CVCS is equipped with two automatic, safety-related, fail-closed, demineralized water isolation valves to ensure CVCS operation does not inadvertently cause a dilution of the reactor coolant system (RCS) boron concentration. Other important functions of the CVCS include providing the means for controlling RCS chemistry, monitoring for RCS leakage, and providing flow paths to the process sampling system (PSS) for normal sampling.

Consistent with General Design Criteria (GDC) 1, CVCS, MHS and BAS structures, systems, and components (SSC) are designed, fabricated, erected, and tested to appropriate quality standards such that their failure does not impact the function of other safety-related or risk significant systems. The safety-related CVCS demineralized water isolation valves and associated piping are Quality Group C per Regulatory Guide (RG) 1.26. The CVCS piping and components outboard of the containment isolation valves (CIVs) up to the next valve that is normally closed or capable of automatic closure are also Quality Group C. Other SSC are Quality Group D. The classifications of CVCS, MHS, and BAS components are discussed further in Section 3.2.

Consistent with GDC 2, safety-related chemical and volume control system SSC are not adversely affected by natural phenomena such as earthquakes, or floods. The safety-related CVCS demineralized water isolation valves and associated piping are designed Seismic Category I per Section 3.2.1.1 and RG 1.29. The CVCS piping and valves outboard of the CIVs up to the next valve that is normally closed or capable of automatic closure are also designed Seismic Category I. The remainder of the piping and components in the CVCS, and the MHS and BAS piping and components, are Seismic Category III unless SSC could adversely interact with Seismic Category I SSC during a safe shutdown earthquake, in which case the SSC are designed to Seismic Category II requirements per Section 3.2.1.2. The Seismic Category I Reactor Building (RXB) provides protection from external phenomena for safety-related CVCS equipment.

Consistent with GDC 3, structures, systems, and components shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. The safety-related CVCS demineralized water isolation valves are provided with protection from fire by the use of fire detection and suppression in the RXB rooms where the valves are located. Although these valves play no active role in achieving safe shutdown after a fire, their failure during a fire could prevent the achievement of safe shutdown by other systems. These valves are therefore treated as safe shutdown components under the fire protection program.

Consistent with GDC 4, the design of CVCS, MHS, and BAS provides protection of safety-related and risk-significant SSC from the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents. Safety-related CVCS components are designed to accommodate normal and abnormal expected and postulated accident scenarios and any dynamic effects to which they may be subjected.

GDC 5 was considered in the design of the CVCS, MHS and BAS. There is no sharing of the CVCS between NPMs. The two MHS subsystems are each shared between up to six NPMs, but support only one NPM at a time. Potential dilution effects related to MHS sharing are precluded by leak detection and isolation provisions that isolate the CVCS of a NPM being heated from those NPMs not being heated. The BAS is shared among up to 12 NPMs and has been appropriately sized and configured to ensure the sharing among NPMs does not preclude sufficient supply of borated water, when desired, to any individual NPM.

Consistent with GDC 10, the module protection system (MPS) is able to prevent or terminate a CVCS boron dilution event with appropriate margin to acceptable fuel design limits. See Section 15.4.6 for the evaluation of the boron dilution event.

GDC 13 was considered in the design of the CVCS, MHS and BAS. These systems do not have safety-related instrumentation. Instrumentation from other NPM systems are provided to the MPS which closes the CVCS demineralized water isolation valves to prevent or terminate a dilution event. The MPS is discussed in Section 7.0.

GDC 14 was considered in the design of the CVCS. Although not a safety-related function, the CVCS is provided with design features necessary to maintain reactor coolant chemistry within specified levels and thereby minimize the probability of corrosion-induced failure of reactor coolant pressure boundary components.

Consistent with GDC 21, redundant, in-series, fail-safe CVCS demineralized water isolation valves are provided, ensuring single failure proof isolation of the demineralized water supply to CVCS to prevent or terminate boron dilution events. The design of the CVCS supports full testing of these valves with the NPM at power.

Consistent with GDC 26, the CVCS and BAS operate together to control reactor coolant boron concentrations thereby providing a second means for reliably controlling the rate of reactivity changes resulting from planned, normal power changes, including xenon burnout, to assure acceptable fuel design limits are not exceeded. The CVCS also provides a secondary means of holding the reactor core subcritical under cold conditions.

PDC 27 was considered in the design of the CVCS and BAS. Due to the unique features of the NPM, the control rods alone, with no credit for boron from CVCS or the emergency core cooling system (ECCS), have sufficient reactivity control capability under postulated accident conditions with appropriate margin for stuck rods to assure that the capability to cool the core is maintained. See Section 4.3 for additional discussion of PDC 27.

Consistent with GDC 28, the potential rate and amount of reactivity insertion due to a CVCS dilution event is limited by the maximum CVCS injection rate and the closure of the demineralizer water supply isolation valves based on analytical limits. This ensures that no damage occurs to the reactor coolant pressure boundary or disturbs the reactor vessel internals to the extent that it affects the ability to cool the core. See Section 15.4.6 for the evaluation of the boron dilution event.

GDC 29 was considered in the design of the CVCS and BAS. There is no anticipated operational occurrence (AOO) or accident for which the CVCS is relied upon to add boron to the RCS. However, an inadvertent dilution of the RCS by the CVCS is considered an AOO. The MPS and the redundant, safety-related demineralized water isolation valves provide a high probability of accomplishing their safety function to prevent or terminate an inadvertent dilution event.

GDC 33 is not applicable to the NuScale Power Plant design because RCS makeup from CVCS is not relied upon to assure that specified acceptable fuel design limits are maintained in the event of postulated accidents. The NPM design preserves reactor coolant inventory by isolating containment (including CVCS) at safety setpoints. Accordingly, the NuScale design supports an exemption from GDC 33.

Consistent with GDC 60, the CVCS supports the capability to control the release of radioactive materials to the environment. Consistent with GDC 61, the CVCS and MHS are designed to provide confinement of radioactive material and to minimize the potential exposure to radioactive materials to the lowest practical levels.

GDC 64 was considered in the design of the CVCS and MHS. The CVCS and MHS do not have direct release paths to the environment. For normal operations, process fluid is passed in closed lines to the PSS, liquid radioactive waste system (LRWS), solid radioactive waste system (SRWS), or radioactive waste drain system (RWDS). The CVCS and MHS support the capability to monitor spaces (Section 12.3.4) containing components that contain radioactivity.

Consistent with 10 CFR 20.1406, “Minimization of contamination,” the CVCS and MHS include practicable design features to minimize contamination of the facility and environment, facilitate decommissioning and minimize the generation of radioactive waste including minimizing the potential for contamination of the normally clean BAS at the interface with the CVCS. These features are described in Section 12.3.5.

Consistent with 10 CFR 50.34(f)(2)(xxvi), CVCS is designed to have provisions for leakage detection and monitoring to minimize the leakage from those portions of CVCS outside of the containment that contain or may contain radioactive material following an accident.

Consistent with SECY-93-087, Item I.F, the design of the CVCS reduces the possibility of a LOCA outside containment.

9.3.4.2 System Description

9.3.4.2.1 General Description

Chemical and Volume Control System

A simplified diagram of the CVCS is shown in Figure 9.3.4-1. Major CVCS components and design parameter values are available in Table 9.3.4-1 and consist of:

- CVCS makeup pumps
- CVCS recirculation pumps
- CVCS regenerative heat exchanger
- CVCS non-regenerative heat exchanger
- CVCS Ion exchangers
- CVCS reactor coolant filters
- CVCS chemical mixing tank
- CVCS expansion tank
- CVCS makeup combining valve
- CVCS makeup and module isolation valves

Reactor coolant flow to the CVCS is discharged from the RCS downcomer. This discharge line penetrates the RPV above the core, reducing the chance that the RPV water level drains below the top of the core in the event of a penetration failure. The coolant may be partially diverted for sampling by PSS and then flows to the CVCS regenerative heat exchanger (RHX) where the temperature is reduced. Flow continues to the CVCS non-regenerative heat exchanger (NRHX) where the temperature is further reduced to a level compatible with the resin temperature requirements for the ion exchangers. After cooling in the NRHX, the flow is directed to the ion exchanger(s) and reactor coolant filters for cleanup. After flow exits the purification leg, flow may be partially diverted for sampling by PSS, sent to LRWS for letdown of RCS inventory or directed to the CVCS recirculation pumps for return to the RCS.

Makeup for reactor coolant is provided by operating the CVCS makeup pumps. Selecting an intermediate position of the three-way combining valve to the demineralized water system (DWS) or BAS upstream of the CVCS makeup pumps results in a mixture of borated and unborated makeup. The desired boron concentration of makeup can be achieved based on the flow proportions of the DWS and BAS supply lines with known boron concentrations. Recycled, degassed reactor coolant from the LRWS can also be added back to the CVCS by a supply line upstream of the makeup pumps. The CVCS makeup pumps increase the pressure of the makeup to match the pressure of the CVCS injection line downstream of the recirculation pumps. The injection line is routed to the RHX where the makeup and recirculation flow recovers heat from the letdown stream before being supplied to the RPV. The CVCS injection line is routed to the RCS riser above the core and to the pressurizer spray line.

The CVCS includes a RPV high point degasification line, separate from the primary CVCS circulation flow path, to provide for the removal of non-condensable gases which collect in the pressurizer vapor space. A nitrogen distribution system (NDS) connection is provided on the RPV high point degasification line to supply pressurized nitrogen to the pressurizer during module startup when a steam volume is not yet established in the pressurizer. The pressurized gas provides sufficient head for operation of the CVCS recirculation pumps and a compressible gas space for pressure control of the reactor vessel during startup.

The low voltage AC distribution system (ELVS) provides electrical power to the CVCS for the makeup pumps, the recirculation pumps, and the motor operated valves. The instrument air system (IAS) provides compressed air for CVCS air operated valves. The actuation of the demineralized water supply isolation valves in the CVCS makeup line is achieved via the MPS removing power to actuator solenoids.

See Section 1.2 for drawings depicting the locations of CVCS equipment within the RXB.

Module Heatup System

The major components of the MHS are the MHS heat exchangers. There are two MHS subsystems provided for use in combination with the CVCS to heat reactor coolant for a NPM during startup until nuclear heat is available. MHS heating combined with simultaneous feedwater heat removal in the steam generators drives RCS flow during the heatup. MHS subsystem 0A services NPMs 1-6 and subsystem 0B services NPMs 7-12. Each MHS subsystem contains two heat exchangers. The CVCS recirculation pumps are used to supply reactor coolant through the MHS and then to the respective NPM. Each MHS subsystem provides heat to only one NPM at a time. The MHS may also be used during shutdown to maintain RCS flow if decay heat is insufficient.

The plant control system (PCS) provides monitoring, alarms, controls and instrumentation power for MHS equipment. The auxiliary boiler system (ABS) described in Section 10.4.10, supplies steam to the MHS heat exchangers.

Boron Addition System

The BAS mixes and stores borated water batches for use as reactor coolant makeup by the CVCS, or as makeup pool water by the SFPCS.

The BAS consists of the following components:

- BAS boric acid hopper
- BAS boric acid batch tank
- BAS boric acid batch tank mixer
- BAS boric acid storage tank
- BAS boric acid transfer pump
- BAS boric acid supply pumps

The BAS equipment and valves are located in the RXB. BAS piping extends from the supply pumps to each CVCS supporting the NPMs. Figure 9.3.4-2 provides a simplified diagram of the BAS. Major BAS components and design parameter values are available in Table 9.3.4-2.

The BAS provides a sufficient volume of borated water to the CVCS over the fuel cycle and during shutdown and startup operations. The design of the BAS provides a sufficient combined supply of boric acid in the boric acid storage tank (BAST) and in the batch tank. The BAS storage capacity can support a 12-NPM shutdown, with the following limiting assumptions:

- One NPM is at end of the fuel cycle boron concentration and is being borated to refueling boron concentration (70 degrees Fahrenheit, k_{eff} 0.95).
- One NPM is at end of the fuel cycle boron concentration with the worst control rod stuck out and is being borated to cold conditions (70 degrees Fahrenheit, k_{eff} 0.98).
- The remaining 10 reactors have initial boron concentrations that are based on distributed points through a fuel cycle since the reactors are expected to be refueled at uniform time intervals. The reactors are then shutdown with all rods inserted and cooled to 100 degrees Fahrenheit while maintaining pressurizer level and the initial boron concentration in each reactor.

The BAS includes one batch tank and one storage tank. The tank storage capacities provide operational flexibility in the preparation of new batches while maintaining borated water in reserve. There is no safety requirement to maintain a specific quantity of borated water in reserve, but the normal inventory of borated water in the BAS is managed to maintain sufficient quantity at a minimum concentration of 2000 ppm boron to ensure the ability to support a 12-NPM shutdown within the previously described limitations.

The BAS is located inside the RXB, which is maintained at a minimum temperature of 50 degrees Fahrenheit (refer to Table 9.4.2-2). The maximum boron concentration in the BAS is 5600 ppm, which corresponds to the solubility limit of boric acid at approximately 45 degrees Fahrenheit. Therefore, the system does not require additional heating to prevent precipitation. The batch tank suction line is designed with an inlet screen to prevent undissolved solids from entering the system.

9.3.4.2.2 Component Descriptions

Major CVCS, MHS and BAS components and design parameter values are available in Table 9.3.4-1 and Table 9.3.4-2.

Chemical and Volume Control System Makeup Pumps

The CVCS has two variable speed makeup pumps that supply the RCS with makeup coolant and control RCS boron concentration by injecting borated water or demineralized water. The CVCS makeup pumps are positive displacement type and provide the high differential pressure required for makeup to the RCS, and the low flow required. One pump is operated at a time with the other pump in standby. Check valves and relief valves are provided on the discharge of each pump to prevent reverse flow and protect against over-pressurization. Pulsation dampeners are also provided on the discharge of each makeup pump to reduce pressure pulsation effects of the positive displacement pumps.

Chemical and Volume Control System Recirculation Pumps

The CVCS includes two variable speed canned-motor centrifugal recirculation pumps which are responsible for circulating reactor coolant through the purification equipment and to the MHS heat exchangers during startup. The pumps operate at full RCS pressure and normally at lower temperatures due to NRHX cooling. They operate at higher temperatures using the NRHX bypass during startup. During normal recirculation, a single pump provides recirculation flow with the other pump in standby. Check valves are included at the pump outlets to prevent coolant back flow to the purification equipment. Connections are provided to the RWDS for pump drainage.

Chemical and Volume Control System Regenerative Heat Exchanger

A regenerative heat exchanger (RHX) assembly is provided for each CVCS. The regenerative heat exchanger assembly consists of four shell and tube type heat exchangers with high temperature NPM discharge on the tube side and the lower temperature injection flow on the shell side. The heat exchanger is sized to maximize thermal efficiency of the CVCS during normal purification conditions with consideration of mass flow imbalances encountered during makeup and letdown operations. Vent and drain connections to the RWDS are provided for both the shell and the tube sides of the heat exchanger.

Chemical and Volume Control System Non-regenerative Heat Exchanger

Each CVCS is equipped with a shell and U-tube type non-regenerative heat exchanger (NRHX) that provides the second stage of cooling by decreasing the temperature of coolant entering the purification equipment to a level compatible with the ion exchange resin. The temperature of the coolant exiting the CVCS RHX is decreased in the CVCS NRHX tubes through transfer of heat to the reactor component cooling water system (RCCWS), which provides the shell side cooling water.

To minimize reactor coolant heat loss for purification, a control valve adjusts RCCWS supply to the NRHX based on the outlet temperature of the CVCS. Some or all of the CVCS letdown flow can bypass the NRHX and purification equipment to accommodate higher CVCS circulation flow rates and minimize heat loss during module heatup using the MHS.

A pressure relief valve on the shell side of the heat exchanger protects against over-pressurization and discharges to the RWDS. Vent and drain connections to the RWDS are provided for both the shell and the tube sides of the heat exchanger.

Chemical and Volume Control System Ion Exchangers and Purification Equipment

Four ion exchanger vessels (two mixed bed, one auxiliary, and one cation bed) are provided for CVCS purification and chemistry control of reactor coolant. CVCS mixed bed ion exchangers A and B are redundant vessels which are normally filled with resin saturated with lithium and boron. One mixed bed ion exchanger is normally in service and the other is in standby. These ion exchangers can be operated one at a time or in parallel, but not in series. CVCS flow can be routed through the cation bed ion exchanger, usually in series with the inservice mixed bed ion exchanger, to remove lithium for pH reduction, as needed. The auxiliary ion exchanger provides flexibility to maximize resin use and to function as an alternate method of boron removal near the end of the fuel cycle instead of using increased makeup and letdown quantities to achieve the same boron removal. A bypass line is provided to divert flow around the ion exchangers on a high temperature signal from NRHX outlet instrumentation to protect the ion exchanger resins from damage. The ion exchangers reside in concrete shielded cubicles.

The CVCS ion exchangers are provided with piping and valves to support regular resin sluicing and flushing. Spent resins are discharged to the SRWS. Two CVCS resin traps (strainers) in parallel are provided downstream of the ion exchangers to catch escaped resin beads. Vent and drain connections to the RWDS are provided for both traps. Connections to the PSS are provided downstream of the ion exchangers and reactor coolant filters for purification performance monitoring to conform with ALARA program principles. Each of the CVCS ion exchangers and resin traps includes differential pressure measurement to identify the need for maintenance or operator action.

Chemical and Volume Control System Reactor Coolant Filters

In addition to the contaminants and particulates filtered by ion exchanger resin, two CVCS reactor coolant filters in parallel are provided to further purify the reactor coolant. Each of these filters includes differential pressure measurement to identify the need for maintenance or operator action. Pleated media cartridge filters are used to filter reactor coolant suspended solids. The filters are provided with permanent radiation shielding to minimize occupational doses to ALARA.

Chemical and Volume Control System Chemical Mixing Tank

The CVCS chemical mixing tank is provided upstream of the makeup pumps for adding solutions to the RCS. The solutions include lithium hydroxide for pH control, zinc for dose reduction and to reduce stress corrosion on system components, and hydrazine to scavenge and reduce oxygen at low temperatures to the required level during startup. Hydrogen peroxide is also added by the mixing tank for hydrogen scavenging and RCS oxygenation for crud burst initiation during shutdown.

Chemical and Volume Control System Expansion Tank

The CVCS expansion tank is provided for pressure control during operation of the CVCS when it is isolated from the NPM, in module bypass mode. The module bypass mode of the CVCS is to support maintenance and testing of the system during outages of the supported NPM or to adjust fluid chemistry prior to opening the module isolation valves to the RCS. The expansion tank is pressurized when in use to provide the required net positive suction head to the recirculation pumps. The size of the expansion tank is sufficient to accommodate volume changes due to moderate temperature changes at low pressures. The expansion tank is provided with a relief valve to protect against over-pressurization, since the tank has a lower design pressure than other CVCS recirculation equipment. In addition, the tank is provided with double isolation valves with pressure indication and a drain valve in between.

Chemical and Volume Control System Makeup Combining Valve

The CVCS modifies the boron concentration of the RCS during normal operation by utilizing the makeup pumps to add makeup fluid with higher or lower boron concentration than the RCS. Reactor coolant makeup can be supplied with demineralized water from the DWS or with borated water from the BAS. A three-way combining valve is used to select the makeup fluid source of demineralized water, borated water, or a mixture of the two using an intermediate valve position. The valve is used in combination with flow indications on the DWS and BAS supply lines to control and verify that the desired proportions of borated and demineralized water are supplied to the CVCS makeup pump(s).

Chemical and Volume Control System Makeup and Module Isolation Valves

Two safety-related CVCS demineralized water supply isolation valves in series are installed in the common DWS/LRWS makeup line to the CVCS makeup pumps. The valves close automatically on a MPS signal to prevent or terminate an inadvertent boron dilution event.

Two CVCS module isolation valves are provided for each NPM, one on the CVCS injection line to the RCS and one on the CVCS suction line from the RCS. These valves can be closed to allow bypass of the NPM and to place the CVCS in the off-line recirculation mode of operation. These valves also receive an automatic isolation signal when leak detection instrumentation detects leakage above the setpoint in the CVCS or PSS.

Module Heatup Heat Exchangers

Two heat exchangers are provided in parallel for the heatup of reactor coolant at startup for each of the two MHS subsystems, which are shared between NPMs. The MHS heat addition induces natural circulation in the NPM at startup due to the CVCS injection location in the RPV main riser and suction/discharge location in the downcomer. RCS flow is sustained when reactor coolant is simultaneously heated by MHS and cooled by feedwater in the steam generators. Double isolation valves with pressure indication and a drain valve in between are provided at the interface of each CVCS with the MHS to detect and troubleshoot CVCS to MHS inter-system leakage.

Boron Addition System Boric Acid Hopper

The BAS boric acid hopper receives boric acid powder and delivers it into the top of the batch tank. Instrumentation and controls are provided for measuring the correct amount for the desired solution. The hopper measures weight change of the hopper inventory to accurately dispense the desired amount of powder for the batch being produced. The boric acid hopper is a skid-mounted assembly including super-sack or drum handling equipment, a hopper to receive the powder, equipment to de-lump and fluidize the powder, and a feeding mechanism.

Boron Addition System Boric Acid Batch Tank

The BAS boric acid batch tank is used to produce borated water from dry boric acid powder delivered by the hopper and demineralized water. The tank is outfitted with a tank mixer, discussed below, to facilitate complete dissolution of the acid, and instrumentation for control and monitoring of tank level. Viewing ports are provided near the bottom of the batch tank to allow visual inspection of the bottom of the tank and the screen.

Boron Addition System Boric Acid Batch Tank Mixer

A motor driven BAS boric acid batch tank impeller mixer is mounted to the batch tank to completely and uniformly dissolve boric acid in demineralized water.

Boron Addition System Boric Acid Transfer Pump

The BAS boric acid transfer pump recirculates the solution of borated water in the batch tank to facilitate mixing and accurate sampling and transfers mixed solutions of borated water from the batch tank to the storage tank.

Boron Addition System Boric Acid Storage Tank

One BAST is provided to store borated water for use by the CVCS and SFPCS. The BAST and batch tank capacities are conservatively sized and include sufficient quantity to support a 12 NPM shutdown with conservative RCS boron concentration requirements. The tank is equipped with instrumentation to monitor level locally and in the MCR.

Boron Addition System Boric Acid Supply Pumps

Two BAS boric acid supply pumps are provided to supply borated water to the CVCS and SFPCS. The pumps normally supply borated water from the BAST; however the system is designed to allow the pumps to draw from either the BAST or the batch tank. The pumps can also be used to recirculate the inventory of the BAST or transfer inventory from the batch tank to the BAST.

9.3.4.2.3 System Operation

The CVCS is used during normal operations except for refueling when the NPM is disconnected from the CVCS. The CVCS is used to establish the boron concentration necessary to make mode changes and to modulate reactor power. The CVCS has sufficient makeup and letdown capacity to supply borated water to the RCS and maintain RCS water inventory within the allowable pressurizer level range for normal modes of operation.

The MHS design precludes boron dilution via intersystem leakage by providing double isolation valves with drains and pressure monitoring between the isolation valves. The normal operating mode of the MHS is reactor startup. During times when the MHS is not required for service the system is isolated from the CVCS by the two isolation valves on each supply and return line and monitored for leakage. The fail-closed double isolation valves between each MHS to CVCS interface are de-energized when the MHS is not in use for a NPM.

Borated water supply from the BAS to the CVCS, then into the RCS, can be used to add negative reactivity to the core during normal operations. The boron concentration is increased by discharging reactor coolant to the LRWS while making up coolant with borated water from the BAS.

Chemical and Volume Control System Normal Operations

The normal modes of operation for the CVCS are as follows:

- reactor startup using MHS
- coolant purification

- chemistry control
- chemical shim adjustment
- volume control
- pressurizer spray
- pressurizer venting

These CVCS normal operating modes can be summarized as reactor startup mode and chemical and volume control mode. Reactor startup mode using the CVCS and MHS is utilized when the decay heat from the core is inadequate to heat the coolant to startup temperatures or inadequate to generate the minimum required RCS flow. The chemical and volume control mode is responsible for purifying the reactor coolant, adjusting reactor coolant chemistry (including boron concentration), providing makeup and letdown for coolant volume changes, and providing pressurizer spray flow.

<u>Reactor Startup Using Module Heatup System</u>

CVCS startup requires that valves are properly aligned and lines and equipment are water solid. The pressurizer is pressurized with nitrogen using the RPV high point degasification line to provide the necessary net positive suction head for the recirculation pumps.

To start the MHS, one or both CVCS recirculation pumps must be operating. The MHS is placed in service by opening the two supply and return isolation valves which normally separate the MHS from the CVCS and by closing the MHS diverting valve. Auxiliary boiler system steam is supplied to the module heatup heat exchangers at pressure less than or equal to CVCS pressure.

The MHS heats the RCS to assist in developing natural circulation through the core prior to nuclear heat addition. The action of injecting high temperature water into the riser compared to the cooler water in the downcomer of the RPV initiates RCS flow. The heat addition of the module heatup heat exchangers is also sufficient to initiate heat removal via feedwater in the steam generators and maintain the required RCS flow needed to transition to nuclear heat.

Early in the heatup, a steam bubble is drawn in the pressurizer to replace the nitrogen gas used to pressurize the RCS to start CVCS. The RPV high point degasification line is used to vent the nitrogen to the LRWS along with some amount of vaporized reactor coolant.

During startup, the combined flow of two CVCS recirculation pumps operating in parallel creates sufficient differential pressure between the ECCS tap on the injection line (inside containment) and the RCS pressure, to close the main ECCS valves. The ECCS is discussed in Section 6.3.

Coolant Purification

Reactor coolant system purification is achieved by ion exchangers and reactor coolant filters in the CVCS. A single CVCS recirculation pump operates for normal continuous reactor coolant purification in the chemical and volume control mode. Normally the purification line is configured with one mixed bed ion exchanger, one resin trap and one reactor coolant filter in service. Flow is blocked by inlet isolation valves to other standby purification components, but they are kept filled and pressurized so that they are ready for service if needed. The standby mixed bed ion exchanger may be placed in service if the operating ion exchanger resin is exhausted or to address other operational conditions. The cation bed ion exchanger is typically bypassed, but may be placed in service to remove lithium and control the concentrations of cesium-137 and other isotopes generated by potential fuel leaks. Purification performance is determined through continuous or periodic sampling by PSS. High differential pressures across purification components or reduced purification performance indicates the need to place the standby purification components into service.

Chemistry Control

The pH of the reactor coolant is increased by adding solutions of lithium hydroxide to the chemical mixing tank in the makeup line. The desired amount of lithium hydroxide is placed in the tank, the tank is filled with demineralized water and makeup flow is then initiated to inject the solution. The pH of the reactor coolant is decreased by removing lithium ions, which is achieved by routing purification flow temporarily through the cation bed ion exchanger.

Hydrazine is added early in the startup process to scavenge dissolved oxygen to below the levels described in Section 5.2.3. Hydrazine solutions are prepared in the chemical mixing tank and injected with the makeup pumps according to the same procedure described for pH control. For oxygen control during normal reactor operation, gaseous hydrogen is introduced from a compressed hydrogen source. Hydrogen addition quantities are verified by monitoring pressure of the compressed hydrogen source. The hydrogen injection pressure regulating valve is set to the appropriate value to ensure an appropriate rate of hydrogen addition. Argon from a compressed source may also be added to support primary-to-secondary leak rate determinations utilizing the same connection to CVCS as that use for hydrogen addition.

To reduce radiation fields and reduce stress corrosion crack initiation rates, zinc is added at the beginning of the fuel cycle and is maintained by continuous injection or by further additions using the chemical mixing tank to replace the zinc that is removed by the ion exchangers. Zinc is added before high temperatures are reached during the startup of the reactor to ensure that it is well incorporated into the oxide films of the wetted surfaces.

Reactor coolant chemistry is monitored through continuous or grab sample analysis by the PSS. Reactor coolant chemistry levels may decrease throughout the fuel cycle due to sampling or makeup and letdown required for routine boron dilutions. Periodic chemical additions may be required throughout the fuel cycle.

Mechanical gas removal from reactor coolant is performed using LRWS and gaseous radioactive waste system (GRWS) equipment. Mechanical degasification is achieved by letting down reactor coolant through the normal LRWS letdown path, then LRWS and GRWS removes the unwanted gases. Makeup of the reactor coolant from the DWS, BAS or degassed LRWS recycle supply is used to maintain reactor coolant inventory. This process can be used to effectively reduce the hydrogen concentration of reactor coolant at shutdown prior to NPM disassembly. The RPV high point degasification line can also be used to aid in mechanical gas removal. It is the primary method for removing non-condensable gases that accumulate in the pressurizer gas/vapor space. These gases consist of fission gases and gases introduced by system ingress.

Chemical Shim Adjustment

The CVCS adjusts the boron concentration in the RCS to compensate for changes in reactivity over the fuel cycle. It also provides the required boration for normal shutdown. To increase the boron concentration, the makeup pumps inject borated water from the BAS and letdown flow is discharged to the LRWS.

The boron concentration of the RCS is decreased by adding demineralized water from the DWS with the makeup pumps while discharging coolant to the LRWS. Routine incremental boron concentration dilution of the RCS by the CVCS is performed by operator action or permission. A dilution rate and quantity, which is calculated and shown to preserve shutdown margin, is proposed by operators or the module control system (MCS) to achieve a final RCS boron concentration in a reasonable time period based on the initial concentration. Near the end of the fuel cycle, a CVCS ion exchanger filled with resin which is not saturated with boron can also be used to lower the RCS boron concentration. This reduces the need for feed and bleed dilution events which require increasingly greater volumes of makeup and letdown fluid near the end of the fuel cycle.

Volume Control

During normal reactor operation, the CVCS is utilized for maintaining the required volume of coolant in the NPM as indicated by the pressurizer liquid level instrumentation. The pressurizer level is maintained in its operating band by operator permissive action or manual operator action to initiate makeup or letdown to the LRWS. Automatic letdown to LRWS is also provided but automatic makeup is not provided to avoid the masking of leaks. A separate CVCS volume control tank is not utilized in the design and there are no CVCS holdup tanks as discussed in NRC IE Bulletin 80-05.

Pressurizer Spray

The CVCS supplies flow to the pressurizer spray nozzles to decrease pressurizer pressure. If pressurizer pressure rises beyond the normal operating band, the spray valve is opened to supply the spray nozzles with subcooled coolant. Additional discussion of pressurizer spray control is included in Section 9.3.4.5 under CVCS Controls.

Pressurizer Venting

During normal operations, pressurizer venting using the RPV high point degasification may be performed periodically if non-condensable gas build-up is significant enough to reduce the effectiveness of pressurizer spray or if required for RCS chemistry control. Pressurizer venting is also used during NPM shutdown to remove non-condensable gases and accelerate hydrogen removal from the RCS.

Boron Addition System Normal Operations

The BAS performs multiple functions during normal operations including batching, mixture transfer, storage, supply, and tank sampling.

Batching

The batch tank is placed in batch mode by the PCS to prepare borated water. The PCS allows the operator to manually perform the steps necessary to prepare a batch of borated water and prevent the opening of valves that could allow premature transfer of the batch. The mode logic of the PCS assists the operator in controlling the system to properly test and accept borated water for release and use from the batch tank.

The operator combines the desired ratio of demineralized water and dry boric acid powder using the PCS to automatically or manually control the batch mixture. The batch can then be mixed using the batch tank mixer and tank recirculation using the boric acid transfer pump. After the batch is mixed it is sampled to verify that the desired boron concentration has been achieved. Based on the sample results, the batch may be approved for use or rejected and either reworked or discarded to the LRWS.

Mixture Transfer and Storage

The batch tank is placed in transfer mode to transfer borated water from the batch tank to the BAST, or supply it to the BAS supply pumps. In this mode the PCS allows the operator to open the valves that allow the borated water to be transferred for use and prevents the operation of the equipment that adds water or dry boric acid powder to the batch tank.

Transferring borated water from the batch tank to the BAST is normally performed by setting the boric acid transfer pump to maintain the BAST nearly full. In automatic operation, the boric acid transfer pump starts and stops based on high- and low-levels in the BAST.

Supply

Supplying borated water to the CVCS is normally performed by setting the boric acid supply pumps into an automatic supply mode. Operations selects this mode through the PCS, and the PCS then controls the required system components to maintain the supply pressure of borated water in the distribution piping whenever there is a demand signal sent from any CVCS.

Operations transfers borated water to the spent fuel pool by establishing a target volume to be transferred in the PCS and then aligning the required valves to direct flow to the spent fuel pool. The PCS terminates the flow when the target volume has been transferred to the pool.

Transferring a mixture to the LRWS may be required if the batch is not suitable for use and must be discarded, or if it is desirable to transfer borated water to the LRWS for some other purpose. The operation requires opening the manual valve from the BAS to the LRWS and uses the PCS to direct the required flow to LRWS.

Tank Sampling

The discharge of the boric acid transfer pump and the boric acid supply pumps include a sample port to facilitate sampling of the mixture in the BAS. Sampling and analysis is required at specific points during the performance of BAS operations to periodically verify that the mixture content meets the required specification. BAS sampling is accomplished by circulating fluid through the BAS piping to ensure that the sample is representative of the mixture in the batch tank or BAST. A sample is then taken from the applicable sample port.

Chemical and Volume Control System Off-Normal Operations

CVCS Leakage Detection High-High Differential Flow

The CVCS provides automated functions to detect and mitigate system leakage. Mass flow within the CVCS is sensed in the system normal operating flow paths. The module injection, pressurizer spray, and module discharge possess flow transmitters, as do the makeup and letdown flow paths. Sensed flow at these locations is compared to detect and quantify system differential flow, providing indication of CVCS component and piping leakage. A system differential flow greater than the high setpoint generates an alarm in the main control room. A system differential flow greater than the high-high setpoint generates an alarm in the main control room, and initiates closure of the module injection isolation valve and the module discharge isolation valve.

Module Heating System to Auxiliary Boiler System Leakage

A radiation monitor is located on each of the ABS exits from MHS heat exchangers 0A and 0B. If radiation is detected in the ABS greater than the high radiation alarm setpoint, the system initiates a MCR alarm notifying the operators to investigate and initiate mitigating actions. If radiation is detected in the ABS that is greater than the high-high radiation isolation setpoint or if radiation monitor power is lost, the system initiates a control room alarm and initiates closure of the CVCS isolation valves for the affected MHS heat exchanger. The radiation monitors associated with this automated system function are discussed in Section 11.5.

Module Heating System Malfunction

During reactor startup, the MHS heats CVCS water so that relatively warm water is injected in the reactor vessel riser. This water is warmer than water in the downcomer, which results in flow through the core via natural circulation. From this condition core flow is increased and sustained using feedwater heat removal in conjunction with the MHS. However, a failure in the MHS could result in cold water injection to the riser, which could lead to flow stagnation or flow reversal. If the reactor is in a startup, very low power condition, loss of normal startup flow is undesirable. As a preventive measure, the MPS provides signals to close the CVCS containment isolation valves (injection line, spray line, and discharge line) if RCS flow is below the low-low-flow setpoint for a designated period of time and the reactor is tripped. An override is provided so that injection may be re-initiated when needed.

<u>CNV Isolation of the CVCS</u>

The safety-related containment isolation valves (CIV) to the CVCS automatically isolate when specified setpoints for critical parameters are exceeded to ensure that reactor coolant system parameters are maintained within analytical limits and to establish a leak-tight barrier to prevent the uncontrolled release of radioactive materials to the environment. The CIVs to the CVCS automatically close upon any of the following signals provided from the module protection system (MPS) instrument and control platform: high pressurizer level, low pressurizer pressure, high containment pressure, low-low pressurizer level, and low-low RCS flow, as discussed in Section 6.2.

<u>Inadvertent Boron Dilution Event</u>

The CVCS has automated features that limit the amount and rate of reactivity increase due to an inadvertent boron dilution event. To limit and mitigate inadvertent dilution events, the CVCS incorporates two redundant safety-related demineralized supply isolation valves. The valves automatically close upon any of the following signals provided from the module protection system (MPS) instrument and control platform: reactor trip system (RTS) actuation, high subcritical multiplication, or low reactor coolant system (RCS) flow.

<u>Process Sampling System Continuous Sample High Radioactivity</u>

To provide CVCS process monitoring and worker protection, a radiation monitor is provided on the CVCS suction line from the reactor coolant system, upstream of the regenerative heat exchanger. A detected high radiation condition or loss of power to the radiation monitor initiates closure of the normally open CVCS discharge process sampling system (PSS) isolation valve, and initiates an alarm in the main control room and the related PSS panel. The radiation monitors associated with this automated system function are discussed in Section 11.5.

<u>High-High Non-regenerative Heat Exchanger Outlet Temperature</u>

The CVCS ion exchange beds are protected from high process liquid temperature. If process temperature on the non-regenerative heat exchanger outlet is greater than the high setpoint, the system generates an alarm in the main control room. If process temperature exceeds the high-high setpoint, the system generates an alarm in the main control room and flow is diverted from the ion exchange bed inlet header, and the ion exchange bed inlet valves close.

Low Regenerative Heat Exchanger Outlet Temperature

The CVCS provides an alarm function to alert the operator to system conditions that could induce potentially adverse thermal fatigue to nuclear power module and reactor components due to low temperature process fluid returning from the CVCS. If process temperature on the regenerative heat exchanger outlet is less than the low setpoint, the system generates an alarm in the main control room. The alarm notifies the operators to investigate and initiate mitigating actions.

Post-accident Nitrogen Supply to the NPM

The CVCS RPV high point degasification line can provide pressurized nitrogen to the NPM during post-accident conditions. Solenoid operated valves supplied by backup electrical power are used in the CVCS flow path from the nitrogen distribution system (NDS) to the CNV isolation valves for the reactor pressure vessel (RPV) high point degasification line. The CVCS valves that support this function have isolation override capability to permit use of this flow path during post-accident conditions.

Reactor Coolant System Makeup with a Complete Loss of Normal AC Power

The CVCS makeup pumps are provided with backup power via the backup power supply system (BPSS), described in Section 8.3.1, to provide a defense-in-depth means of adding reactor coolant to the RCS during a loss of normal AC electrical power. The three-way combining valve may require manual manipulation to supply the CVCS makeup pumps with either BAS or DWS inventory. If the CIVs have been actuated to their closed position, an injection path is re-established through containment by opening the required valves at the containment vessel penetrations.

In the event of loss of normal AC electrical power, the design capacity of the backup power supply system with respect to CVCS and BAS equipment is to supply power to any single CVCS makeup pump, one BAS supply pump and one DWS supply pump. This provides CVCS with the capability to supply high pressure makeup fluid to any one NPM at a time through the normal injection and spray paths if required for use in a beyond design basis event.

Boron Addition System Off-Normal Operations

Off-normal operation of the BAS is required when failure or maintenance of SSC disrupts normal system operations. The BAS is designed with features to provide operational flexibility when responding to off-normal events. These features include the BAST bypass line, the ability to manually control actuated components through the PCS, and manual valves to isolate components or direct flow in the system.

The BAST bypass line makes it possible for the boric acid supply pumps to supply borated water from the batch tank directly to CVCS or transfer it into the BAST via the storage tank recirculation line. The bypass line also allows mixture in the BAST to be pumped back into the batch tank, if needed.

9.3.4.3 Safety Evaluation

The CVCS and BAS operate together to satisfy GDC 26 as the second reactivity control system capable of controlling the rate of reactivity changes resulting from planned, normal power changes (including xenon burnout) to assure acceptable fuel design limits are not exceeded. However, there is no design basis event for which boron addition via the CVCS and BAS is relied upon (in lieu of the safety-related control rods).

The CVCS, MHS, and BAS are nonsafety-related systems. However, the CVCS is equipped with two automatic, safety-related, fail-closed, demineralized water isolation valves to ensure CVCS operation does not inadvertently cause a dilution of the RCS boron concentration. See Section 4.3 for additional discussion of GDC 26.

Consistent with GDC 1, CVCS, MHS and BAS SSC are designed, fabricated, erected, and tested to appropriate quality standards such that their failure does not impact the function of other safety-related or risk significant systems. The safety-related CVCS demineralized water isolation valves and associated piping are Quality Group C per RG 1.26. The CVCS piping and components outboard of the CIVs up to the next valve that is normally closed or capable of automatic closure are also Quality Group C. Other SSC are Quality Group D. The classification of CVCS, MHS, and BAS is discussed further in Section 3.2.

Consistent with GDC 2, the safety-related CVCS components are housed in the RXB. The safety-related demineralized water isolation valves are located below grade in the Seismic Category I RXB. The RXB is designed to protect against natural phenomena such as tornadoes, seismic events and floods, including the maximum probable flood as described in Section 3.4.2. The safety-related CVCS demineralized water isolation valves and associated piping are designed to Seismic Category I per Section 3.2.1.1 and RG 1.29. The CVCS Quality Group C equipment extending from the flanged connection at the boundary with the containment system piping outboard of the CIVs to the first seismic restraint beyond the CVCS Quality Group C boundary valves is also designed to Seismic Category I. The MHS and BAS piping and components, and the remainder of piping and components in the CVCS, are Seismic Category III, but are upgraded to Seismic Category II per Section 3.2.1.2 using the design guidance of RG 1.29 if the routing of piping or the location of components could adversely interact with Seismic Category I SSC during or after a safe shutdown earthquake.

Consistent with GDC 3, the safety-related CVCS demineralized water isolation valves are provided with protection from fire by the use of fire detection and suppression in the RXB rooms where the valves are located. Although these valves play no active role in achieving safe shutdown after a fire, their failure during a fire could prevent the achievement of safe shutdown by other systems. These valves are therefore treated as safe shutdown components under the fire protection program and are each located in a separate fire area.

Consistent with GDC 4, the safety-related CVCS components are designed to accommodate normal and abnormal expected and postulated accident scenarios and any dynamic effects to which they may be subjected. In addition, the CVCS, MHS, and BAS systems and their components are located inside the RXB, which is designed to protect equipment inside the building against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.

GDC 5 was considered in the design of the CVCS, MHS and BAS. There is no sharing of the CVCS between NPMs. Each MHS is shared between up to six NPMs and, when in service for heating a given module, could represent an inadvertent dilution source for other modules operating at a higher boron concentration than the module being heated. There is also a potential for difficult to detect leakage between the six chemical and volume control systems sharing a single MHS. Therefore the CVCS of operating modules not being heated by MHS are isolated from the MHS system with two closed isolation valves provided with a drain valve and alarmed pressure indication between the valves. An alarm condition would result in main control room (MCR) notification of the need to check the isolation valves for leakage. The BAS is shared among all installed NPMs and has been appropriately sized and configured to ensure the sharing among NPMs does not preclude the supply of boron, when desired, to any individual NPM. Thus, sharing of the MHS and BAS between NPMs does not significantly impair their ability to perform their intended functions. If an accident occurs in one NPM, sharing of the MHS and BAS does not adversely affect an orderly shutdown and cooldown of the remaining NPMs.

Component or control system failures or improper operation could result in low boron concentration makeup water resulting in unintended dilution of the boron concentration in the RCS. This dilution event is classified as an AOO. Consistent with GDC 10 and GDC 21, the most probable dilution source of this AOO is isolated by two series, safety-related, fail-closed, single failure proof isolation valves located in the common demineralized water/LRWS water flow path to the CVCS makeup three way combining valve. Automatic closure of either demineralized water isolation valve via the MPS closes the supply of this inadvertent dilution source to the three way combining valve. MPS actuation occurs based on the capability of nuclear instrumentation to detect the effects of the dilution on the reactor. Under conditions of low RCS flow when the effects of the dilution are delayed and more difficult to detect, the demineralized water isolation valves are interlocked to prevent opening or by closing the valves if a low RCS flow condition develops when the valves are open. Also consistent with GDC 21, design of the CVCS supports full testing of the valves with the NPM at power.

GDC 13 was considered in the design of the CVCS, MHS, and BAS. These systems do not have safety-related instrumentation. MPS instrumentation closes the CVCS demineralized water isolation valves to prevent or terminate a dilution event.

GDC 14 was considered in the design of the CVCS. The CVCS maintains acceptable purity levels in the reactor coolant through the removal of insoluble corrosion products and dissolved ionic material by filtration and ion exchange. The CVCS provides an interface with the PSS to permit analysis of the chemistry conditions in the RCS. The CVCS is able to correct out of specification chemistry conditions that may over time challenge the material properties of the reactor coolant pressure boundary. See Section 3.1 for additional discussion of GDC 14. Out of specification chemistry in the RCS does not typically require immediate corrective actions except for severe out of specification chemistry conditions (Action level 3) in the Electric Power Research Institute (EPRI) 3002000505 Pressurized Water Reactor Primary Water Chemistry Guidelines, Reference 9.3.4-1. EPRI Action Level 2 and Action Level 1 conditions require correction within 24 hours and 7 days, respectively. A CVCS purification flow of 22 gpm is sufficient to allow correction of chemistry impurities from Action Level 2 concentrations to below the Action Level 2 threshold within the 24 hour EPRI guidelines requirement.

PDC 27 was considered in the design of the CVCS and BAS. Due to the unique features of the NPM, the control rods alone, with no credit for boron from CVCS, have sufficient reactivity control capability under postulated accident conditions (with appropriate margin for stuck rods) to assure that the capability to cool the core is maintained. See Section 4.3 for additional discussion of PDC 27.

Consistent with GDC 28, the potential rate and amount of reactivity insertion due to a CVCS dilution event is limited by the maximum CVCS injection rate and the demineralizer water supply isolation valve closure based on analytical limits. This ensures that no damage occurs to the reactor coolant pressure boundary or disturbs the reactor vessel internals to the extent that it affects the ability to cool the core. See Section 15.4.6 for the evaluation of the boron dilution event.

GDC 29 was considered in the design of the CVCS and BAS. There is no AOO or accident for which the CVCS is relied upon to add boron to the RCS and the CVCS is isolated during accident conditions. However, an inadvertent dilution of the RCS by the CVCS is considered an AOO. The MPS and the redundant, safety-related demineralized water isolation valves provide a high probability of accomplishing their safety function to prevent or terminate an inadvertent dilution event.

GDC 33 is not applicable to the NuScale Power Plant design because RCS makeup from CVCS is not relied upon to assure that specified acceptable fuel design limits are maintained in the event of postulated accidents. The NPM design preserves reactor coolant inventory by isolating containment (including CVCS) at safety setpoints. Accordingly, the NuScale design supports an exemption from GDC 33.

Consistent with GDC 60, the CVCS is designed with appropriate interfaces with the GRWS, LRWS and SRWS to control the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation. These interfacing systems include sufficient holdup capacity for the retention of gaseous and liquid effluents.

Vent and drain lines are provided for CVCS and MHS major equipment. CVCS and MHS vents and drains discharge to the RWDS for collection and processing by the GRWS, LRWS and SRWS. The BAS does not normally contain radioactive material. The BAS is connected to systems that contain contaminated water during normal operation and, due to the potential for cross contamination, check valves are provided to minimize the potential for cross contamination from connected systems. BAS discharge paths are to systems that are compatible with receiving contaminated water. The BAS is provided with sample ports if cross contamination is suspected or if testing is desired.

The CVCS circulates pressurized reactor coolant outside of containment during normal operation. The CVCS system is provided with leak detection instrumentation capable of continuously comparing the RCS mass flowrates removed from the RCS and returned to the RCS by the CVCS (including consideration for makeup or letdown). An unaccounted for difference in this mass flowrate indicating a net loss of RCS coolant initiates an alarm in the MCR upon reaching the high setpoint. When the threshold for the high-high setpoint is reached the CVCS is automatically isolated by the two CVCS module isolation valves, one on the CVCS injection line to the RCS, and one on the CVCS suction line from the RCS. The CVCS module isolation valves are located outboard of the safety-related containment vessel CIVs. This is a nonsafety function and is intended to quickly isolate smaller CVCS leaks that would potentially take longer for the safety-related CIVs to close and isolate at safety system settings.

The CVCS and MHS contain radioactive fluid and, consistent with GDC 61, are designed to ensure adequate safety. CVCS piping is shielded where necessary to minimize radiation levels and system design features ensure that highly radioactive ion exchange resins are properly retained in the ion exchange vessels pending controlled transfer of spent resins to the SRWS. Design provisions are included for controlled flushing and draining to LRWS and RWDS.

GDC 64 was considered in the design of the CVCS and MHS. The CVCS and MHS do not have direct release paths to the environment during normal operations. Process fluid is passed in closed lines to the PSS, LRWS, SRWS, or RWDS. For postulated CVCS line breaks, fluid is collected by the RWDS. Area radiation monitors are provided in equipment rooms with CVCS or MHS radiological sources; these are provided as part of the fixed area radiation monitoring system and are described in Section 12.3. The CVCS suction line from the RCS is provided with a process radiation detector to monitor the incoming reactor coolant to be processed and sampled. The radiation monitor is located upstream of the continuous sample line to the PSS and the line is isolated on a high reading. In addition, the ABS is equipped with radiation monitors. In the event of a failure in the MHS heat exchanger pressure boundary between MHS and ABS fluid, the CVCS/MHS supply and return isolation valves are closed automatically to stop leakage upon a high-high radiation signal from ABS.

The CVCS processes radioactive reactor coolant and is therefore subject to a radiation control program. CVCS components which have elevated levels of radiation are the ion exchangers, the reactor coolant filters, the resin traps, and the CVCS suction from the RCS piping. Shielding for the CVCS ion exchanger vessels and reactor coolant filters is provided by concrete cubicles. Primary coolant piping in CVCS equipment rooms is shielded to minimize surveillance and maintenance dose rates. The CVCS has several features to reduce radiation exposure to ALARA levels.

- Steel alloys with low cobalt content are specified for materials of construction for components containing reactor coolant to minimize the generation of Cobalt-60.
- CVCS equipment drains and pressure relief valves are routed to the RWDS.

- Area radiation monitors are provided for rooms containing CVCS equipment which are radiological sources (NRHX, RHX, recirculation pumps, ion exchangers, filters and resin traps).
- Sluicing of ion exchanger resin is done remotely (outside of the cubicles), to remove resins and flush the vessels.
- Control panels and valve stations for CVCS equipment are provided with permanent shielding to limit worker exposure and meet site ALARA goals.
- Manual valves on pipes filled with reactor coolant have valve operators extending outside of shielded barriers to minimize dose for manual actions.
- Components that are not radiological sources (hydrogen bottles, makeup pumps, and chemical addition tanks) which require periodic access are separated from radiological sources.

The CVCS is designed to maintain occupational radiation exposure to ALARA levels as discussed in Section 12.1 and Section 12.3.

The BAS does not normally contain radioactive material and check valves are provided to minimize the potential for cross contamination from connected systems. BAS discharge paths are to systems that are compatible with receiving contaminated water. The BAS is supplied by the DWS via a direct connection to the BAS batch tank and an indirect connection to the BAS storage tank that can be used to supply demineralized water for recirculation and flushing through any of the tanks and piping, and then discharged to the LWRS.

With respect to 10 CFR 50.34(f)(2)(xxvi) (Item III.D.1.1 in NUREG-0737), the CVCS is designed to be as leak free as practical. The system is in continuous use during normal operation and is provided with leakage detection instrumentation. During accident conditions, the CVCS is isolated from the RCS by the CIVs and is not needed to circulate primary coolant outside of containment. In addition, there are no safety systems that circulate reactor coolant outside of containment.

Consistent with SECY-93-087, Item I.F, the design of the CVCS reduces the possibility of a LOCA outside containment. As shown in FSAR Figure 6.2-4, the CVCS is the only system with connections to the RCS and piping that runs outside containment. Therefore, the CVCS is the total scope for intersystem LOCA consideration in the NuScale design. The CVCS containment isolation valves meet the SECY-93-087 recommendations for pressure isolation valves; position indication is provided to the control room and they have the capability for leak testing and are periodically leak tested as part of the Inservice Testing Program (FSAR Section 3.9.6). Although intersystem LOCAs are prevented by the CVCS containment isolation valves, the CVCS is designed to withstand RCS design pressure to the extent practicable. The CVCS recirculation loop, including the purification bypass line, are designed to withstand RCS design pressure. The CVCS letdown line and CVCS reactor vessel high point degasification line connections to the liquid radwaste system are designed to withstand RCS design pressure up to the degasifier tank where design pressure is reduced and overpressure protection is provided. The process sampling system lines connected to the CVCS are designed to withstand RCS design pressure. The makeup line and components upstream of the CVCS makeup pumps are the only portion of the

CVCS that is not designed to withstand RCS design pressure. However, the CVCS makeup pumps are positive displacement type with integral check valves; in addition, a check valve is provided between the makeup pumps' discharge and the injection tee into the recirculation loop to minimize potential reactor coolant leak back to the low pressure portion of the CVCS makeup line. The CVCS design incorporates pressure and level alarms that provide the control room with indication of adverse conditions. For example, in the event of reactor coolant leakage past the makeup pumps, the pressure indicating transmitter at the suction of the makeup pump provides a high pressure alarm in the MCR.

9.3.4.4 Inspection and Testing

The inservice inspection (ISI) requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, 2013 Edition, Section XI (Reference 9.3.4-2) are applicable to the CVCS Quality Group C (per RG 1.26) equipment. This includes the Quality Group C equipment just outside of containment and the demineralized water supply isolation valves. Section 5.2 and Section 6.6 provide the requirements applicable to the CVCS regarding inservice nondestructive examination requirements for system components. The MHS and BAS are nonsafety-related, and have no safety functional requirements, and therefore have no inservice inspection requirements.

10 CFR 50.55a requires inservice testing (IST) for American Society of Mechanical Engineers Boiler and Pressure Vessel Code Section III, Class 1, 2 and 3 pumps and valves; therefore the CVCS American Society of Mechanical Engineers Section III, Class 1 and Class 3 components are subject to these requirements. 10 CFR 50.55a specifies the American Society of Mechanical Engineers Operation and Maintenance Code as the testing standard. See Section 3.9.6 for the inservice testing program plan.

The methodology associated with the development of Inspections, Tests, Analyses, and Acceptance Criteria is presented in Section 14.3.

9.3.4.5 Instrumentation and Controls

Chemical and Volume Control System Instrumentation

CVCS instrumentation includes flow, temperature, pressure, radioactivity, boron concentration, level, and valve position indication devices. MHS instrumentation includes temperature, and pressure; there are no valves in MHS with position indication devices. BAS instrumentation includes flow, temperature, pressure, level, valve position indicating devices, and weight (boric acid powder).

Chemical and Volume Control System Controls

The MCS provides nonsafety monitoring and control for the CVCS and receives input from CVCS nonsafety instrumentation. The MCS receives some monitoring and control from the MPS for control of CVCS components that support pressurizer level and pressure, initiate letdown flow, and open pressurizer spray. The PCS provides nonsafety monitoring for the MHS.

The CVCS is isolated from the RCS by the safety-related dual CIVs on the RCS injection line, the pressurizer spray line, the RCS discharge line, and the RPV high point degasification line upon receipt of an actuation signal from the MPS (see Section 6.2.4).

Controls are provided for the CVCS to keep reactor coolant within required chemistry limits. CVCS makeup and letdown controls are used to maintain the RCS inventory within the prescribed operating range as indicated by pressurizer liquid level instrumentation. CVCS controls are provided to supply the pressurizer spray nozzles with subcooled fluid for pressure reduction. The MHS is provided with controls to heat reactor coolant and generate the required RCS flow prior to transitioning to nuclear heat.

The primary CVCS controls for continuous purification of reactor coolant are speed control of the recirculation pumps and heat removal regulation of the NRHX via CVCS temperature indication to the respective RCCWS control valve. Control of CVCS ion exchanger alignment and the CVCS reactor coolant filters is manual and can be performed remotely.

CVCS control by the MCS is provided for automatic pressurizer spray actuation in response to high pressurizer pressure indication. The initial response to reaching the spray actuation setpoint is full opening of the normally closed spray supply valve to establish flow to the RCS via the pressurizer spray nozzles. The spray diverting valve also starts to close, diverting additional flow from the normal CVCS return path to the pressurizer spray path. When the target pressure is reached, MCS closes the spray supply valve and opens the spray diverting valve.

Pressurizer spray can be manually controlled to lower reactor vessel pressure or to perform a timely chemistry adjustment of the RCS which may require increased flow through the pressurizer to mix with the rest of the RCS fluid.

CVCS controls are provided for RCS fluid inventory management. The primary controls are remote permissive or manual starting, stopping and speed control of the positive displacement makeup pumps as well as remote automatic or manual control of letdown isolation valves and the letdown control valve for discharge to the LRWS. CVCS makeup is initiated from the MCR by operator action or permission based on low pressurizer liquid level indication. CVCS liquid letdown to LRWS is automatically initiated based on high operating band pressurizer liquid level. CVCS liquid letdown to LRWS can be manually initiated from the MCR.

Controls are provided within the CVCS to manage the boron concentration of the RCS fluid. To increase the boron concentration of the RCS, the CVCS makeup pumps inject borated water from the BAS and to maintain a nearly constant volume within the RCS, letdown flow is discharged to the LRWS. The boron concentration of RCS is decreased by adding demineralized water from the DWS with the CVCS makeup pumps while discharging letdown flow to the LRWS. A three-way combining valve upstream of the CVCS makeup pumps is used to control the CVCS makeup process liquid boron concentration; it is used to select the makeup fluid source of either demineralized water, borated water, or a combination of the two using an intermediate valve position.

CVCS controls are also provided to manage reactor coolant chemistry other than boron concentration. CVCS chemistry controls include addition of lithium hydroxide, zinc acetate dehydrate, hydrazine, gaseous hydrogen, and hydrogen peroxide.

CVCS controls are provided for automatic diversion of flow around the ion exchangers if temperature indication at the NRHX outlet reaches the high temperature setpoint for ion exchanger resin protection. The high temperature setpoint triggers realignment of the three-way bypass diverting valve and remote closure of the ion exchanger inlet valves.

CVCS controls are provided to bypass some or all flow around the NRHX, and purification equipment. Remote manual control of a control valve allows for a range of bypass flow rates. This bypass is primarily used during startup to divert a majority of flow around the NRHX while still purifying a portion of flow. This bypass may also be used when necessary to keep CVCS injection temperatures above a defined threshold to limit thermal stresses on NPM components. Indications from CVCS instrumentation provides input to RCCWS control valves. Each CVCS NRHX tube side outlet temperature instrument is used to adjust RCCWS cooling water flow to the respective NRHX.

CVCS controls are provided for on-line sampling of RCS fluid. Sampling is performed continuously on the RCS discharge line, upstream of the tube side of the RHX. Manual grab sampling is performed by remote manual opening and closing of isolation valves which discharge to the PSS. Grab sample points are located in the purification leg downstream of the ion exchangers and reactor coolant filters and in the injection line to the RCS, downstream of the shell side of the RHX.

CVCS controls are provided to periodically vent non-condensable gases from the pressurizer through a pressure regulating valve to the LRWS. The normally closed RPV high point degasification line CIVs are opened for this operation. Non-condensable gases are vented, as necessary, but venting is anticipated to be infrequent - a few times per fuel cycle. During the shutdown process, the RPV high point degasification line is used to remove non-condensable gases, including hydrogen, from the reactor vessel coolant.

CVCS controls are provided for operation of the system when flow to and from the NPM is isolated. Remote manual control is provided for valves to divert flow through a bypass of the NPM. Local manual operation is required to put a pressurized expansion tank into service in this operating condition to provide necessary system pressure for recirculation pump operation and accommodate fluid temperature changes.

CVCS controls are provided for filling and pressurizing the pressurizer gas space with nitrogen through the RPV high point degasification line during startup and shutdown. Remote manual control of an isolation valve on the line from the nitrogen distribution system and isolation valves on the degasification line are used to permit flow to the NPM.

CVCS control of reactor coolant heatup by the MHS is primarily accomplished by the choice of running one or two recirculation pumps and adjusting the pump(s) speed. The maximum heatup rate without approaching boiling conditions in the reactor coolant is achieved by maintaining the MHS steam supply pressure from the ABS to no more than RCS pressurizer pressure. Once pressurizer pressure exceeds the maximum ABS steam supply pressure, potential boiling is no longer a concern.

Chemical and Volume Control System Alarms

The CVCS has alarms associated with flow, temperature, pressure, tank level, boron concentration, RCS leakage, and radioactivity. There are alarms for high differential pressure across each ion exchanger, resin trap, and reactor coolant filter. Each alarm alerts the MCR of a potential adverse condition. MHS pressure and temperature instrumentation in the heat exchanger outlet alarms when coolant temperature approaches saturated conditions. Nonsafety CVCS and MHS alarms are provided to the MCR by the MCS.

There are no safety-related CVCS or MHS instrumentation indications and therefore, there are no CVCS or MHS generated safety-related alarms.

Boron Addition System Controls

The PCS provides nonsafety monitoring and control for the BAS and receives input from BAS nonsafety instrumentation. Inputs from the PCS to the BAS are valve, pump, mixer, and hopper control and actuation signals. Outputs from the BAS to the PCS are level, flow, and pressure indications from BAS instrumentation, as well as position information for BAS valves. BAS monitoring and control is provided to the MCR by the PCS.

Normal control of the BAS supply function to CVCS is automatic. After the initial system alignment is made to either the BAST or batch tank, the PCS is placed in control of the boric acid supply pumps and supply recirculation control valve. The PCS starts and stops the pumps based on demand signals from CVCS. The PCS maintains the supply line pressure by adjusting the pump speed based on a signal from the supply pressure instrumentation. If the demand from the CVCS is less than the pumps minimum required flow rate, the minimum flow is achieved by allowing some fluid to bypass back to the storage tank through the supply recirculation control valve, based on the flow measurement from the supply flow instrumentation.

Normal control of the batch tank transfer operations is automatic. Initiating the automatic transfer mode triggers the PCS to align the required actuated valves to the transfer positions and start and stop the transfer pump to maintain the level of the storage tank. While the system is in transfer mode, interlocks prevent accidental additions of boric acid from the hopper, or water from the DWS through the batch tank demineralized water valve that would alter the boron concentration of process fluid being sent to the storage tank. When the system is placed in batch mode, interlocks prevent transfer to the storage tank by closing the storage tank bypass valve and storage tank supply valve. To aid in the batching operation, the PCS has automatic functions to allow the operator to specify a tank refill level for demineralized water and quantity of boric acid to be added from the hopper. When the operator specified values are met, the PCS automatically stops the flow into the batch tank. Mixing of the batch tank is performed by manually starting the mixer and transfer pump from the PCS. In addition to their normal automatic functions, the BAS pumps and valves also have the ability to be manually operated via the PCS for events such as maintenance, system cleaning, or transferring borated water to the SFPCS.

Boron Addition System Alarms

The BAS has alarms associated with high and low tank levels and with low supply pressure. BAS alarms are generated by and handled via the PCS. The BAS is not a safety-related system, and does not have any safety alarms.

9.3.4.6 References

9.3.4-1 Electric Power Research Institute "Pressurized Water Reactor Primary Water Chemistry Guidelines," EPRI #3002000505, EPRI, Palo Alto, CA, 2014.

9.3.4-2 American Society of Mechanical Engineers, “Boiler and Pressure Vessel Code,” 2013 Edition, New York, NY.

Table 9.3.4-1: Chemical and Volume Control System/Module Heatup System Major Equipment with Design Data and Parameters

Component Description	Design Parameter	Value	I&C Interface
CVCS Makeup Pumps			Yes
	Type	Positive displacement	
	Design pressure	2250 psia	
	Design temperature	150 °F	
	Capacity	20 gpm	
	Variable speed	Yes	
	Material	Stainless steel	
CVCS Recirculation Pumps			Yes
	Type	Canned, centrifugal	
	Design pressure	2250 psia	
	Design temperature	650 °F	
	Capacity	45 gpm (with MHS aligned and both pumps operating)	
	Variable speed	Yes	
	Material	Stainless steel	
CVCS Reactor Coolant Filters			No
	Design pressure	2250 psia	
	Design temperature	200 °F	
	Material	Stainless steel	
CVCS Resin Traps			No
	Design pressure	2250 psia	
	Design temperature	200 °F	
	Material	Stainless steel	
CVCS Chemical Mixing Tank			No
	Design pressure	150 psig	
	Design temperature	150 °F	
	Capacity	5 gal	
CVCS Regenerative Heat Exchanger			No
	Type	Shell and tube (four vessels in series)	
	Tube/shell design pressure	2250 psia / 2250 psia	
	Material	Stainless steel	
CVCS Nonregenerative Heat Exchanger			No
	Type	Shell and u-tube (single vessel)	
	Tube/shell design pressure	2250 psia / 150 psig	
	Tube/shell design temperature	650 °F / 200 °F	
	Material	Stainless steel	
MHS Module Heatup Heat Exchangers			No
	Type	Shell and tube (two in parallel per MHS subsystem)	
	Tube/Shell Design Pressure	2250 psia / 1250 psig	
	Material	Stainless steel	
CVCS Expansion Tank			No
	Design pressure	150 psig	
	Design temperature	200 °F	
	Capacity	75 gal	
	Material	Stainless steel	
CVCS Ion Exchangers (Mixed Bed, Cation Bed, Auxiliary)			No
	Design pressure	2250 psia	

Table 9.3.4-1: Chemical and Volume Control System/Module Heatup System Major Equipment with Design Data and Parameters (Continued)

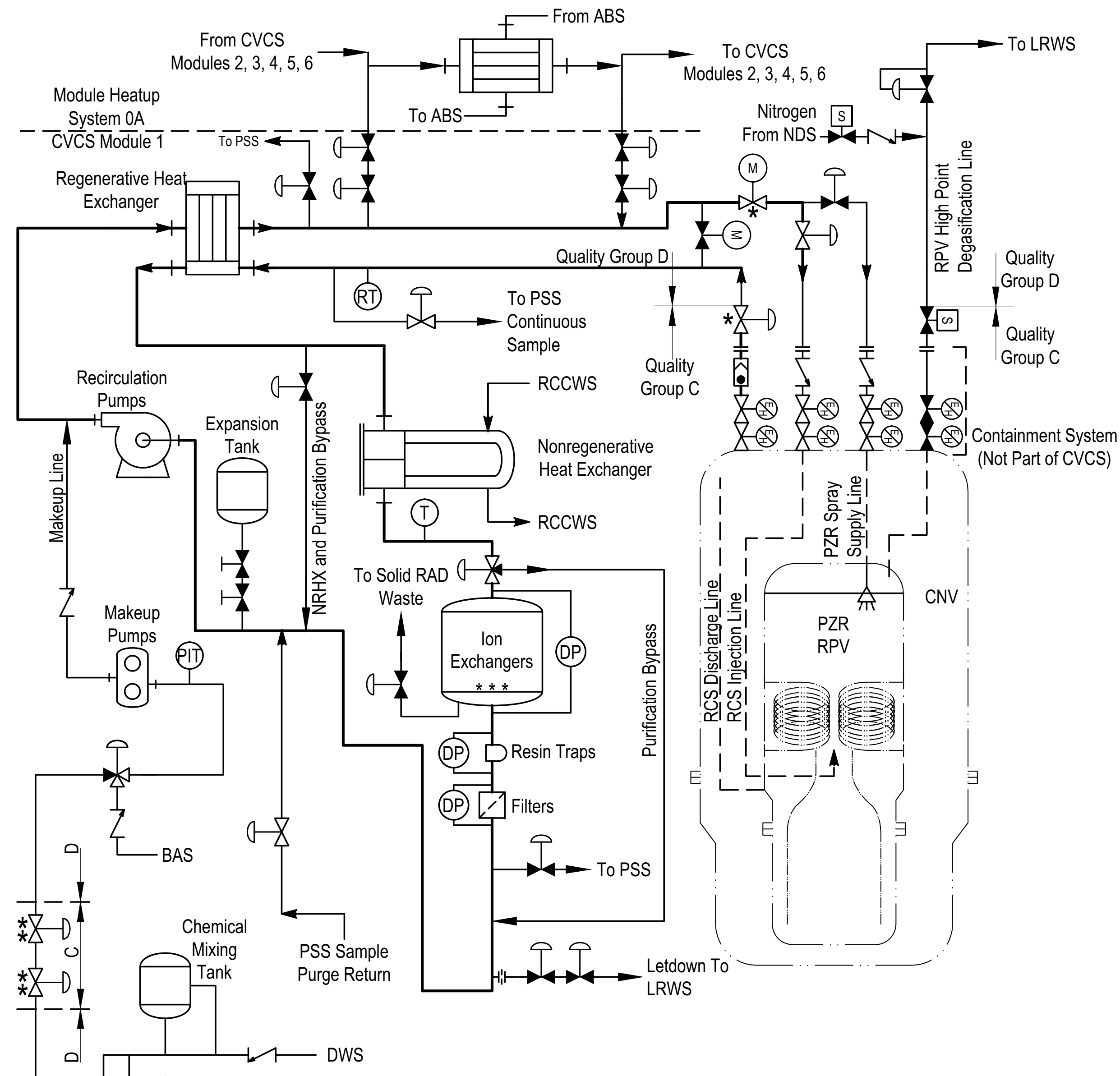
Component Description	Design Parameter	Value	I&C Interface
	Design temperature	200 °F	
	Required resin volume	8.8 ft^3	
	Material	Stainless steel	

Table 9.3.4-2: Boron Addition System Major Equipment with Design Data and Parameters

Component Description	Design Parameter	Value	PCS Interface
Boric Acid Batch Tank			-
	Design pressure	Atmospheric	
	Design temperature	150 °F	
	Capacity	10,000 gallons	
	Material	Stainless steel	
Boric Acid Transfer Pump			On/Off
	Type	Centrifugal	
	Design pressure	125 psig	
	Design temperature	150 °F	
	Capacity	110 gpm	
	Variable speed	No	
	Material	Stainless steel	
Boric Acid Storage Tank			-
	Design pressure	Atmospheric	
	Design temperature	150 °F	
	Capacity	15,000 gallons	
	Material	Stainless steel	
Boric Acid Supply Pumps			0-100%
	Design pressure	125 psig	
	Design temperature	150 °F	
	Capacity	50 gpm	
	Variable speed	Yes	
	Material	Stainless steel	

Figure 9.3.4-1: Chemical and Volume Control System Diagram

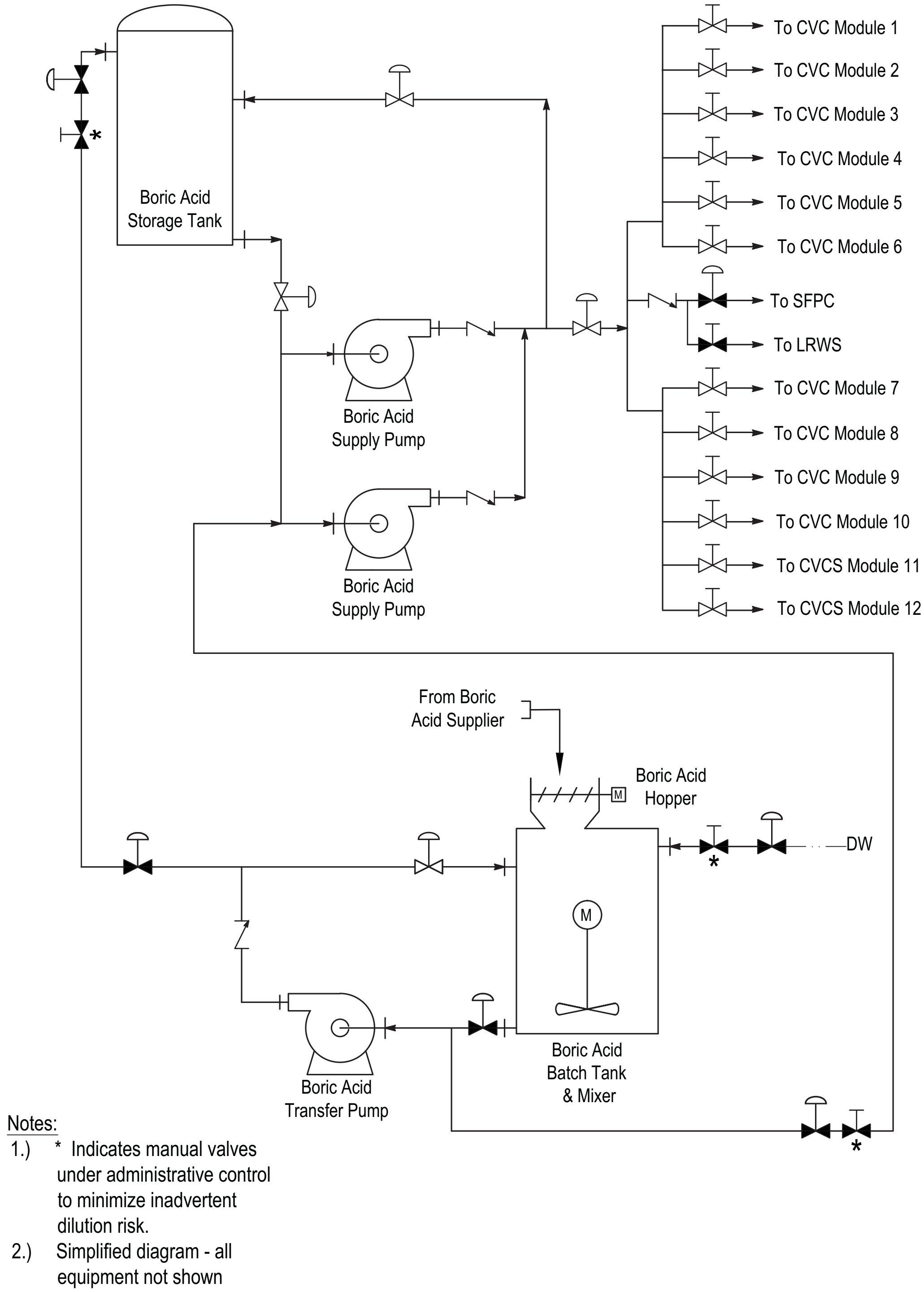
(Chemical and Volume Control System Module 1 with Module Heatup System Subsystem 0A Shown)



Notes:

1.) * Module isolation valve closes on detection of leak in CVCS/Process Sampling System (mass flow imbalance).
2.) ** Demineralized water isolation valve.
3.) Simplified diagram - not all equipment shown.
4.) *** Quantity four ion exchangers as follows: 2 mixed bed, 1 auxiliary, 1 cation

Figure 9.3.4-2: Boron Addition System Diagram



9.3.5 Standby Liquid Control System

The standby liquid control system is applicable only to boiling water reactor designs. The design is a pressurized water reactor, and therefore, this section is not applicable.

9.3.6 Containment Evacuation System and Containment Flooding and Drain System

The containment evacuation system (CES) and the containment flooding and drain system (CFDS) are used to transfer liquids and gases between the containment vessel (CNV) free volume and other plant systems.

The functions of the CES include:

- establishing and maintaining a vacuum in the CNV during NPM operation by removing non-condensable gases from the CNV, which reduces convective heat transfer from the reactor vessel to the reactor pool.
- measuring CNV pressure during NPM operation via pressure sensors on the CES vacuum pump suction line to monitor leakage into the CNV from all sources.
- monitoring radioactivity levels in the non-condensable gas removed from the CNV and, depending on the radioactivity level in the gas, either filtering and discharging the gas through the reactor building ventilation system (RBVS) plant exhaust stack or transferring the gas to the gaseous radioactive waste system (GRWS).
- support the process sampling system (PSS), as described in Section 9.3.2 providing a suction and return path for continuous monitoring of hydrogen and oxygen concentration in the containment atmosphere during normal operations.
- support post-accident monitoring, providing a suction path for post-accident monitoring of hydrogen and oxygen concentration in the containment atmosphere as described in Section 9.3.2. The return path for monitoring of hydrogen and oxygen concentration in the containment atmosphere is the CFDS.
- vaporizing and removing water from the CNV during NPM startup following refueling, condensing the water vapor, and discharging the water to the radioactive waste drain system (RWDS).
- removing water vapor from the CNV during NPM operation and providing a method to condense, collect, and sample the water removed from the CNV prior to the water being discharged to the RWDS.
- quantifying the amount of water vapor removed from the CNV during NPM operation to monitor leakage into the CNV from all sources and to allow leak-before-break (LBB) methodology to be applied to leakage from feedwater and main steam piping in the CNV.
- removing non-condensable gases from the reactor coolant system (RCS), prior to CFDS pump-down of the CNV.
- providing a path for pressurization of the CNV in support of refueling and maintenance operations.

The functions of the CFDS include:

- flooding the CNV with reactor pool water during NPM cooldown in preparation for refueling operations.
- draining the CNV during NPM startup operations and routing water removed from the CNV to the reactor pool through the reactor pool cooling system (RPCS)

- routing non-condensable gases removed from the CNV during NPM startup operations through discharge HEPA filters to the RBVS plant exhaust stack for release to the environs, if radioactivity levels are below specified limits
- providing the capability to add borated coolant inventory from the reactor pool to the CNV to remove decay heat during a beyond design basis accident.
- support post-accident monitoring, providing a return path for post-accident monitoring of hydrogen and oxygen concentration in the containment atmosphere as described in Section 9.3.2. The suction path for monitoring of hydrogen and oxygen concentration in the containment atmosphere is the CES.

Figure 9.3.6-1 is a system diagram of the CES. Each of the up to twelve NPMs has an independent CES. Figure 9.3.6-2 is a system diagram of the CFDS. There are two independent CFDS subsystems, each supporting up to six NPMs. Piping from the CES connection flange to the CNV nozzle, including the two containment isolation valves, is considered part of the containment system. The containment isolation function is also considered part of the containment system. The containment isolation valves and the containment isolation function are addressed in Section 6.2.4.

9.3.6.1 Design Bases

This section identifies the required or credited functions of the CES and the CFDS, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii). See Section 9.3.6.3 for the Safety Evaluation.

The CES and the CFDS do not have safety-related functions and are not required to operate during or after any design basis accident. The CES and the CFDS are not required to reach the safe shutdown mode and temperature as defined in the technical specifications.

Consistent with General Design Criterion (GDC) 2, structures, systems, and components shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. GDC 2 was considered in the design of the CES and the CFDS. Structures, systems, and components (SSC) that could affect safety- related components are appropriately supported to prevent damage due to the safe shutdown earthquake. The reactor building (RXB) provides protection from external natural phenomena. Quality group and seismic category of CES and CFDS components are identified in Table 3.2-1.

Consistent with GDC 4, structures, systems, and components shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. General Design Criteria 4 was considered in the design of the CES and the CFDS. There are no safety-related functions or SSC in the CES or the CFDS; therefore, there are no SSC that need to be protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids.

Consistent with GDC 5, structures, systems, and components shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

Consistent with GDC 30, components that are part of the reactor coolant pressure boundary shall be designed, fabricated, erected, and tested to the highest quality standards practical. Means shall be provided for detecting and, to the extent practical, identifying the location of the source of reactor coolant leakage. General Design Criterion 30 was considered in the design of the CES and the CFDS. The CES provides three methods to detect and quantify leakage into the CNV. See Section 9.3.6 for a description of the three leakage detection methods.

Consistent with GDC 60, the nuclear power unit design shall include means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences. General Design Criterion 60 was considered in the design of the CES and the CFDS. Liquid effluents are returned to the reactor pool or, as necessary, routed to the RWDS. Gaseous effluents are filtered and routed to the Reactor Building HVAC system (RBVS) or, when specified limits are exceeded, to the GRWS, where they are contained, monitored, and processed for release to the environment.

Consistent with GDC 64, means shall be provided for monitoring the reactor containment atmosphere, spaces containing components for recirculation of loss-of-coolant accident fluids, effluent discharge paths, and the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents. General Design Criterion 64 was considered in the design of the CES and the CFDS. Liquid effluents are returned to the reactor pool or, as necessary, routed to the RWDS. Gaseous effluents are filtered and routed to the Reactor Building HVAC system (RBVS) or, when specified limits are exceeded, to the GRWS, where they are contained, monitored, and processed for release to the environment.

Consistent with 10 CFR 20.1101(b), the CES and the CFDS have provisions for draining and flushing piping and major components to the RWDS prior to maintenance or inspection activities to reduce dose to onsite personnel to as low as reasonably achievable (ALARA). Consistent with 10 CFR 20.1406, the CES and the CFDS have provisions for draining and flushing piping and major components to the RWDS prior to maintenance or inspection activities to reduce generation of radioactive waste and minimize contamination of the facility and the environment.

The NuScale design supports exemption from 10 CFR 50.34(f)(2)(xiv)(E) as applied to the CES. Design basis events meet their thermal and hydraulic acceptance criteria without reliance on isolating the CES in a high radiation signal. No design basis event results in degraded or damaged core conditions. Section 19.2 analyses demonstrate severe accident conditions, with resultant core damage, also result in generation of reliable containment isolation signals, without reliance on isolation on high containment radiation. An in-containment event resulting in core damage or degradation also results in containment isolation on low low pressurizer level and high containment pressure. An event that leads to core damage or degradation also results in containment isolation on low low pressurizer level. These features provide a reliable alternative means to prevent radiological release from the CES to the environs. Refer to Part 7, Chapter 13 for further details.

9.3.6.2 System Description

9.3.6.2.1 Containment Evacuation System

General Description

Each NPM is supported by a dedicated, nonsafety-related CES. The CES establishes and maintains a vacuum in the CNV by removing water vapor and non-condensable gases from the CNV using a vacuum pump that draws gases from the top of the CNV and discharges the gases to the CES condenser as shown in Figure 9.3.6-1.

Condensate from the CES condenser is gravity drained to a sample vessel before being gravity drained to the RWDS. Samples of the non-condensable gases are directed to the process sampling system sample panel for analysis.

The CES is operated from the main control room (MCR) using the module control system (MCS) that provides both automatic and operator control of key CES functions, including valve alignment, vacuum pump speed, and purge gas flow. The MCS provides

- indication, alarms, and interlocks for CES flow, temperature, pressure, radioactivity level, humidity, and valve position
- alarms and required automatic actuation for off normal conditions

Electrical power for the CES vacuum pumps and valves is provided by the low voltage AC electrical distribution system (ELVS). Electrical power for the CES instrumentation and control equipment is provided by normal DC power system (EDNS).

Component Descriptions

Vacuum Pump

The CES for each NPM includes two parallel, 100-percent capacity, mechanical vacuum pumps. Redundant pumps are provided to allow maintenance activities during normal operation. The vacuum pumps are 100-percent duty cycle, variable-speed pumps with dry process-side internals. The vacuum pumps are cooled by the reactor component cooling water system (RCCWS).

To support NPM startup, each CES vacuum pump is capable of establishing a vacuum below the saturation pressure of the water inside the CNV during NPM heat up. This capacity allows the CES to remove residual water left in the CNV following draining. The CES vacuum pumps also can be used to mechanically degas the reactor coolant during the initial stages of the CNV evacuation process, as described in Section 9.3.6.2.3.

To support NPM operation, a single CES vacuum pump is operated at 100-percent speed. The CES vacuum pumps are capable of maintaining the CNV vacuum at a pressure within specified limits when the reactor is at power and total leakage into the CNV from all sources is less than the most limiting permissible leak rate.

Purge gas is provided to the CES vacuum pumps. It is used on an intermittent basis as directed by pump maintenance procedures.

Each CES vacuum pump is equipped with inlet and outlet isolation valves with remote position indication and actuation. The suction and discharge ports of the CES vacuum pumps are equipped with pressure-monitoring instruments for equipment protection and performance monitoring. The CES vacuum pump trips are initiated by:

- loss of electrical or control power
- high pump discharge pressure or temperature
- high sample vessel level
- CES containment isolation valve actuation

Condenser

The CES for each NPM includes a stainless steel shell-and-tube condenser. Water vapor and non-condensable gases removed from the CNV by the vacuum pump and vacuum pump purge gas are discharged to the shell side of the CES condenser, which is maintained at or above atmospheric pressure. The reactor component cooling water system is supplied to the tube side of the CES condenser.

Water vapor removed from the CNV is condensed and the condensate is gravity drained to the CES sample vessel. Non-condensable gases removed from the CNV and vacuum pump purge gas are vented from the condenser past radiation monitors and are directed to either the RBVS plant exhaust stack after passing through charcoal and high-efficiency particulate air (HEPA) filter banks or to the GRWS for processing if CES gaseous process radiation levels exceed specified limits, as described in Section 11.5.

Pressure instrumentation provided on the vacuum pump discharge and the condenser shell, and temperature instrumentation on the vacuum pump discharge and gas discharge from the condenser are provided for monitoring performance and protecting equipment. The shell side of the CES condenser includes a pressure relief valve that discharges to the RWDS. The shell side of the CES condenser also has a connection to the nitrogen distribution system, which is used to purge the condenser and gas discharge path prior to maintenance.

Sample Vessel

The CES for each NPM includes a containment evacuation sample vessel. Water vapor removed from the CNV by vacuum pump is condensed and the condensate is gravity drained to the CES sample vessel. The MCS and sample vessel level instrumentation are configured to track the time interval required for a fixed quantity of condensate to accumulate in the sample vessel, which allows the MCS to calculate leak rates into the CNV. The sample vessel also includes pressure, temperature, and radiation monitoring instrumentation. The sample vessel is configured to allow grab samples to be collected before the condensate is gravity drained to the RWDS. Grab samples and sample vessel radiation instrumentation are used to provide an indication of the leakage source.

Each CES sample vessel includes a connection to the nitrogen distribution system and a demineralized water flush. A relief valve on the sample vessel is drained to the RWDS.

9.3.6.2.2 Containment Flooding and Drain System

General Description

The CFDS is a nonsafety-related system used to flood a CNV with borated reactor pool water after shutdown in preparation for NPM refueling and to drain water back to the reactor pool in preparation for NPM startup. The CFDS can also be used to add water to a CNV during a beyond design basis event.

The CFDS is shared between multiple NPMs because the system is used only as needed to prepare and recover an NPM from conditions needed for refueling. There are two independent CFDS subsystems, each servicing up to six NPMs. Each CFDS includes two pumps that can be aligned to either flood or drain any of the six supported NPMs as shown in Figure 9.3.6-2. Each subsystem includes a drain separator tank that is used to separate entrained gases from the water drained from a CNV before the water is returned to the reactor pool.

Flooding and draining an individual CNV is conducted through the same CNV penetration. The CFDS pump operation is automatically prevented if the CFDS isolation valve to more than one NPM is open, and valve operation to other NPMs is prevented once the CFDS pump aligned to an NPM and the pump is in service. In addition, for the selected NPM, the CFDS module isolation valve cannot be opened and CFDS pump start is prevented if RCS wide range hot leg temperature is greater than 350 degrees F. These features, coupled with administrative controls in plant procedures, prevent inadvertent CFDS makeup to an operating NPM.

The CFDS suction connections from the reactor pool are at an elevation below the normal operating level and above the minimum level required for NPM and spent fuel pool radiation shielding and heat removal. This CFDS suction line configuration prevents CFDS operation or siphoning from inadvertently lowering pool level to below safety limits. A siphon-break line with a manual valve is provided near each CFDS reactor pool supply connection in the event that a siphon is created and cannot be stopped by other system flow path valves to prevent unintended containment flooding or flooding above the desired containment level.

The CFDS operation is controlled from the MCR using the plant control system (PCS), which provides:

- automatic and operator control of key CFDS functions
- CFDS valve alignment, except the NPM isolation valves, controlled by the module control system (MCS)
- CFDS alarms and interlocks
- indication of CFDS flow, temperature, pressure, containment drain separator tank level, gaseous discharge process radiation level, and valve position

The EDNS provides electrical power for the CFDS instrumentation and control equipment. The CFDS pumps and valves are powered from the ELVS.

Component Descriptions

Pumps

Each CFDS subsystem includes two parallel, 100-percent-capacity centrifugal pumps that can be aligned to either flood or drain any of the up to six supported NPMs. Each pump is configured with a discharge check valve and inlet and outlet isolation valves. Vents and drains for each pump discharge to the to the RWDS. The pump supply header is provided with pressure instrumentation and the discharge header is provided with pressure and flow monitoring instrumentation, a flow control valve, and a strainer.

Drain Separator Tank

Each CFDS subsystem includes a containment drain separator tank. Water removed from the CNV during draining is discharged from the CFDS pump to the containment drain separator tank, which allows entrained gases to be vented before the water is returned to the reactor pool through the RPCS. Gases in the separator tank are vented from the tank past radiation monitors and, if radiation levels are within limits, are discharged through the RBVS plant exhaust stack after passing through charcoal and HEPA filter banks. The containment drain separator gas discharge line is isolated automatically if radiation levels exceed specified limits.

A pressure-regulating valve in the drain separator tank gas discharge line controls gas discharge pressure during CNV draining operations, and a drain separator tank relief valve drained to the RWDS is provided to prevent overpressure. The containment drain separator tank includes connections for venting and draining the tank to the RWDS.

Containment drain separator tank level is monitored in conjunction with a flow control valve to maintain a constant level in the tank by regulating flow to the RPCS. High tank level trips the CFDS pump to prevent flooding the tank and low tank level isolates flow to the RPCS to prevent compressed air from the separator tank from entering the RPCS.

9.3.6.2.3 System Operation

The CES and the CFDS do not have safety-related functions and are not required to operate during a design basis accident. The operation of the CES and the CFDS is described together because of the interaction between the two systems for some of the functions.

Normal Operations

Containment Draining following Refueling

The CFDS, shown in Figure 9.3.6-2, is used to drain a CNV following refueling. To facilitate CNV draining, the CES is aligned to the service air system to pressurize the CNV through the CES containment penetration to provide additional net positive suction head for the CFDS pump during CNV draining. The CNV draining is initiated by starting one of the CFDS pumps, and CNV draining status is monitored by using CNV-level instrumentation and timing the duration of the draining. The CFDS performance is monitored using instrumentation for system flow rate, pressure, and temperature. As CNV water level decreases, the required net positive suction head for the CFDS pump is maintained by service air pressure. The CNV draining is terminated when the CNV water level falls below the open end of the CFDS suction piping inside containment, which is in close proximity to the bottom of the CNV. Completion of CNV draining is detected by the increase in CFDS pump suction pressure, which occurs when water in the CFDS suction line that runs to the bottom of the CNV is replaced by air.

When CNV draining is completed, service air pressurization of the CNV is secured and the CFDS valve lineup is changed to allow the CNV to depressurize by venting through the drain separator tank to the RBVS plant exhaust stack. When the CNV is depressurized to atmospheric pressure, the CFDS isolation valve for the NPM is closed and the other CFDS and CES valves are repositioned to the standby flooding position to support potential emergency flooding operations. The CES valves are repositioned for normal operation and the CFDS containment isolation valves for NPMs are closed.

Containment Evacuation and Drying

The CES is used to evacuate the CNV to remove the water that remains after the CFDS draining process and to establish the CNV normal operating condition.

The CES valve lineup for containment evacuation ensures the:

- service air system supply valve to the CES is closed
- vacuum pump bypass valve is closed
- suction and discharge valves for the vacuum pump that will be operated are open
- liquid and gaseous discharge paths from the containment evacuation condenser are established

After the CES equipment is aligned, a single vacuum pump is placed in service to reduce the pressure in the CNV. When CNV pressure is at or below the saturation pressure corresponding to the temperature of the water within the CNV, the water evaporates and is removed by the vacuum pump. The vapor is then condensed in the CES condenser, drained to CES sample tank, and discharged to the RWDS.

During the CNV pressure reduction, the use of the module heatup system may commence. This increases RCS temperature and aids in the vaporization of liquid in the CNV.

Non-condensable gases removed during the establishment of initial vacuum are monitored for radiation. The CES gaseous process flow passes through charcoal and HEPA filter banks and subsequently is discharged to the environs through the continuously-monitored RBVS plant exhaust stack. During initial operation of the CES, the GRWS discharge path is not available because the quantity of air in the CES gaseous process flow exceeds the GRWS capacity. To prevent exceeding the GRWS system capacity, the discharge flow of the CES vacuum pump is monitored, and during high CES flow conditions the automatic transfer to the GRWS due to a gaseous process high radiation condition is prevented by an interlock. As a result, a gaseous process high radiation condition during the initial establishment of CNV vacuum results in a CES isolation.

Containment Vacuum and Reactor Coolant System Leak Detection During Operation

During normal power operation, the CES maintains the CNV below the specified maximum operating pressure by removing water vapor generated by leaks from systems and components inside the CNV. A small amount of leakage from mechanical connections and valves open to the CNV atmosphere (e.g., emergency core cooling system valves and reactor pressure vessel (RPV) safety relief valves) may occur. Other potential sources of leakage into the CNV include the main steam system, the feedwater system, and the reactor component cooling water system. Removing non-condensable gases and water vapor from leaks into the CNV reduces heat transfer from the RPV to the CNV and reactor pool, and prevents water vapor from condensing and collecting at the bottom of the CNV.

During normal operation, the CES supports three separate methods that can detect leakage into the CNV. Two of these methods, CNV pressure and CES sample tank level detection, can quantify leakage into the CNV. Section 9.3.6.3 provides a description of the leakage detection methods and compliance with RG 1.45.

Monitoring of the CNV Atmosphere

The CES supports the plant sampling system (PSS) providing a suction and return path for continuous monitoring of the containment atmosphere hydrogen and oxygen concentration during normal plant operation as described in Section 9.3.2.

Containment Flooding in Preparation for Refueling

The CFDS, as shown in Figure 9.3.6-2, is used to flood a CNV with reactor pool water to support NPM disassembly and refueling operations. CNV flooding is initiated as part of the NPM cooldown operation because the flooded CNV facilitates NPM cooldown by increasing heat transfer from the RPV to the reactor pool.

When the CFDS is used to flood a CNV, one of the CFDS pumps is aligned to take suction from the reactor pool and discharge to the selected NPM. To minimize thermal stress on NPM components, flooding is initiated only after temperatures for the NPM being flooded are below a specified maximum temperature and reactor pool bulk temperature is above a specified minimum temperature. To ensure that component temperature limits are not exceeded and to prevent inadvertent flooding of an operating NPM, the selected CFDS module isolation valve cannot be opened and CFDS pump start is prevented if the selected NuScale Power Module RCS wide range hot leg temperature is greater than 350 degrees F. The CFDS flow path for flooding a CNV includes connections for a temporary skid-mounted heater if an off-normal condition requires flooding a CNV with elevated RPV temperatures.

The CFDS alignment for flooding requires that the CFDS containment isolation valves and the CFDS module isolation valve for the NPM being flooded are open. The CFDS pump is started with the CNV at atmospheric pressure and CFDS performance is monitored by system flow rate, pressure, and temperature, and CNV level instrumentation. The CNV is flooded approximately to the elevation of the RPV pressurizer baffle plate. Automatic action shuts off the operating CFDS pump and closes the CFDS module isolation valve when the preset water level in the CNV is reached, as determined by CNV level instrumentation. At completion of flooding operation, the CFDS containment isolation valves and the CFDS module isolation valve for the NPM being flooded are closed.

Reactor Coolant System Non-Condensable Gas Removal

The CES can be used to remove dissolved gases from the RCS. This activity is performed prior to CFDS pump-down of the CNV by drawing a vacuum on the CNV with the emergency core cooling system (ECCS) valves open. The CES valve line-up for removal of dissolved gases from the RCS is similar to containment evacuation; it ensures the:

- service air system supply valve to the CES is closed
- vacuum pump bypass valve is closed
- suction and discharge valves for the vacuum pump that will be operated are open
- liquid and gaseous discharge paths from the containment evacuation condenser are established
- ECCS vent valves are open

After the CES equipment is aligned, a single vacuum pump is placed in service to reduce the pressure in the CNV. When CNV pressure is at the predetermined point above the saturation pressure corresponding to the temperature of the water within the CNV and the RCS, CES vacuum pump speed is adjusted to maintain the desired CNV pressure. Vapor drawn from the CNV and RCS is condensed in the CES condenser, drained to CES sample tank, and discharged to the RWDS.

Non-condensable gases removed during the establishment of CNV and RCS vacuum are monitored for radiation. The CES gaseous process flow passes through charcoal-HEPA filter banks and is subsequently discharged to the environs through the continuously-monitored RBVS plant exhaust stack. During initial operation of the CES, the GRWS discharge path is not available because the quantity of air in the CES gaseous process flow exceeds the GRWS capacity. To prevent exceeding the GRWS system capacity, the discharge flow of the CES vacuum pump is monitored, and during high CES flow conditions the automatic transfer to the GRWS due to a gaseous process high radiation condition is prevented by an interlock. As a result, a gaseous process high radiation condition during the initial establishment of CNV vacuum results in CES isolation.

Non-condensable gases removed during the establishment of CNV and RCS vacuum are monitored for radiation using the process described for containment evacuation and drying.

Off-Normal Operations

The CES and CFDS are nonsafety-related and are not assumed to operate during or after any design basis accident. However, the CFDS can be used to add additional borated coolant inventory to the CNV to remove decay heat during a beyond design basis event.

The CES and CFDS off-normal operations include:

- high-radiation levels in gases discharged from the CES condenser
- high-radiation levels in gases discharged from the containment drain separator tank
- equipment failure affecting one or both CES vacuum pumps
- addition of coolant inventory into a CNV during a beyond design basis event

High Radiation Levels in Gases Discharged from the Containment Evacuation System Condenser

Non-condensable gases removed from the CNV by the CES are vented from the CES condenser past radiation monitors. If radiation levels of the non-condensable gases exceed specified limits, it could be an indication of RCS leakage into the CNV.

High-radiation levels in the gases removed from the CNV actuate an alarm in the MCR. If the radiation level in the CES gaseous process flow exceeds a specified limit, or upon monitor failure, the discharge path is transferred from the RBVS to the GRWS and the following automated functions are initiated:

- service air to the CES isolates
- the containment evacuation system to PSS sample line isolates

The charcoal decay beds in the GRWS allow for adsorption and additional decay time for the gaseous radioactive contaminants present in the CES discharge.

The GRWS discharge path is not used if high-radiation levels occur during initial containment evacuation because the quantity of gas flow or air content could exceed GRWS capacity.

High Radiation Levels in Gases Discharged from the Containment Drain Separator Tank

Water removed from the CNV during draining is pumped to the containment drain separator tank that removes entrained gases which then are vented from the tank past radiation monitors. High-radiation levels in the non-condensable gases removed from the CNV actuate an alarm in the MCR. If radiation levels of the non-condensable gases exceed specified limits, then the discharge path is isolated. With the discharge line isolated, the radioactive gases are left in the system to decay until the level is below the limit for release through the RBVS plant exhaust stack.

Equipment Failure Affecting One or Both Containment Evacuation System Vacuum Pumps

An equipment malfunction affecting one vacuum pump (e.g., pump failure or valve control problems) causes automatic shutdown of the affected vacuum pump, closes the suction and discharge valves, and initiates an alarm in the MCR. Operator action is needed to place the standby vacuum pump into operation to maintain vacuum pressure in the CNV.

An equipment malfunction affecting both vacuum pumps (e.g., malfunction of a common CES control valve) or loss of a support system (e.g., RCCWS for the CES condenser) can result in reaching system parameters that result in automatic shutdown of the affected vacuum pumps, closes the suction and discharge valves of both pumps to maintain the vacuum pressure in the CNV, and initiates an alarm in the MCR.

Addition of Coolant Inventory into a Containment Vessel during a Beyond Design Basis Event

The CFDS is not required to operate during or after any design basis accident. As a defense-in-depth measure, the CFDS may be used to inject water from the reactor pool into a NPM containment in a beyond design basis event. This function is not safety-related.

When not in operation, the CFDS pump suction lines are normally maintained filled and vented to facilitate readiness for emergency containment flooding operations. Before initiating emergency containment flooding, CNV pressure must be low enough to allow opening the CFDS containment isolation valve and water injection into the CNV using a CFDS pump. Emergency flooding is initiated from the MCR using the MCS to open the containment isolation valves. The CFDS is pre-aligned for containment flooding operation, allowing flooding to begin by starting a CFDS pump using the PCS. When the water in containment reaches the desired level, operators shut off the operating CFDS pump and close the respective CFDS containment isolation valves.

Post-accident Containment Atmosphere Monitoring

The CES and CFDS support post-accident containment atmosphere monitoring. The CES provides a suction path for post-accident monitoring of hydrogen and oxygen concentration in the containment atmosphere by the PSS as described in Section 9.3.2. The return path for the PSS hydrogen and oxygen monitor is supported by the CFDS, returning the discharge of the PSS sample pump to the CNV.

9.3.6.3 Safety Evaluation

The CES and the CFDS are nonsafety-related systems that have no safety-related SSC required to operate during or after any design basis accident. Additionally, the CES and CFDS are not required for an NPM to reach safe shutdown mode and temperature as defined in the technical specifications regardless of the status of the other NPMs.

General Design Criterion 2 was considered in the design of the CES and CFDS.

The RXB provides protection from external natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami and seiches. The SSC that could adversely affect Seismic Category I components are appropriately supported to prevent damage due to a safe shutdown earthquake. The classification of the piping and components for the CES and CFDS conforms to the requirements of Regulatory Guide (RG) 1.29, Revision 5, with the exception as noted in Section 3.2.1 for classifying SSC as Seismic Category II. In both the CES and CFDS, the piping from the NPM disconnect flange to the pipe gallery wall is Seismic Category II because the piping does not perform a Seismic Category I function, but it must be properly restrained to prevent damage to Seismic Category I SSC. The SSC beyond the pipe gallery wall are Seismic Category III because the system is not required to continue operating during or after a safe shutdown earthquake and failure of its SSC does not endanger the operability of Seismic Category I SSC or the occupants of the MCR.

General Design Criterion 4 was considered in the design of the CES and CFDS. There are no safety-related functions or SSC in the CES or CFDS; therefore, there are no SSC that need to be protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids. Additional information pertaining to impact of environmental effects associated with flooding is provided in Section 3.4. Dynamic effects associated with missile impact and pipe rupture are provided in Sections 3.5 and 3.6, respectively.

General Design Criterion 5 was considered in the design of the CES and CFDS.

Each NPM is supported by a dedicated CES. The CES is in continuous operation when the NPM is at power. No CES equipment or instrumentation is shared between NPMs.

Each NPM is supported by a CFDS that may support multiple NPMs because the CFDS is used only as needed to prepare and recover an NPM from conditions needed for refueling. There are two independent CFDS subsystems, each servicing up to six NPMs.

The CFDS does not have safety-related functions and is not required to operate during or after any design basis accident. Additionally, the CFDS is not required for an NPM to reach safe shutdown mode and temperature as defined in the technical specifications regardless of the status of the other NPMs.

Inadvertent flooding of the CNV for an NPM that is at power or not below the temperature or pressure required for flooding is prevented by system interlocks and administrative controls within plant procedures. Each NPM is isolated from the CFDS by three valves in series, the NPM isolation valve and the two CFDS containment isolation valves.

General Design Criterion 30 requirements are satisfied by the CES which supports three methods for detecting and, to the extent practical, identifying the source of leakage into the primary containment vessel. These leak-detection methods are CNV pressure monitoring, CES sample tank level change monitoring, and CES vacuum pump discharge process radiation monitoring. These leak detection methods are consistent with the guidance in RG 1.45, Revision 1, and also satisfy requirements for LBB leakage monitoring of the main steam and feedwater piping within the CNV as described in Sections 3.6 and 5.2.

Regulatory Positions C.2.1, C.2.2, and C.2.3 in RG 1.45 are satisfied in that:

- leakage to the primary reactor containment from unidentified sources can be detected, monitored, and quantified for flow rates greater than or equal to 0.05 gpm using CNV pressure or CES sample tank level timing.
- leakage detection response time (not including transport delay time) is less than one hour for a leakage rate greater than 1 gpm using CNV pressure or CES sample tank level timing.

Regulatory Position C.2.3 of RG 1.45 also is satisfied in that radiation detectors in the CES condenser vent line and sample tank provide an early indication of RCS leakage. They provide the ability to discern changes in CES process radiation levels and assist the operator in assessing the source of leakage into the CNV. Radiation monitoring for the CES is described in Section 11.5.

Regulatory Position C.2.4 in RG 1.45 is satisfied in that CNV pressure monitoring is performed by two redundant seismically qualified pressure sensors located on the suction line to the CES vacuum pumps. The attendant instrument and control platform for these transmitters is the module protection system (MPS), providing a seismically qualified interface to the main control room.

Regulatory Position C.2.5 in RG 1.45 is satisfied in that all methods have provisions that permit calibration and testing during plant operation.

When operating CNV vacuum is established, the equilibrium pressure in the CNV can be correlated directly to the total leakage into the CNV. If leakage into the CNV subsequently increases above the leakage rate corresponding to the existing equilibrium pressure, CNV pressure increases until a new equilibrium pressure is established at a pressure corresponding to the higher leakage rate. The derivation of the leak rate from CNV pressure changes is described in Section 5.2.

The CNV pressure monitoring response time and sensitivity are sufficient to support application of LBB monitoring of main steam and feedwater piping inside containment, as described in Section 5.2. All leakage detected and quantified using CNV pressure monitoring is treated conservatively as unidentified leakage unless the source and quantity can be identified using a different method. Factors that potentially would degrade CES performance, such as leakage on the vacuum pump suction line or vacuum pump wear, result in conservative leak rate indication as they result in higher CNV pressure, causing the leak rate into the CNV to be overstated.

The CES sample tank level change timing method is based on collecting and quantifying the water vapor removed from the CNV by the CES. The CES vacuum pump removes water vapor from the CNV and discharges the water vapor into the CES condenser, where it condenses and drains by gravity to the CES sample tank. The MCS calculates the leak rate by measuring the time interval for the condensate collected in the CES sample vessel to fill the known volume between the low-level and high-level setpoints. The high-level setpoint actuates the CES sample vessel drain valve, which allows the condensate to gravity drain to the liquid radioactive waste drain system. The low-level setpoint closes the CES sample vessel drain valve and reinitializes the timing cycle. An alarm is actuated if the leak rate exceeds the specified limit. The sample vessel has the capability to draw grab samples and is equipped to detect radioactivity and actuate an alarm for radioactivity levels that may be an indication of RCS leakage. The CES sample tank level change timing is a sensitive and accurate indicator of leakage into the CNV as water vapor is continuously removed from the CNV and then collected and quantified. The derivation of the leak rate using this method includes allowances for water vapor carryover past the CES condenser that is not collected in the sample tank, and is described in Section 5.2.

Humidity detectors in the CES vent path provide indication of significant increases in carry over, providing operators with a means to discern a condition that indicates a potential loss of leakage. The CES sample tank level change timing leak rate detection function response time and sensitivity are sufficient to support LBB monitoring of main steam and feedwater piping inside containment. All leakage detected and quantified using sample CES sample tank level change timing is conservatively treated as unidentified leakage, unless the source can be identified and quantified using a different method.

Leakage detection and quantification using both CNV pressure monitoring and CES sample tank level change timing assumes the CES vacuum pump removes all water vapor resulting from leaks inside the containment. Condensation and accumulation of water vapor in the bottom of the CNV is prevented by limiting plant operation to the domain wherein the combination of CNV pressure and ultimate heat sink temperature preclude condensation inside the CNV.

Consistent with GDC 60 and GDC 64, the CES and CFDS have the capability to monitor and control the release of radioactive materials to the environment during normal operation. Liquid removed from the containment is returned to the reactor pool through the RPCS or the RWDS, when appropriate. The RWDS is discussed in Section 11.2. Gaseous discharge from the CES condenser and the CFDS containment drain separator tank are monitored for radioactivity and, if radioactivity levels are within specified limits, discharged to the environment through the RBVS plant exhaust stack after passing through charcoal-HEPA filter banks. If radiation levels of the CES gaseous discharge exceed specified limits, the gases are diverted automatically to the GRWS for processing. Section 11.3 describes the GRWS automated isolation functions related to elevated level of radiation in that system. If radiation levels of the CFDS gaseous discharge exceed specified limits, the release path is isolated automatically. The CES and CFDS process radiation monitors and the bases for their setpoints are discussed in Section 11.5.

The CES and the CFDS are designed to reduce and prevent the spread of contamination and minimize radiation exposure. Specific consideration was given to implement the requirements in 10 CFR 20.1406 to minimize, to the extent practical, contamination of the facility and the environment, generation of radioactive waste, and to facilitate decommissioning. Additionally, the design conforms to 10 CFR 20.1101(b) in that, to the extent practical, procedures and engineering controls based upon sound radiation protection principles are used to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable.

The CES sample vessels are equipped with a demineralized water flush line and a nitrogen purge connection to rinse and purge the tank to reduce radioactivity prior to maintenance and to reduce accumulation of radioactivity. The discharge path for non-condensable gases removed from the CNV is monitored for radiation and discharged through the RBVS plant exhaust stack after passing through charcoal-HEPA filter banks. If radiation levels of the non-condensable gases exceed specified limits, the gases are diverted to the GRWS for processing.

The CES and the CFDS vents and drains are routed in closed lines to the RWDS and RBVS. Gaseous discharge from the CFDS containment drain separator tanks is sent through HEPA filtration and through the RBVS plant exhaust stack; however, a radioactivity monitor automatically isolates the line on a high radioactivity indication for required processing prior to a release of effluent.

The CES and the CFDS components outside containment are located in equipment galleries separate from SSC expected to generate high radiation levels. The CFDS piping inside containment vessels is subject to higher levels of radiation than equipment outside of containment due to proximity to the RPV. A self-mating connection is provided in the CFDS piping inside containment at the containment bolting flange so that human interaction is not needed to disassemble or assemble the connection during refueling.

9.3.6.4 Inspection and Testing Requirements

The inservice inspection and inservice testing requirements of 10 CFR 50.55a do not apply to the CES or CFDS because the piping and equipment beyond the outer containment isolation valve are Quality Group D according to the guidelines in RG 1.26, Revision 4, Regulatory Position 3.

Initial testing of the CES and CFDS is addressed in Section 14.2. Inspections, Tests, Analyses, and Acceptance Criteria for the CES and the CFDS are addressed in Section 14.3.

9.3.6.5 Instrumentation Requirements

There is one CES per NPM. No CES equipment or instruments are shared between NPMs. There are two independent containment flood and drain systems. Each CFDS is shared by up to six NPMs. The CES and the CFDS have indication and alarms to alert operators in the MCR of potentially adverse conditions. The types of parameters monitored are presented under the General Description headings of Section 9.3.6.2.1 and Section 9.3.6.2.2.

The CES indication associated with determining CNV pressure for leak detection is supported by the MPS, providing a seismically qualified interface to the main control room. The remainder of the CES instrumentation signals are sent to the MCS providing indication and initiating automated features and alarms when the monitored parameters exceed setpoints. The CFDS instrumentation signals are sent to the PCS and the MCS to provide control and indication, and automated features and alarms are initiated when the monitored parameters exceed setpoints.

The conditions that initiate alarms that are not associated with automated system functions require operator action to acknowledge, troubleshoot, and act to mitigate the condition. The automated component protection functions, interlocks, and system isolations for the CES and the CFDS are provided inSection 9.3.6.2 and Section 9.3.6.3.

Figure 9.3.6-1: Containment Evacuation System Diagram

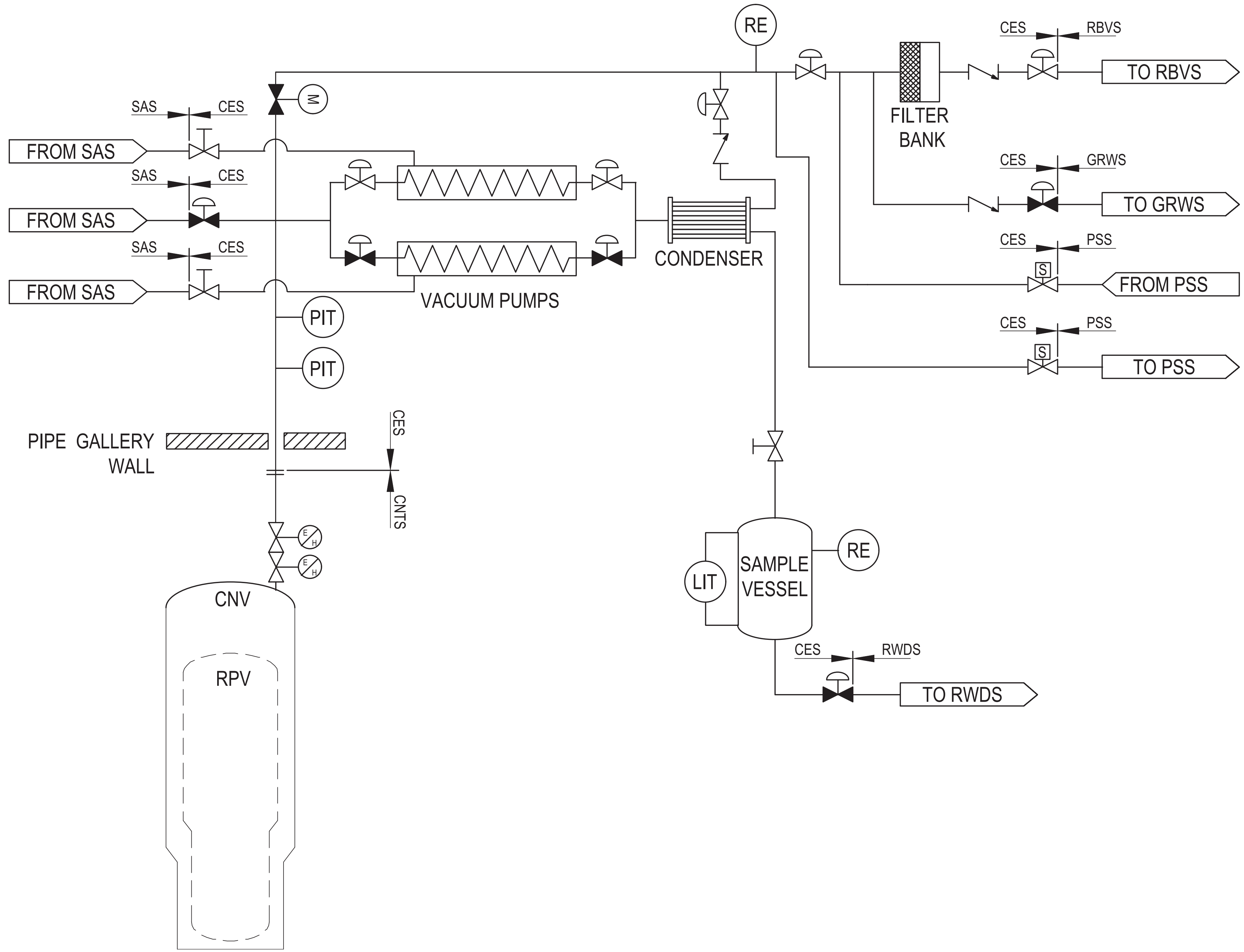
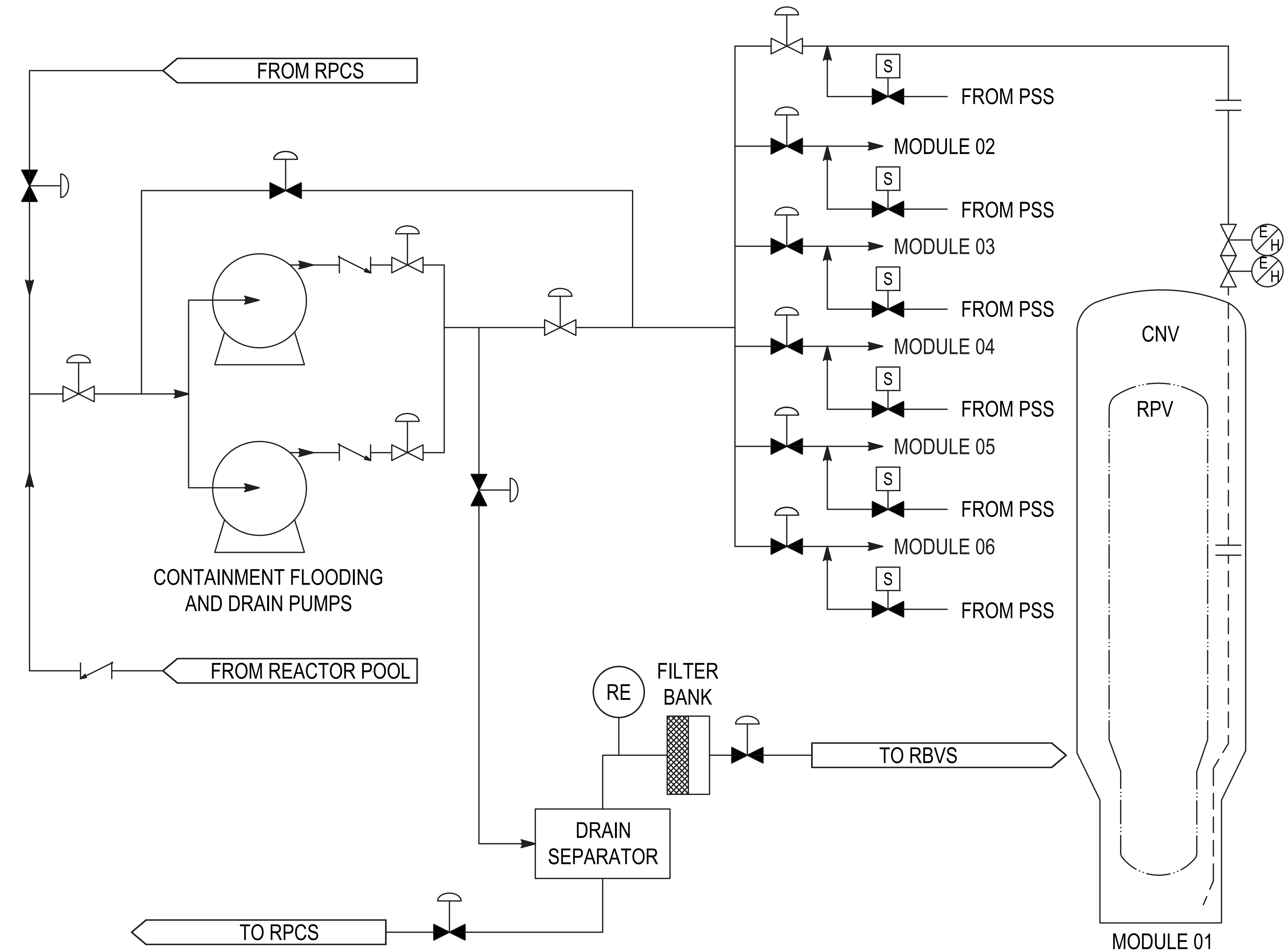


Figure 9.3.6-2: Containment Flooding and Drain System Diagram



9.4 Air Conditioning, Heating, Cooling, and Ventilation Systems

9.4.1 Control Room Area Ventilation System

The normal control room HVAC system (CRVS) serves the entire Control Building (CRB) and the access tunnel between the CRB and Reactor Building. The CRVS boundary begins at the air intake on the outside of the CRB and extends to the point of discharge from the CRB.

Under certain postulated conditions the control room envelope (CRE) is isolated and air is provided by the control room habitability system (CRHS). The CRHS is described in Section 6.4.

9.4.1.1 Design Bases

This section identifies the required or credited functions of the CRVS, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The CRVS serves no safety-related functions, is not credited for mitigation of design basis accidents, and has no safe-shutdown functions. General design criteria (GDC) 2, 3, 4, and 5 were considered in the design of the CRVS. Per GDC 2, the ability of the Seismic Category I CRVS structures, systems, and components (SSC) to withstand the effects of a safe shutdown earthquake is consistent with Section 3.2.1.1 and the guidance of Regulatory Guide (RG) 1.29. Components of the CRVS whose failure could adversely affect Seismic Category I SSC or could result in incapacitating injury to occupants of the control room during or following an SSE are designed as Seismic Category II. Consistent with GDC 3, the CRVS is designed to limit hydrogen concentration in battery rooms in accordance with Regulatory Position C.6.1.7 of RG 1.189, Revision 2 by using guidance in section 52.3.6 of NFPA 1 (Reference 9.4.1-11).

Consistent with GDC 4, the CRVS is protected against dynamic effects and is designed to accommodate the effects of, and be compatible with, the environmental conditions of normal operation, maintenance, testing, and postulated accidents. Consistent with GDC 5, the CRVS is common for up to 12 NuScale Power Modules and is designed to operate during an accident in one unit without affecting the capability to conduct a safe and orderly shutdown and cooldown in the remaining units. See Section 9.4.1.3 for the CRVS safety evaluation.

The CRVS, in conjunction with the CRHS (Section 6.4), maintains the CRE within the temperature and humidity limits needed to support personnel and to maintain equipment during all modes of operation, including normal, abnormal, station blackout, and toxic gas conditions.

Consistent with PDC 19, the control room remains functional such that actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain the plant in a safe condition under accident conditions, including loss-of-coolant accidents and hazardous chemical releases. In accordance with RG 1.78, Revision 1, the CRVS includes toxic gas monitors.

The design of the CRVS takes into account the requirements of 10 CFR 20.1406(b) as discussed in Section 12.3.

The CRVS is designed to be compatible with environmental conditions associated with normal operation, maintenance, and testing based on the outdoor conditions listed in Table 9.4.1-1, and is designed to maintain indoor conditions as shown in Table 9.4.1-2. Design parameters for the major system components are presented in Table 9.4.1-3.

9.4.1.2 System Description

The CRVS serves the entire CRB which includes, the CRE, the Technical Support Center, and other areas. The system includes an outside air intake, one outside air filtration unit (AFU), two supply air handling units (AHUs), a standby water chiller, kitchen and restroom general exhaust fan, smoke purge exhaust fans, battery room exhaust fans, and associated ductwork, dampers, unit heaters, reheat coils, and instrumentation.

In normal operation, the CRVS maintains the areas served at a positive pressure (at least 1/8 in. wg) with respect to the outside environment to limit infiltration of dust and radioactive materials. Most of the air supplied by the CRVS recirculates through the system. A sufficient amount of outside air is introduced to provide adequate ventilation for the occupants, to provide makeup air to offset exhaust, and to maintain a slight positive pressure with respect to the outside environment. During normal operation, the CRVS maintains temperature and humidity control within ranges suitable for the comfort of personnel and to prevent degradation of equipment. Because the CRVS is designed with two 100 percent capacity AHUs, loss of one AHU does not result in degraded system performance.

A simplified diagram of the CRVS is shown in Figure 9.4.1-1.

The CRB is designated as Seismic Category I at elevation 120’-0” and below (except as noted in Section 1.2.2.2) and Seismic Category II above elevation 120’-0”. The CRE isolation dampers are located below the 120'-0" level and the CRVS air handling units, filtration unit, and all exhaust fans are located on the 120'-0" level. The seismic classification of CRVS components is identified in Table 3.2-1. The CRVS is designed such that failure of non-Seismic I components will neither prevent a Seismic Category I component from functioning nor result in incapacitating injury to control room occupants.

A 480VAC standby chiller located in the heating ventilation and air conditioning (HVAC) equipment area provides chilled water to the CRVS if 4160 VAC power is not available. The standby chiller and associated components are not provided with redundancy because this equipment does not perform a safety, risk-significant, or regulatory-required function. These components are part of the chilled water system (CHWS) and can be powered by the backup diesel generator system (BDGS).

The CRVS penetrations through fire-rated barriers are protected by a fire damper with a rating equivalent to that of the barrier. Combination fire and smoke dampers are provided at each fire-rated duct shaft penetration to allow a building level to be isolated from the CRVS if smoke or fire is detected. The supply and smoke purge dampers can be opened by manual operator input from the main control room (MCR) to allow building levels to be purged of smoke individually.

The supply, return, smoke purge, and general exhaust ductwork serving the CRE are the only HVAC penetrations through the CRE. These penetrations include redundant Seismic Category I isolation dampers that are physically located within the CRE. These dampers can be closed to isolate the CRE, allowing the CRHS to pressurize and provide breathable air to the CRE. There are no single active failures which would prevent isolation of the CRE.

The CRVS is normally powered by the low voltage AC electrical distribution system. Each of the two AHUs, two battery room exhaust fans, and two smoke purge fans is powered from a separate low voltage AC electrical distribution system bus. During a loss of normal AC power, the BDGS provides power to the following equipment so that the CRVS can continue to operate:

- AHUs (only one of the two AHUs is powered at a time)
- AHU pre-heat coil for the powered AHU
- air filtration unit fan motor
- air filtration unit heating coil
- standby chiller (a component of the CHWS)

The CRB is considered a vital security area and HVAC penetrations through the CRB envelope are protected with appropriate security barriers as described in Section 13.6.

9.4.1.2.1 Component Description

Air Intake

The CRVS outside air intake is located on the side of the CRB above the 120 ft level. The CRVS supply air intake location is not located near the steam generator safety valves, relief valves, diesel tractor parking areas, the Reactor Building HVAC system exhaust stack, or other gas emitters that may cause a hazard to personnel or operations in the control building. The intake is more than 10 meters from the Reactor Building HVAC system exhaust and from any Reactor Building or Turbine Generator Building wall penetration or door.

Because the CRVS is not safety-related, the CRVS design does not incorporate the use of a tornado damper in the outside air intake. The CRB walls that enclose the HVAC equipment at this level are not designed to withstand the effects of tornadoes.

The outside air intake ductwork includes redundant smoke detectors, radiation monitors, and toxic gas monitors. The outdoor air intake louver is equipped with a bird screen to minimize the intrusion of birds, trash, and other large debris.

Air Filtration Unit

An air filtration unit (AFU) is located on the 120'-0" level of the CRB upstream of the main supply AHUs. The AFU is used to filter outside air when radioactivity is detected, and includes a heater, pre-filters, high-efficiency particulate air (HEPA) filters, an activated charcoal adsorber, test sections, and a variable speed supply fan. The heating coil maintains relative humidity below 70 percent to improve charcoal filter effectiveness. The charcoal filter removes at least 99 percent of all forms of iodine.

The AFU is designed in accordance with American Society of Mechanical Engineers (ASME) Standard N509 (Reference 9.4.1-1) as modified by Section C.3 of RG 1.140. Components of the AFU are designed, constructed, and tested in accordance with Section C.4 of RG 1.140. Provisions for accessing HEPA filter housings are in accordance with Section HA of ASME AG-1(Reference 9.4.1-2) and Section 4.8 of ASME N509. The charcoal filter bank has a deluge sprinkler connection, which may be activated manually. Drains from the AFU are routed to the balance-of-plant drain system.

Supply Air Handling Units

The main CRVS supply subsystem consists of two 100 percent capacity AHUs. Each AHU housing contains filters, a chilled water cooling coil, a humidifier, and a variable-speed supply fan. Additionally, two 100 percent duct-mounted pre-heat coils are mounted upstream of the AHUs to pre-heat outside air during winter conditions. The pre-heat coils prevent the formation of condensation that would freeze when the cold outside air mixes with the higher humidity return air. The main supply AHUs are located on the 120'-0" level of the CRB in the HVAC equipment area. The supply fans are designed and rated in accordance with AMCA 210 (Reference 9.4.1-4) and AMCA 300 (Reference 9.4.1-5).

The ductwork downstream of each AHU includes a smoke detector, a temperature element, and a flow element. Drains from the AHUs are routed to the balance-of-plant drain system.

Cooling Coils

The AHU chilled water cooling coils are designed and rated in accordance with ASHRAE Standard 33-2016 (Reference 9.4.1-3) and AHRI 410-2001 (Reference 9.4.1-6).

Humidifiers

There is a humidifier located in each of the two supply AHUs.

Standby Chiller

The CHWS includes a standby chiller and associated equipment that operates on 480 VAC to provide chilled water to the CRVS when 4160 VAC service is not available to power the normal chilled water source. The air-cooled condensing unit for the standby chiller is roof-mounted.

Fan Coil Unit

Cooling and heating of the elevator equipment room is provided by two redundant fan coil units, one primary and one standby. At a minimum, each fan coil unit includes a low-efficiency filter, a chilled water cooling coil, a heating coil, and a centrifugal supply fan.

Exhaust Fans

The CRVS includes the following exhaust fans located on the 120'-0" level:

- two 100 percent capacity smoke purge fans
- two 100 percent capacity battery room exhaust fans
- one general exhaust fan for the rest rooms

Exhaust fans are designed and rated in accordance with AMCA 210 and AMCA 300.

Duct and Accessories

Ductwork, dampers, and supports are constructed of galvanized steel and meet the requirements of the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Round and Rectangular Industrial Duct Construction Standards or SMACNA HVAC Duct Construction Standards - Metal and Flexible (Reference 9.4.1-7, Reference 9.4.1-8, Reference 9.4.1-9).

Supply and exhaust ducting have manual balancing dampers which are adjusted and set when the system is initially tested and balanced.

Isolation Dampers

The supply, return, smoke purge, and general exhaust ductwork serving the CRE are the only HVAC penetrations through the CRE boundary. Each penetration includes redundant isolation dampers to protect CRE occupants from hazardous conditions. The CRE isolation dampers are qualified to shut tight against CRE pressure in support of the CRHS for maintaining MCR habitability.

There are no components in the CRVS or other systems whose failure due to a seismic event would preclude operation of the CRE isolation dampers.

The CRE isolation dampers are located within the CRE of the CRB. The CRE is located within a portion of the CRB classified as Seismic Category I. The CRE isolation dampers are also designed to Seismic Category I and are protected from external events to the extent that the CRB is protected from such events.

Isolation dampers and associated vent and test connections with manual test valves are also included in the outside air intake to isolate the air intake or to divert air through the charcoal filtration unit.

Fire Dampers

Fire dampers are provided at duct penetrations through fire barriers to maintain the fire resistance ratings of the barriers. The fire dampers meet the design and installation requirements of UL 555 (Reference 9.4.1-14), and are in compliance with NFPA 90A (Reference 9.4.1-13) and NFPA 80 (Reference 9.4.1-12).

Smoke Dampers

Smoke dampers are provided to isolate areas or AHUs. The smoke dampers meet the design and installation requirements of UL 555s (Reference 9.4.1-15).

Combination Fire and Smoke Dampers

Combination fire and smoke dampers are provided at duct penetrations through fire barriers to maintain the fire resistance ratings of the barriers and isolation of smoke. The combination fire and smoke dampers meet the design and installation requirements of UL 555 and UL 555s.

9.4.1.2.2 System Operation

9.4.1.2.2.1 Normal Operation

During normal operation, one AHU operates continuously to provide room temperature and humidity control. The general exhaust fan operates continuously to exhaust air from the rest rooms. The battery room exhaust fan also operates continuously to prevent the buildup of hydrogen gas in the battery rooms, limiting hydrogen concentration to less than one percent by volume.

Outside air is provided through an outside air intake duct. The CRVS is a constant volume system supplying a constant supply airflow. The outside airflow rate is manually balanced during system startup to provide ventilation for the occupants, to provide makeup air for the general and battery exhaust fans, and to provide pressurization air for the CRB areas with respect to the surrounding areas and the outside environment. The operating AHU fan modulates to maintain the design air flow rate regardless of filter loading. Once filter differential pressure reaches the predefined maximum, an alarm is initiated in the MCR to alert the operator that filter replacement is required.

The outside air and recirculated supply air is continuously monitored for smoke by redundant smoke detectors located in the outside air intake duct and a smoke detector downstream of each supply AHU. In addition, the outside air is continuously monitored for toxic gas and airborne radioactivity by redundant toxic gas detectors and redundant radiation monitors located in the outside air intake duct.

The humidifier located in the AHU increases the moisture content of the supply air as required to maintain humidity as determined by a space-mounted sensor located in the MCR.

Supply air ductwork is routed down through each level of the building within a fire-rated shaft. At each level, supply air distribution ductwork is routed through a ceiling plenum to ceiling-mounted supply air diffusers. Zones are provided with reheat coils mounted in the supply duct above the ceiling and controlled by space-mounted temperature sensors. Return air from each space is drawn through ceiling-mounted return grilles into the ceiling plenum. Return air is drawn from each ceiling plenum into a return air duct that is routed up through each floor of the building within a fire-rated shaft. Return air is joined with outside air before proceeding to the supply AHUs.

The AHU pre-heat controller and chilled water cooling coil control valve are modulated to maintain the supply air temperature as determined by a duct-mounted sensor. The supply air temperature setpoint is adjusted based on input from space-mounted temperature sensors in the MCR.

9.4.1.2.2.2 Off-Normal Operation

Loss of an Air Handling Unit

The CRVS design includes two fully redundant AHUs. The standby AHU starts automatically if the operating unit fails. In addition, MCR operators can place AHUs in and out of service manually.

High Radiation Alarm

Upon detection of a high radiation level in the outside air intake, the normal outside air flow path is isolated and 100 percent of the outside air is bypassed through the air filtration unit to filter outside air and minimize radiation exposure to personnel within the CRB. This mode of operation allows the CRVS to continue providing breathable air to CRB personnel and maintain the CRB at positive pressure with respect to the outside environment.

If high levels of radiation are detected downstream of the air filtration unit, the plant protection system (PPS) generates signals to perform the following actions:

- Close the outside air isolation dampers
- Close the CRE isolation dampers
- Initiate CRHS air flow
- Open the CRHS pressure relief isolation valves

In addition, the plant control system (PCS) generates signals to perform the following actions:

- Stop the AHU fans

- Stop the AFU fan
- Stop the battery room exhaust fans
- Stop the general exhaust fan

The CRHS provides a supply of breathable air for the CRE occupants and maintains the CRE at a positive pressure with respect to the surrounding areas. The heat sink capacity of surrounding structures of the CRE helps maintain the temperature in the CRE within acceptable tolerances.

Control building areas outside of the CRE are not expected to be occupied for significant periods when the CRVS is not operating. If the Technical Support Center (TSC) becomes uninhabitable, the TSC functions are transferred to a location designated by the emergency plan.

Radiation monitors are described in Section 11.5.

General Fire or Smoke Detection Alarm

Upon detection of smoke within a specific area served by the CRVS, an alarm is sent to the fire detection panel in the MCR. The building level associated with that area is completely isolated from other levels by smoke dampers. The main supply AHU reduces airflow and continues to supply air to, and return air from, the other levels in the CRB. The stairwell and elevator pressurization fans are also turned on. In accordance with NFPA 90A, a main supply AHU fan is automatically stopped if smoke is detected by the smoke detector just downstream of it.

Smoke purge exhaust is drawn from the ceiling plenum of the fire zone being purged into a smoke purge duct that is routed up through each floor of the building within a fire-rated shaft. Smoke purge air is discharged to the outside through an exhaust louver on the south wall of the CRB.

Smoke or Toxic Gas in Outside Air

Upon detection of smoke or toxic gas in the outside air duct, the outside air isolation dampers are closed to isolate the CRB from the environment. The CRVS is then operated in recirculation mode. The AHU supplying air to the space will continue to supply air and to return air from the space, but the outside air damper will be closed. The CRB is not pressurized when the CRVS is in recirculation mode.

Loss of Normal AC Power

On a loss of power to both CRVS air handler units for 10 minutes or loss of power to all EDSS-C battery chargers, the PPS and PCS generate the same signals as those listed for high radiation downstream of the air filtration unit. The time delay provides a reasonable time for power restoration and therefore may prevent an unnecessary initiation of the CRHS. Within 72 hours, the CRVS, if available, is then utilized to provide air conditioning and building pressurization. Portions of the CRVS and CHWS can be powered by the BDGS to provide the CRB with HVAC service, including charcoal filtering. System operation following loss of normal AC power does not affect the safety of MCR personnel or performance of equipment needed to safely operate the plant.

9.4.1.3 Safety Evaluation

As noted in Section 15.0.0, no operator actions are required or credited to mitigate the consequences of design basis events. As such, the operators perform no safety-related functions as defined in 10 CFR 50.2 either during or after the 72-hour period following a design basis accident. Section 19.3 notes that the D-RAP expert panel determined that none of the nonsafety systems are risk significant. Therefore, the CRVS is neither a safety-related system as defined in 10 CFR 50.2 nor an RTNSS system as defined in Section 19.3 of NUREG-0800.

The CRVS does not serve a safety-related function or risk-significant function. However, the CRE isolation dampers support the regulatory-required function of the CRHS, which relies on these dampers to isolate the CRE upon a loss of all AC power or if radiation levels are above the design limit of the charcoal filters, or if smoke or toxic gas is detected in the outside air intake.

GDC 2 was considered in the design of CRVS. The CRE isolation dampers are located within the CRE of the CRB which is classified as a Seismic Category I structure at that building elevation. The CRE isolation dampers and the smoke, toxic gas, and radiation detectors that initiate their closure are also designed to Seismic Category I standards. The CRE isolation dampers are protected from floods, tornadoes, hurricanes, tsunamis, seiches, and seismic events to the extent that the CRB is protected from such events. Portions of the CRVS whose failure in an earthquake could adversely impact MCR equipment or personnel are designed to Seismic Category II standards. The remaining portions of the CRB are Seismic Category III (non-seismic).

GDC 3 was considered in the design of the CRVS, which prevents explosive levels of hydrogen from forming in CRB battery rooms.

GDC 4 was considered in the design of CRVS. The CRE isolation dampers perform a required function because they form a portion of the CRE boundary, which allows the CRHS to pressurize the CRE. The CRE isolation dampers are protected from the effects of missiles that may result from equipment failures or tornadoes. The CRB itself is a mild environment with no potential of a credible missile source as the result of equipment failure. Additionally, there is no credible source of a high-energy pipe failure within the CRB that could cause loss of function of the CRE isolation dampers. The CRVS maintains a suitable ambient temperature and humidity for personnel and equipment in the MCR and other areas of the CRB during normal operation and when the nonsafety-related BDGS is available. The CRVS has radiation monitors, toxic gas monitors, and smoke detectors located in the outside air intake and downstream ductwork, which allow the PPS to isolate the CRE and the outside air intake as needed in the event of fires, failures, malfunctions, toxic gas, or high radiation.

GDC 5 was considered in the design of CRVS. The CRVS serves the control room, which provides services for all NuScale Power Modules. However, the CRVS does not have a function relative to shutting down a NuScale Power Module or maintaining it in a safe shutdown condition. Operation of the CRVS does not interfere with the ability to operate or shut down a unit.

Upon detection of smoke or toxic gas in the outside air duct, the outside air isolation dampers are closed to isolate the CRB from the environment. The CRVS is then operated in recirculation mode to provide conditioned air to the occupied areas of the CRB, with no outside air being introduced into the building. The CRB is not pressurized in this mode.

When gaseous or particulate radioactivity in the outside air duct exceeds the high setpoint, the normal outside air flow path is isolated and 100 percent of the outside air is bypassed through the air filtration unit to remove iodine and particulates. If high levels of radiation are detected downstream of the air filtration unit, or if normal AC power is lost to both CRVS air handling units for 10 minutes, or if power is lost to all EDSS-C battery chargers, the CRE is isolated and breathable air is supplied by the CRHS. An additional design feature allows the BDGS to provide power to components necessary for continued operation of the CRVS during a loss of normal AC power.

In normal operation, the CRVS maintains the MCR at a positive pressure relative to the outside environment. In off-normal conditions, the redundant CRE isolation dampers provide a barrier against the surrounding environment. These design features provide compliance with PDC 19.

The CRVS maintains the CRB at a higher pressure than its surroundings, except when in recirculation mode, limiting the amount of contamination that could enter during normal operation. The CRVS includes radiation monitors in the intake ductwork. When a high radiation signal is generated, the normal outside air flow path is isolated and 100 percent of the outside air is bypassed through the CRVS air filtration unit. When high radiation is detected downstream of the AFU, a signal is generated to close the outside air isolation dampers, which prevents further contamination from entering the CRB through this pathway. Thus, the CRVS limits the spread of contamination in compliance with 10 CFR 20.1406(b).

In a station blackout event, the CRE isolation dampers close to form part of the CRE. The CRHS then provides bottled air to the CRE. Along with the CRHS, the CRE isolation dampers ensure that a suitable operating environment is maintained to support operators and equipment in the MCR.

9.4.1.4 Inspection and Testing

Preoperational testing of the CRVS is performed as described in Section 14.2.

The CRVS is provided with adequate instrumentation, temperature, flow, and differential pressure indicating devices to facilitate testing and verification of proper equipment function. Additionally, the CRVS is designed to permit periodic inspection and testing of major components, such as fans, motors, dampers, coils, filters, and ducts to verify their integrity, operability, and capability. CRVS equipment and components are provided with proper access for initial and periodic inspection and maintenance activities.

Initial in-place testing of the air filtration unit and fan is in accordance with Section C.6 of RG 1.140, which endorses Section TA of ASME Standard AG-1. Duct and housing leak tests are performed after equipment installation. Testing is in accordance with Section TA of ASME AG-1, with maximum total leakage rate as defined in Article SA-4500. Periodic in-place testing of the AFU is in accordance with Section C.6 of RG 1.140, which endorses portions of ASME Standard N510 (Reference 9.4.1-16). Laboratory testing of AFUs is in accordance with Section C.7 of RG 1.140.

Access for inservice testing and inspection are per ASME AG-1, and for the CRVS air filtration unit (AFU), ASME N509, Section 4.8.

Fans, cooling coils, and heating coils are factory tested and certified. Initial testing and balancing to SMACNA HVAC Systems Testing, Adjusting and Balancing standards (Reference 9.4.1-10) are performed during the commissioning phase to verify operational performance. Routine maintenance is performed in accordance with manufacturer's recommendations.

COL Item 9.4-1: A COL applicant that references the NuScale Power Plant design certification will specify a periodic testing and inspection program for the normal control room heating ventilation and air conditioning system.

Controls over the availability and reliability of the CRVS will be included in the owner-controlled requirements manual.

9.4.1.5 Instrumentation Requirements

The CRVS includes instrumentation and controls essential to its performance. Principal instruments are listed in Table 9.4.1-4. The CRVS human-system interface is developed with human factors engineering functional allocations, task analyses, and alarm philosophies to determine the functions of the CRVS that are monitored or controlled locally, in the MCR, or both.

The CRVS uses reliable, industry-accepted temperature, pressure, smoke detection, and flow elements and transmitters. Instrumentation is designed to be placed in the system to efficiently and safely control the CRVS and alert the operator of undesirable conditions. Instrumentation and controls are in accordance with the applicable guidance or ASME AG-1 and ASME N509.

The CRVS design incorporates automatic HVAC controls accessible from the MCR. During normal operating conditions, the CRVS is operated in the automatic mode with local manual override capabilities.

The CRVS intake ductwork includes radiation monitors, toxic gas monitors, and smoke detectors. Additional smoke and radiation monitors are located downstream of the AHUs. Signals from smoke detectors located in HVAC equipment are sent to the fire detection system and the MCR.

9.4.1.6 References

9.4.1-1 American Society of Mechanical Engineers, *Nuclear Power Plant Air-Cleaning Units and Components*, ASME N509-2002, New York, NY.

9.4.1-2 American Society of Mechanical Engineers, *Code on Nuclear Air and Gas Treatment*, AG-1, 2015 Edition, New York, NY.

9.4.1-3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, "Methods of Testing for Rating Forced Circulation Air Cooling and Air Heating Coils," ASHRAE Standard 33-2016.

9.4.1-4 Air Movement and Control Association International, Inc., "Laboratory Methods of Testing Fans for Rating," AMCA Standard 210-07, Revision 2008, Arlington Heights, IL.

9.4.1-5 Air Movement and Control Association International, Inc., "Reverberant Room Method for Sound Testing of Fans," AMCA Standard 300-14, Revision 2014, Arlington Heights, IL.

9.4.1-6 Air-Conditioning, Heating, and Refrigeration Institute, "Forced-Circulation Air Cooling and Air Heating Coils," AHRI 410-2001, Arlington, VA.

9.4.1-7 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), "Round Industrial Duct Construction Standards," Second Edition, 1999, Chantilly, VA.

9.4.1-8 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), "Rectangular Industrial Duct Construction Standards," Second Edition, 2004, Chantilly, VA.

9.4.1-9 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), "HVAC Duct Construction Standards-Metal & Flexible," Third Edition, 2005, Chantilly, VA.

9.4.1-10 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), "HVAC Systems Testing, Adjusting and Balancing," Third Edition, 2002, Chantilly, VA.

9.4.1-11 National Fire Protection Association, "Fire Code," NFPA 1, 2015 Edition, Quincy, MA.

9.4.1-12 National Fire Protection Association, "Standard for Fire Doors and Other Opening Protectives," NFPA 80, 2016 Edition.

9.4.1-13 National Fire Protection Association, NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, 2015 Edition, Quincy, MA.

9.4.1-14 Underwriters Laboratories Inc. (UL), UL 555, "Standard for Fire Dampers," 7th Edition, Northbrook, IL.

9.4.1-15 Underwriters Laboratories Inc. (UL), UL 555S, "Smoke Dampers," 5th Edition, Northbrook, IL.

9.4.1-16 American Society of Mechanical Engineers, *Testing of Nuclear Air Treatment Systems*, ASME N510-2007, New York, NY.

Table 9.4.1-1: CRVS Outdoor Air Design Conditions

Parameter	Temperature*
Maximum outdoor design dry bulb temperature	115°F
Maximum coincident design wet bulb temperature	80°F
Maximum non-coincident wet bulb temperature	81°F
Minimum outdoor design dry bulb temperature	-40°F

*Table 9.4.1-1 temperatures are zero percent exceedance values (historical limits excluding peaks <2 hours)

Table 9.4.1-2: CRVS Indoor Air Design Conditions

Area	Temperature	Relative Humidity
Main control room	73°F to 78°F	35% to 60%
Occupied areas; light work (central alarm station, offices, laboratories, etc.) without special electronic equipment.	73°F to 78°F	35% to 50%
Areas with frequent inspections or maintenance (without sensitive electronic equipment)	50°F to 105°F	Not Controlled
Areas with electronic equipment	65°F to 85°F	30% to 55%*
Battery rooms	68°F to 77°F	30% to 55%*

*The relative humidity for areas with electronic equipment, including the battery rooms, is in accordance with manufacturers' requirements.

Table 9.4.1-3: Major CRVS Equipment

CRVS Supply AHUs (2x100%)			
Component	Quantity (per AHU)	Capacity*	Units
Fan	1	40,000	cfm
Cooling coil	1	1,383	MBtu/hr
Heating coil, normal	1	47	kW
Heating coil, smoke purge	1	168	kW
Humidifier	1	134	lb/hr

CRVS Air Filtration Unit			
Component	Quantity (per AHU)	Capacity*	Units
Fan	1	3,600	cfm
Heating coil	1	107	kW

Various Fans			
Fan	Quality	Capacity*	Units
Smoke purge exhaust	2	6,500	cfm
General exhaust	1	400	cfm
Battery room exhaust	2	1,200	cfm
Stairwell heating and pressurization	1 per stairwell	540 and 630	cfm
Elevator machine room	1	1,000	cfm
Elevator pressurization	1	5,000	cfm

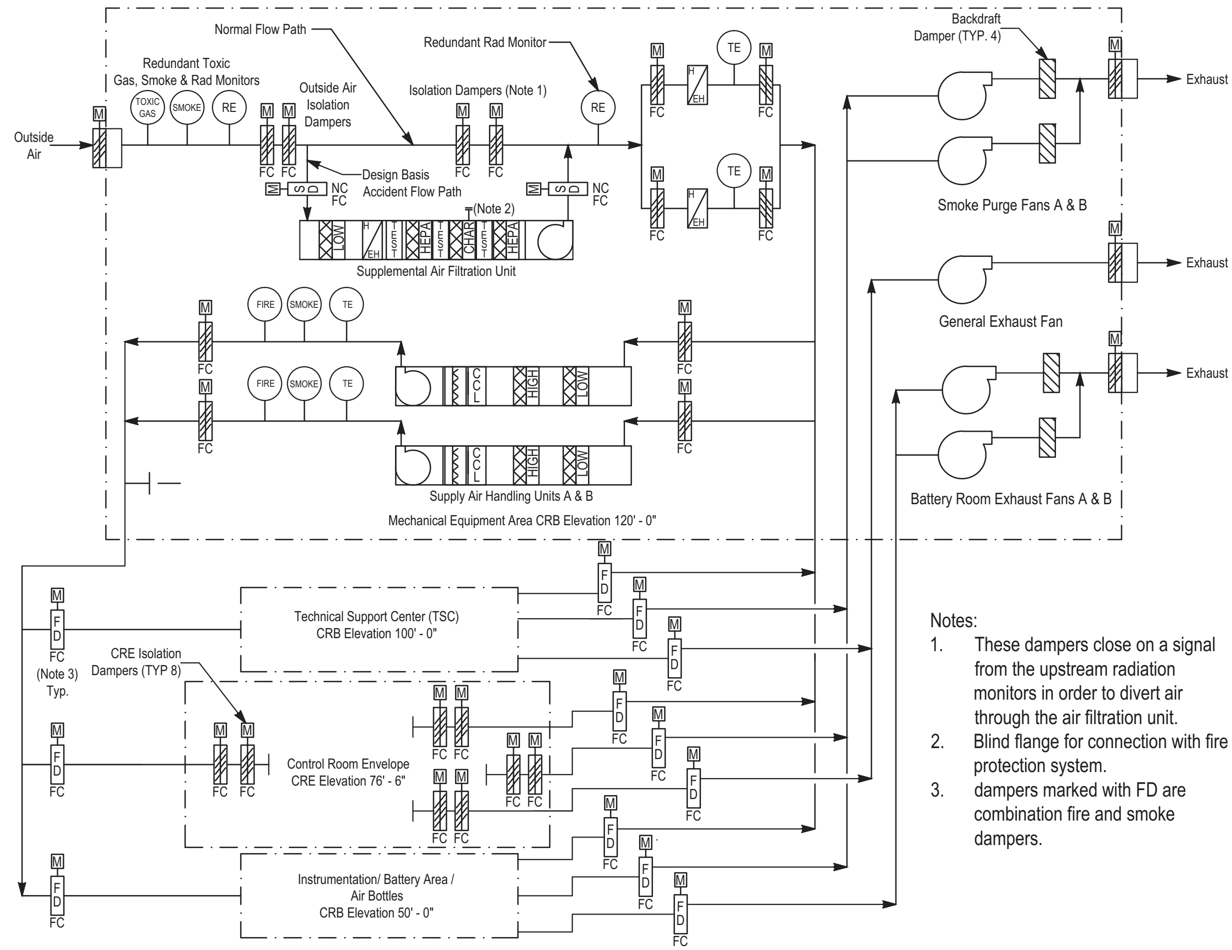
*Nominal values, per each device

Table 9.4.1-4: CRVS Instruments

Type	Sensor Location	Local Indication	Monitored by PCS or PPS
Radiation monitors (upstream of charcoal filtration unit)	Duct mounted - outside air intake ductwork	Yes	PCS
Radiation monitors (downstream of charcoal filtration unit)	Duct mounted - outside air intake ductwork	Yes	PPS
Differential air pressure, filters	Unit mounted - AHUs and outside air filter unit	Yes	PCS
Differential air pressure, building pressure	Mounted in CRE and outside of building	No	PCS
Smoke detectors	Duct mounted - AHU supply and return ducts (as required per NFPA 90A)	No	PCS
Smoke detectors	Duct mounted - outside air intake	No	PPS
Toxic gas detectors	Duct mounted - outside air intake	Yes	PPS
Temperature sensors	Duct mounted - AHU supply ducts	No	PCS
Temperature sensors	Room mounted - selected CRB internal spaces and rooms	Yes	PCS
Relative humidity sensors	Room mounted - selected CRB internal spaces and rooms	Yes	PCS
Relative humidity sensors	Unit mounted - charcoal filtration unit	No	PCS
Air flow measuring stations	Duct mounted - AHU supply ducts	No	PCS
Damper position except as noted below	Dampers	Yes	PCS
CRE isolation damper* position	Dampers	Yes	PPS
Outside air isolation damper* position	Dampers	Yes	PPS

* These dampers receive a close signal from the PPS

Figure 9.4.1-1: Control Room Ventilation System Diagram



Notes:

1. These dampers close on a signal from the upstream radiation monitors in order to divert air through the air filtration unit.
2. Blind flange for connection with fire protection system.
3. dampers marked with FD are combination fire and smoke dampers.

9.4.2 Reactor Building and Spent Fuel Pool Area Ventilation System

The Reactor Building (RXB) contains a single air volume encompassing the reactor pool, the refueling pool, spent fuel pool (SFP), dry dock, new fuel storage, the NuScale Power Modules (NPMs) and their handling equipment. The Reactor Building HVAC system (RBVS) is designed to maintain acceptable ambient conditions in the RXB to support personnel and equipment, and to control airborne radioactivity in the area during normal operation and following events that have the potential to release radioactivity in the RXB, such as a fuel handling accident.

The RBVS includes three subsystems: the supply subsystem, the general area exhaust subsystem, and the SFP exhaust subsystem. During normal operation, the RBVS provides conditioned and filtered outside air to the RXB, high-efficiency particulate air (HEPA)- exhaust from RXB, and HEPA-filtered exhaust from the SFP area. The two exhaust subsystems deliver air to the plant exhaust stack for discharge from the plant. In addition to air from the RXB, the RBVS general area exhaust subsystem receives and filters air from the Radioactive Waste Building HVAC system (RWBVS) and the Annex Building HVAC system (ABVS).

9.4.2.1 Design Bases

This section identifies the RBVS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The RBVS serves no safety-related or risk significant function, is not credited for mitigation of design basis accidents, and has no safe shutdown function. General Design Criteria (GDC) 2, 3, and 5 were considered in the design of the RBVS. Components of the RBVS whose structural failure could adversely affect Seismic Category I SSC are designed as Seismic Category II. The remainder of the RBVS is Seismic Category III (nonseismic). Consistent with GDC 3, the RBVS is designed to limit hydrogen concentration in battery rooms in accordance with Regulatory Position 6.1.7 of Regulatory Guide (RG) 1.189 by using guidance in Section 52.3.6 of NFPA 1 (Reference 9.4.2-6). Consistent with GDC 5, the RBVS is common for the NPMs and is designed to operate during an accident on one unit without significantly affecting the capability to conduct a safe and orderly shutdown and cooldown on the remaining units. See Section 9.4.2.3 for the safety evaluation.

The RBVS is designed to remove radioactive contaminants from the exhaust streams of RXB general area, the radioactive waste building general area, and the annex building (ANB). The exhaust from the RBVS is monitored for radioactive contamination consistent with GDC 60. The RBVS includes air filtration and utilizes automatic realignment of the SFP area subsystem to limit release of airborne radioactive contaminants to the environment consistent with GDC 61. Consistent with GDC 64, RBVS exhaust paths are monitored for radioactive releases.

To maintain the radiation exposure to operating and maintenance personnel as low as reasonably achievable (ALARA), the RBVS is designed to facilitate maintenance, inspection, and testing in accordance with the guidance in RG 8.8.

Consistent with 10 CFR 20.1406, the design of the RBVS includes provisions to limit the spread of contamination and to facilitate eventual plant decommissioning.

The anticipated range of outdoor weather conditions is presented in Table 9.4.2-1. Design temperatures for RXB conditioned spaces are presented in Table 9.4.2-2. Design data for the major RBVS components are presented in Table 9.4.2-3.

9.4.2.2 System Description

The RBVS maintains ventilation, permits personnel access, and controls airborne radioactivity in the RXB during normal operation and following postulated events that could release radioactivity in the RXB, such as a fuel handling accident.

The RBVS is generally a once-through system utilizing 100 percent outside air. Exceptions to the once-through air flow path include the:

- module protection system input and output rooms
- battery rooms
- battery charger rooms
- remote shutdown station
- telecommunications rooms
- elevator machine room

These rooms are determined to be radiologically clean and are not designed with once-through flow because they are maintained at positive pressure relative to the surrounding spaces. Pressurization air for these rooms is provided from the main RBVS supply system and ensures continuous airflow from these areas to areas of potential contamination. Moderate air exchange is accomplished via the pressurization air. The system is designed to move air from areas that are not contaminated or are expected to have low levels of contamination to areas that are likely to be more contaminated.

Other than the exceptions noted above to the rooms with once-through air flow, the RBVS provides a minimum of 0.5 air changes per hour in most areas of the RXB. Areas of the RXB considered most likely to become contaminated are provided with a higher air change rate in order to reduce concentration levels to within ALARA guidelines. These areas are summarized in Table 9.4.2-5

The control system maintains supply and exhaust fan speed so that air pressure in the RXB remains below air pressure in the outdoor environment.

A simplified diagram of the RBVS is shown in Figure 9.4.2-1.

Areas served by the RBVS include:

- reactor pool area
- SFP area
- dry dock area
- new fuel area
- battery, battery equipment, and input and output rooms
- galleries
- telecommunications rooms
- hot lab
- remote shutdown station
- elevator machine room

The supply subsystem includes four main supply air handling units (AHUs), AHUs for the input and output rooms, battery room, and battery charger rooms (two per operating NPM), and two remote shutdown station AHUs. There are ten telecommunications rooms, each of which is served by two fan coil units (FCUs). The elevator machine room is served by two FCUs. The reactor pool area also includes two supplemental recirculation AHUs that provide the additional cooling capacity to meet the heat loads in this area.

The general area exhaust subsystem includes HEPA filter units and exhaust fans. The SFP exhaust subsystem includes two charcoal and HEPA filter units and exhaust fans.

Both the general area and SFP exhaust subsystems have a standby fan and filter set, and each fan and filter set has isolation dampers that can be closed to isolate the equipment for inspection, testing, and maintenance while the remaining sets are in operation. Airflow through each exhaust filter is limited to approximately 30,000 cfm to ensure reliable in-place testing in accordance with RG 1.140. The RBVS filters all exhaust air in order to reduce radioactivity release to the environment.

The general exhaust subsystem collects exhaust air from the non-spent fuel areas on each level of the RXB, including the battery rooms. The exhaust ducts are all routed and connected to a main general exhaust duct at the 75 ft level of the RXB. Exhaust from the RWBVS (Section 9.4.3) and the ABVS then joins exhaust from the RBVS. Radiation monitors are provided in the exhaust ductwork of the RWBVS and the ABVS upstream of the point at which these systems tie into the RBVS exhaust ductwork.

The combined exhaust from the RBVS, RWBVS, and the ABVS is then ducted to the RWB where it is distributed to multiple HEPA filter units, each of which is in series with a centrifugal exhaust fan. These RBVS general exhaust filter units are located on the 100 ft level on the north side of the RWB. The discharge from the RBVS general exhaust fans is then collected into a single discharge duct that connects to the plant exhaust stack, which is located in the northwest corner of the RWB.

The SFP exhaust subsystem draws air through vents located just above the water level around most of the SFP perimeter. This exhaust is ducted to one of two HEPA filtration units with associated exhaust fans. The fan and filter units operate in a lead and stand-by arrangement in which one unit is in operation and the redundant unit is in stand-by. The SFP exhaust filter units utilize HEPA filters and charcoal adsorbers to minimize radioactivity contained in the SFP exhaust. The exhaust is normally filtered through the HEPA filters, but also passes though charcoal adsorbers if high radiation is detected upstream of the SFP filter unit. The SFP exhaust proceeds directly to the plant exhaust stack. The spent fuel exhaust subsystem is designed for continuous operation during all modes of plant operation. All portions of the SFP exhaust subsystem that are located inside the RXB are designed to Seismic Category II standards. This includes the SFP exhaust filter units and fans.

Each NPM bay has an exhaust air vent that incorporates a fire damper and a blast damper.

Condensation from RBVS equipment is directed to the radioactive waste drain system.

9.4.2.2.1 Component Description

Outside Air Intakes

The RBVS supply air intakes are located so that they are clear from the steam generator atmospheric dump valves, any relief valves, diesel tractor parking areas, the plant exhaust stack, and other gas emitters that may present a hazard to personnel or operations in the RXB.

Outdoor air intake openings are equipped with louvers, bird screens, security and debris screens, blast dampers, and fire dampers to minimize the effects of high winds, rain, snow, ice, trash, and other external forces on the operation of the system, including aircraft impact. Air intake openings are provided with hardened shrouds to protect the dampers from external events. The shrouds protecting the HVAC intakes are constructed of 7000 psi concrete with four #11 bars at 12" on center each way, top and bottom. In addition, the horizontal portion of the awning protection has two #6 shear ties at 12" on center.

Supply Air Handling Units and Fans

Cooling and heating of the ventilation air serving the RXB is provided by four AHUs with variable speed supply air fans. Each AHU is sized at one-third of the total capacity. Three of the units are normally in operation and one is in standby. The AHU housing consists of a prefilter bank, a high efficiency filter bank, a heating coil bank, a chilled water cooling coil bank, and a centrifugal supply fan. During winter conditions, outdoor air below 40 degrees Fahrenheit is preheated by a duct mounted preheat coil before entering the AHU.

General Area Exhaust Fan and Filter Units

There are nine general area exhaust fan and filter units. Eight are normally in service and one is in standby. Each unit includes a low efficiency filter bank followed by a HEPA filter bank. The filter unit is a draw-through type unit with a centrifugal exhaust fan downstream of the filter section. Each fan and filter set exhausts to the plant exhaust stack.

The filtration unit configurations, including housing, internal components, ductwork, dampers, fans, and controls, are designed, constructed, and tested to meet the applicable performance requirements of ASME N509, N510, and AG-1 (Reference 9.4.2-1, Reference 9.4.2-2, and Reference 9.4.2-3) to satisfy the guidelines of RG 1.140. The filtration unit housings are designed so that maximum leakage rates do not exceed one percent of the design flow in accordance with ASME AG-1.

Spent Fuel Pool Exhaust Charcoal and HEPA Filter Units

There are two SFP exhaust fan and filter combinations (one primary, one standby), each with a 100 percent capacity. Each SFP exhaust charcoal and HEPA filter unit includes, in order of the flow stream: low efficiency filter, heater bank, test section, HEPA filter bank, test section, charcoal adsorbers, test section, bypass section, low efficiency filter, and a HEPA filter bank. There are two flow paths through the SFP exhaust filter units. During normal operation, the air passes through the low efficiency filter and the final HEPA filter bank. Upon detection of radiation levels above the set design limit, the exhaust is diverted through all sections of the filter unit. The filter unit is a draw-through type unit with an exhaust fan downstream of the filter section.

Per RG 1.140, the SFP exhaust charcoal and HEPA filter units include low efficiency and HEPA prefilters to protect the charcoal filter modules, and final HEPA filters to remove carbon fines before air passes to the exhaust fans and discharges to the plant exhaust stack. The SFP exhaust air filtration units include heating coils to maintain the entering air relative humidity below 70 percent to prevent excessive moisture from degrading the adsorption capacity of the charcoal, per RG 1.140.

Charcoal filtration removes radioactive iodine in accordance with 10 CFR 20 and 10 CFR 50 Appendix I. The air filtration units are able to withstand inlet concentrations of radioactive iodine up to 10^6 μCi/cm^3, relative humidity of the influent stream up to 100 percent, and temperatures of the influent stream up to 125 degrees Fahrenheit.

The fans for the SFP exhaust are powered from separate buses of the low voltage AC electrical distribution system. Blind flange connections for a deluge water spray system on the charcoal filters are provided in accordance with NFPA 804 (Reference 9.4.2-10).

Supply and Exhaust Fans

The supply fans follow filter stages and cooling and heating coil stages. Fans are designed and rated in accordance with AMCA 210 and AMCA 300 (Reference 9.4.2-4 and Reference 9.4.2-5).

AHU and FCU Filters

The low-efficiency and high-efficiency filters have a rated dust spot efficiency based on ASHRAE 52.2 (Reference 9.4.2-17). The filters meet UL 900 (Reference 9.4.2-18) Class I construction criteria, non-burning.

High-Efficiency Particulate Air Filters

The high-efficiency particulate air (HEPA) filters in the exhaust subsystems minimize the release of contaminated particulates from the facility. HEPA filters are constructed, qualified, and tested in accordance with UL 586 (Reference 9.4.2-22), and ASME AG-1, Section FC. Each HEPA filter cell is individually shop tested to verify an efficiency of at least 99.97 percent using a monodisperse 0.3-µm aerosol in accordance with ASME AG-1, Section TA.

Each charcoal adsorber is designed constructed, qualified, and tested in accordance with ASME AG-1, Section FE. Each charcoal adsorber is a single assembly with welded construction and 4-inch deep bed Type III rechargeable adsorber cell.

Input and Output Rooms, Battery Room, and Battery Charger Room AHUs

Each NPM has a dedicated set of rooms consisting of two input and output rooms, four battery rooms, and four battery charger rooms. Each set of rooms is served by two 100 percent capacity recirculation AHUs. During normal operation, each AHU operates at 50 percent capacity. One AHU serves Train A and C charger rooms, and the other AHU serves Train B & D charger rooms. Upon failure of one of the AHUs, the available AHU then serves all rooms at 100 percent capacity while the failed unit is serviced. Supply and return air is conveyed from the AHUs through ductwork to the rooms. During normal operation, cooling is provided by chilled water cooling coils. Each AHU is also equipped with a direct expansion cooling coil. The air cooled condensing unit associated with each direct expansion coil is located outside the building. The purpose of the direct expansion coils and associated condensing units is to provide room cooling without powering the chilled water system.

The input and output rooms, battery rooms, and battery charger rooms are equipped with duct-mounted electric reheat coils for individual room temperature and humidity control.

Remote Shutdown Station AHUs

Cooling and heating of the remote shutdown station is provided by two 100 percent capacity (one primary, one standby) AHUs. The AHUs each include a low efficiency filter bank, a chilled water cooling coil bank, a heating coil, and a variable speed supply fan.

Reactor Pool Area Air Handling Units

The reactor pool area on the 100-ft level in the RXB is served by two 100 percent capacity (one primary, one stand-by) recirculation AHUs. These recirculation AHUs provide additional cooling capacity for this area by chilled water cooling coils. Supply and return air is conveyed from the AHUs through ductwork to the reactor pool area. Heating for the reactor pool area is provided by a heating coil located in the reactor pool area AHUs.

Fan Coil Units

The cooling and heating of each telecommunication room and the elevator machine room is provided by an FCU. The telecommunication rooms and elevator machine room are served by two 100 percent capacity (one primary, one stand-by) FCUs. The FCUs each incorporate a low efficiency filter, a chilled water cooling coil, a heating coil, and a supply fan.

Duct and Accessories

Ductwork, duct supports and accessories are constructed of galvanized steel. Ducting interior and exterior surfaces have relatively smooth finishes to reduce localized collection of radioactive contamination. The lengths of ducting runs are minimized, as are abrupt changes in direction. These measures are good ALARA practices and facilitate eventual site decommissioning. The RBVS component housings and ductwork are designed to exhibit, on a test, a maximum total leakage rate as defined in Article SA-4500 of ASME AG-1.

Ductwork, supports, and accessories meet the design and construction requirements of Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) HVAC Duct Construction Standards - Metal and Flexible (Reference 9.4.2-14), SMACNA Rectangular Industrial Duct Construction Standards (Reference 9.4.2-15), and SMACNA Round Industrial Duct Construction Standards (Reference 9.4.2-16).

Supply and exhaust ducting has balancing dampers that are manually set when the system is initially tested and balanced.

Isolation Dampers

Isolation dampers are low-leakage, single-blade or parallel-blade type and have spring return actuators which fail in the safe position. Isolation dampers are used to isolate components for maintenance or replacement. Bubble-tight dampers are utilized for isolation of the exhaust filter units.

Fire Dampers

Fire dampers are provided at duct penetrations through fire barriers to maintain the fire resistance ratings of the barriers. The fire dampers meet the design and installation requirements of UL 555 (Reference 9.4.2-11) and are in compliance with NFPA 90A (Reference 9.4.2-8) and NFPA 804.

Smoke Dampers

Smoke dampers are provided for smoke isolation of areas or AHUs. The smoke dampers meet the design and installation requirements of UL 555s (Reference 9.4.2-12).

Combination Fire and Smoke Dampers

Combination fire and smoke dampers are provided at duct penetrations through fire barriers to maintain the fire resistance ratings of the barriers and isolation of smoke. The combination fire and smoke dampers meet the design and installation requirements of UL 555 and UL 555S.

Blast Dampers

Blast dampers are included in the intake and exhaust ductwork to protect the RXB from explosions in adjacent areas. The exhaust blast dampers are located at the ductwork interface between the RXB and the RWB.

Plant Exhaust Stack

The plant exhaust stack is located in the northwest corner of the RWB. The minimum stack height is set in accordance with criteria in RG 1.194, Section 3.2.2. Per the Department of Energy Nuclear Air Cleaning Handbook (Reference 9.4.2-20), Section 5.5.2, the stack is designed to maintain a minimum stack exit velocity of 3,000 fpm to prevent downwash from winds up to 22 mph, to keep rain out, and to prevent condensation from draining down the stack. The plant exhaust stack is designed in accordance with ASME-STS-1 (Reference 9.4.2-19) and ASME AG-1, Section AA.

9.4.2.2.2 System Operation

9.4.2.2.2.1 Normal Operation

During normal plant operation, the RBVS main supply AHUs, the general exhaust, and the SFP exhaust units are active and servicing the RXB general area, the reactor pool area, the fuel handling area, and the equipment galleries. In addition, RBVS filters exhaust from the ABVS and the RWBVS via the general exhaust subsystem.

The main supply AHUs and general exhaust filter units operate continuously and provide sufficient ventilation and air conditioning to maintain personnel comfort and equipment reliability. One of the general area fans and one of the filter units is in standby mode allowing flexibility for maintenance activities.

The general exhaust system also serves the battery rooms to maintain hydrogen concentrations to less than one percent by volume.

The SFP exhaust subsystem draws air near the surface of the SFP through vents located along the long sides of the SFP and the refueling dock pool. The SFP exhaust air bypasses the charcoal adsorbers of the filter units during normal operation. One of the two SFP exhaust fans and filter units is in service and the remaining exhaust fan and filter unit is in standby.

The recirculating cooling subsystem, located in the SFP area, is normally in operation, as are the AHUs servicing the input and output rooms, battery rooms, and battery charger rooms, the remote shutdown AHU, and the FCUs servicing the telecommunications rooms and the elevator machine room.

9.4.2.2.2.2 Off-normal Operation

High Radiation Alarm in Plant Exhaust Stack

A high radiation signal from the sensor in the plant exhaust stack provides an alarm in the main control room (MCR), but results in no automatic actions. The operating staff takes action to determine the source of the contamination and isolate it. In general, this does not include shutting down RBVS supply and exhaust fans, as these provide control of air flow direction through the RBX and out a monitored release path.

High Radiation Alarm in Spent Fuel Pool Area

Upon detection of radiation within the SFP exhaust ductwork exceeding the high limit, three automatic actions occur:

- The SFP exhaust air is diverted through both the HEPA filter and the charcoal adsorbers.
- The isolation damper of the RXB general exhaust from the dry dock area and SFP area is closed.
- The supply fans reduce capacity to accommodate the reduction in exhaust.

These realignments ensure that potentially contaminated air in the SFP area passes through the charcoal filters. In addition, air in other areas of the RXB continues to flow from areas of low contamination to areas of potentially higher contamination, and exhaust from the RWB and ANB continues to flow into the RBVS exhaust.

Recovery from an event that has triggered this high radiological mode takes place after an analysis of the event has occurred. The RBVS may be allowed to return to normal operation only after the hazard has been contained and the system has been determined safe to operate in its normal configuration. Negative pressure in both the RXB and RWB is maintained at all times as the RBVS returns from off-normal operation to normal operation.

Loss of Normal Power

If the normal power supply to the RBVS is lost, the following actions take place:

- The isolation dampers for the general area exhaust fan and filter sets fail to their closed position.

- The isolation dampers located in the normal flow path of the spent fuel pool exhaust ductwork fail to their open position.
- The isolation dampers located in the ductwork of the secondary flow path, containing the charcoal filters, fail to their closed position.

These actions provide a passive HEPA filtered vent path for the atmosphere within the RXB, providing a monitored release path to the environment for the potentially contaminated air.

The SFP area, the chemical and volume control system rooms, and the demineralizer rooms have higher potential contamination levels than surrounding areas. Therefore, the system is designed with exhaust capacity exceeding supply capacity, which creates airflow into these areas from the cleaner areas. If the normal power supply to the RBVS is lost, the SFP exhaust filter units and associated fans can be powered by the auxiliary AC power source with the general area exhaust subsystem not running. In this configuration, all exhaust from the RXB passes through HEPA filters. If the radiation level is sufficiently high, the exhaust also passes through charcoal filters. The resulting system flow maintains the preferred direction of air flow from areas of lower potential radioactivity to areas of higher potential radioactivity.

The remote shutdown station AHUs can also be powered by the auxiliary AC power source. The AHUs serving the input and output rooms, battery rooms, and battery charger rooms can be powered from the backup diesel generator system. Cooling for these rooms can be provided by installed direct expansion coils which can also be powered from the backup diesel generator system.

Fire or Smoke in Charcoal Filter Alarm

In the event of an indication of a fire in one of the charcoal filter banks, the MCR dispatches a team to evaluate the filter bank. Operators in the MCR stop the related fan, isolate the system by closing the unit isolation dampers, and start the standby fan and filter set. The filter bank has temperature sensors on the entrance and exit sides of the charcoal filter section and a smoke detector on the exit side of the filter section. The two-stage temperature alarms are for high and high-high. The deluge sprinkler system is activated manually once an evaluation has confirmed the need for activation. This is in conformance with the requirements of ASME N509, Section 4.11 and ASME AG-1, Section FE-4600 and Table IA-C-1000.

Fire or Smoke Detection Alarm

If smoke is detected, an alarm is initiated on the fire detection system in the MCR. The stairwells and elevator are pressurized by dedicated pressurization fans to minimize smoke infiltration. In accordance with NFPA 90A, when smoke is detected in the ductwork downstream from an air handler, the air handler fan automatically stops. The fan can be manually reactivated to aid with smoke removal.

Fire Detection Alarm

In the event of a fire occurring within the RXB, duct-mounted fire dampers prevent the spread of fire through duct penetrations of fire-rated floors and partitions. Operators isolate smoke-filled areas by manually closing the appropriate smoke dampers, and isolating the supply and exhaust ductwork for an area. The RBVS subsystems remain in operation unless plant operators determine that there is a need to manually shut down the subsystems.

Elevated Temperatures Under Bioshield

Degradation of the polyethylene radiation shielding material could potentially occur if the exhaust ventilation provided for the reactor module bays does not maintain air temperatures under the bioshield less than 180°F (e.g., due to damper failure). Therefore, conditions in which the air temperature under the bioshield exceeds 180°F require an evaluation of the continued efficacy of the bioshield polyethylene material's radiation shielding properties.

9.4.2.3 Safety Evaluation

The RBVS is nonsafety-related and does not perform a function to prevent a design basis accident, nor is it credited to mitigate the consequences of a fuel handling accident or any other design basis accident. The exhaust subsystem from the spent fuel pool area is credited as a passive vent path for high energy line breaks in the Reactor Building. Section 15.0.3 describes the radiological consequences of design basis accidents.

General Design Criterion 2 was considered in the design of the RBVS. In accordance with Section 3.2.1.2 and the design guidance of RG 1.29, portions of the RBVS whose structural failure could adversely affect the operability of Seismic Category I SSC are designed to Seismic Category II standards. Other portions of the RBVS are designed to Seismic Category III (nonseismic).

General Design Criterion 3 was considered in the design of the RBVS. The RBVS prevents explosive levels of hydrogen from forming in RXB battery rooms.

General Design Criterion 5 was considered in the design of the RBVS. The RBVS does not have a function relative to shutting down an NPM or maintaining it in a safe shutdown condition. Operation of the RBVS does not interfere with the ability to operate or shut down an NPM.

All exhaust from the RXB passes through HEPA filters. Exhaust from the SFP area also passes through charcoal filter banks when radiation is detected. On a loss of the normal power supply to the RBVS, all of the RBVS fans stop and dampers re-align so that all exhaust passes through the HEPA filter section of the SFP exhaust filter units.

The SFP exhaust fans can be restarted using the auxilliary AC power source for power. In this alignment, the RXB is maintained at a lower pressure than its surroundings, air flow within the building is from typically lower contamination areas to areas that may be more contaminated, and all exhaust passes through the SFP exhaust filter units. This design controls release of radioactive contaminants to the environment, satisfying GDC 60.

The SFP is located within the RXB, which is a controlled-leakage building. Exhaust from the SFP area passes through the RBVS exhaust charcoal and HEPA filter units. The exhaust normally bypasses the charcoal filter, but passes through the charcoal when a high radiation level is detected in the ductwork downstream of the SFP area. In this condition, the general exhaust subsystem fans reduce capacity and maintain the design exhaust airflows for the RWB and ANB. The RBVS supply system reduces its capacity to provide ventilation air while maintaining the RXB at negative pressure relative to the atmosphere. Based on these design considerations, the RBVS satisfies GDC 61.

All HVAC exhaust from the RXB, RWB, and ANB is monitored for radioactivity by sensors in the plant exhaust stack. Radiation monitors are also provided in the general exhaust ductwork from the RWB, RXB, and the Annex Building.The functions of these monitors constitute compliance with GDC 64.

The RBVS is designed to move air from areas of typically lower radioactive contamination to areas that are potentially more contaminated. The RBVS is designed with ducting runs as short as practical and that do not have sudden directional changes. Interior and exterior duct surfaces are relatively smooth. The SFP area exhaust subsystem removes air from this potentially contaminated area and filters the exhaust. These design measures help to prevent localized buildup of radioactive contamination and facilitate the eventual decommissioning of the plant in accordance with10 CFR 20.1406.

9.4.2.4 Inspection and Testing

A system air balance test and adjustment to design conditions is conducted in the course of the plant preoperational test program (Section 14.2). Airflow rates are measured and balanced in accordance with the guidelines of SMACNA HVAC Systems Testing, Adjusting and Balancing (Reference 9.4.2-13). Initial in-place testing of the RBVS is performed in accordance with Section TA of ASME AG-1. Periodic, in-place testing of normal atmosphere cleanup systems and components is performed in accordance with ASME N510.

Duct and housing leak tests are performed following equipment installation in accordance with Section TA of ASME AG-1 with maximum total leakage rate as defined in Article SA-4500.

For ease of inspection and maintenance, there is a minimum of three feet between mounting frames of component banks.

Fire dampers are periodically tested and inspected in accordance with NFPA 80 (Reference 9.4.2-7). Smoke (or fire and smoke) dampers are periodically tested and inspected in accordance with NFPA 105 (Reference 9.4.2-9).

COL Item 9.4-2: A COL applicant that references the NuScale Power Plant design certification will specify periodic testing and inspection requirements for the Reactor Building heating ventilation and air conditioning system in accordance with Regulatory Guide 1.140.

9.4.2.5 Instrumentation Requirements

The HVAC instrumentation is part of the plant control system. See Table 9.4.2-4 for a listing of the instruments associated with RBVS.

The following is a description of the general instrumentation utilized to monitor the RBVS:

- Automatic actuating dampers have position sensors that transmit damper position.
- Pressure differential sensors at each filter stage are located in AHUs and exhaust filter units to indicate if a filter is becoming loaded with particulate and should be changed. Filters located in the smaller FCUs either have local pressure differential indication or require visual inspection.
- Flow measurements are monitored for all AHU fans and exhaust fans to indicate system flow.
- A duct-mounted temperature element monitors temperature downstream of the main supply AHUs to control supply air temperature. The areas in the RXB served by just the main supply AHUs and the reactor pool area recirculation AHUs, that is, no local AHU or FCU, also contain room-mounted temperature elements in selected rooms for temperature monitoring in these spaces. These room-mounted temperature elements are used to adjust the set point temperature of the supply air from the main supply AHUs.
- Room-mounted temperature elements are located in the areas served by local recirculation AHUs and FCUs and are utilized to control the units, respectively. A room-mounted temperature element is located in the rooms that are served by dedicated reheat coil and unit heaters.
- Room-mounted humidity sensors are located in areas requiring humidity control to monitor the need for humidification or dehumidification as necessary.
- Humidity sensors are located in charcoal filter units. Excessive humidity can cause degradation of charcoal filtration media.
- Radiation monitors are provided in the SFP exhaust ductwork upstream of the charcoal filter units and in the plant exhaust stack. Radiation monitors are also provided in the general exhaust ductwork from the RWB, RXB, and ANB. These monitors are located upstream of where the respective exhaust ducts tie into the RBVS general exhaust. The radiation monitors are connected to local alarms and to indicators in the MCR. Radiation alarms will activate when radioactive gas levels are detected.
- Fan drive status, along with downstream flow, is used to activate the standby exhaust unit when a running unit fails. Indications in the MCR show if there is exhaust fan drive trouble or if the exhaust fan has stopped running.

Refer to Section 11.5 for a description of the plant exhaust stack radiation monitor, and to Section 12.3 for a description of the SFP area radiation monitor.

9.4.2.6 References

9.4.2-1 American Society of Mechanical Engineers, *Nuclear Power Plant Air-Cleaning Units and Components*, ASME N509-2002, New York, NY.

9.4.2-2 American Society of Mechanical Engineers, *Testing of Nuclear Air Treatment Systems*, ASME N510-2007, New York, NY.

9.4.2-3 American Society of Mechanical Engineers, *Code on Nuclear Air and Gas Treatment*, AG-1, 2015 Edition, New York, NY.

9.4.2-4 Air Movement and Control Association International, Inc., “Laboratory Methods of Testing Fans for Rating,” AMCA Standard 210-07, Revision 2007, Arlington Heights, IL.

9.4.2-5 Air Movement and Control Association International, Inc., “Reverberant Room Method for Sound Testing of Fans,” AMCA Standard 300-14, Revision 2014, Arlington Heights, IL.

9.4.2-6 National Fire Protection Association, “Fire Code,” NFPA 1, 2015 Edition, Quincy, MA.

9.4.2-7 National Fire Protection Association, “Standard for Fire Doors and Other Opening Protectives,” NFPA 80, 2016 Edition, Quincy, MA.

9.4.2-8 National Fire Protection Association, “Standard for the Installation of Air-Conditioning and Ventilating Systems,” NFPA 90A, 2015 Edition, Quincy, MA.

9.4.2-9 National Fire Protection Association, “Standard for Smoke Door Assemblies and Other Opening Protectives,” NFPA 105, 2016 Edition, Quincy, MA.

9.4.2-10 National Fire Protection Association, “Standard for Fire Protection for Advanced Light water Reactor Electric Generating Plants,” NFPA 804, 2015 Edition, Quincy, MA.

9.4.2-11 Underwriters Laboratories, Inc. (UL), “Standard for Fire Dampers,” UL 555, 7th edition, July 2006, Northbrook, IL.

9.4.2-12 Underwriters Laboratories, Inc. (UL), “Standard for Smoke Dampers,” UL 555S, 5th edition, February 2014, Northbrook, IL.

9.4.2-13 Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA), “HVAC Systems Testing, Adjusting and Balancing,” Third Edition, 2002, Chantilly, VA.

9.4.2-14 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), “HVAC Duct Construction Standards - Metal and Flexible,” Third Edition, 2005, Chantilly, VA.

9.4.2-15 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), "Rectangular Industrial Duct Construction Standards," Second Edition, 2004, Chantilly, VA.

9.4.2-16 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), "Round Industrial Duct Construction Standards," Second Edition, 1999, Chantilly, VA.

9.4.2-17 American Society of Heating, Refrigerating and Air-Conditioning Engineers, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," ASHRAE Standard 52.2-2012, Atlanta, GA.

9.4.2-18 Underwriters Laboratories, Inc. (UL), "Standard for Air Filter Units," UL 900, 8th Edition, April 2015, Northbrook, IL.

9.4.2-19 American Society of Mechanical Engineers, *Steel Stacks*, ASME STS-1-2011, New York, NY.

9.4.2-20 U.S. Department of Energy, "Nuclear Air Cleaning Handbook," DOE-HDBK-1169-2003, November 2003, Washington, D.C.

9.4.2-21 Institute of Electrical and Electronics Engineers, "IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications," IEEE Standard 1187-2013, Piscataway, NJ.

9.4.2-22 Underwriters Laboratories, Inc. (UL), "High-Efficiency, Particulate, Air Filter Units," UL 586, 9th Edition, August 2009, Northbrook, IL.

Table 9.4.2-1: Outside Air Temperature Range for Reactor Building Ventilation System

Parameter	Temperature*
Maximum outdoor design dry bulb temperature	100°F
Maximum coincident design wet bulb temperature	77°F
Minimum outdoor design dry bulb temperature	-10°F

*Table 9.4.2-1 temperatures are one percent annual exceedance values

Table 9.4.2-2: Reactor Building Ventilation System Indoor Design Conditions

Area	Temperature	Relative Humidity
Occupied areas; light work (control rooms, offices, laboratories, etc.) without special electronic equipment	73°F to 78°F	30% to 50%
Occupied areas; moderate work (shops, maintenance facilities)	65°F to 85°F	35% to 60% (see Note 2 below)
Inaccessible areas (without sensitive electronic equipment)	50°F to 130°F	Not controlled
Areas with frequent inspections and maintenance (without sensitive electronic equipment)	50°F to 105°F	Not controlled (see Note 3 below)
Areas with electronic equipment	65°F to 85°F	30% to 55% (see Note 1 below)
Battery rooms	68°F to 77°F	30% to 55% (see Note 1 below)

Note 1: The relative humidity for areas with electronic equipment, including the battery rooms, is in accordance with manufacturer's requirements. Temperature is based on recommended operating temperatures from Section 5.4.1 of IEEE 1187-2013 (Reference 9.4.2-21).

Note 2: In addition to the indoor design conditions shown, the maximum wet bulb globe temperature in the fuel handling area of the RXB is 80 degrees F during normal operation.

Note 3: For areas where heat stress on personnel is a concern, the design includes local cooling, as needed, to maintain working conditions consistent with the NuScale HFE Program Management Plan.

Table 9.4.2-3: Reactor Building Ventilation System Major Components

RBV Main Supply Air Handling Unit (33% capacity each)			
Component	Quantity (per AHU)	Capacity*	Units
Fan	1	39,000	cfm
Cooling coil	1	3224	MBH
Heating coil, primary	1	251	kW
Heating coil, preheat/snow melt	1	628	kW
Battery, Charger, & Input and Output Rooms AHU (2 AHUs per NPM)**			
Component	Quantity (per AHU)	Capacity*	Units
Fan	1	3200	cfm
Cooling coil	1	114	MBH
Humidifier	1	46	lb/hr
Heating coil, battery room	1 per battery room	5	kW
Heating coil, battery charger room	1 per charger room	1	kW
Heating coil, I/O room	1 per I/O room	3	kW
Battery & Charger Room {{ Withheld - See Part 9 }} AHU (4 AHUs total)			
Component	Quantity (per AHU)	Capacity*	Units
Fan	1	7200	cfm
Cooling coil	1	209	MBH
Humidifier	1	15	lb/hr
Heating coil, battery room	1	7	kW
Heating coil, battery charger room	1	12	kW
Reactor Pool Area Recirculation AHU (2 x 100%)			
Component	Quantity (per AHU)	Capacity*	Units
Fan	1	30,000	cfm
Cooling coil	1	1795	MBH
Heating coil	1	309	kW
Remote Shutdown Station AHU (2 x 100%)			
Component	Quantity (per AHU)	Capacity*	Units
Fan	1	2630	cfm
Cooling coil	1	69	MBH
Heating coil	1	7	kW
Humidifier	1	8	lb/hr
RBVS General Exhaust Fan and Filter Combinations			
Component	Quantity	Capacity*	Units
Fans	9 (8 operating, 1 standby)	23,000	cfm
Filter housings	Each filter housing contains a pre-filter section followed by HEPA filters		
RBVS Spent Fuel Pool Fan and Filter Combinations			
Component	Quantity	Capacity*	Units
Fans	2 @ 100%	30,000	cfm
Filter housings	2 @ 100%. Normal operation: air flows through a prefilter section followed by HEPA filters. Radiological mode: air flows through a prefilter section, then a heating coil, then HEPA filters, then charcoal filters, then through the normal operation section.		

*Nominal values for each fan or coil

**For each NPM there are 2 AHUs serving 2 input/output rooms, 4 battery rooms, and 4 battery charger rooms. This table shows the tag numbers for the equipment designated for NPM Number 1.

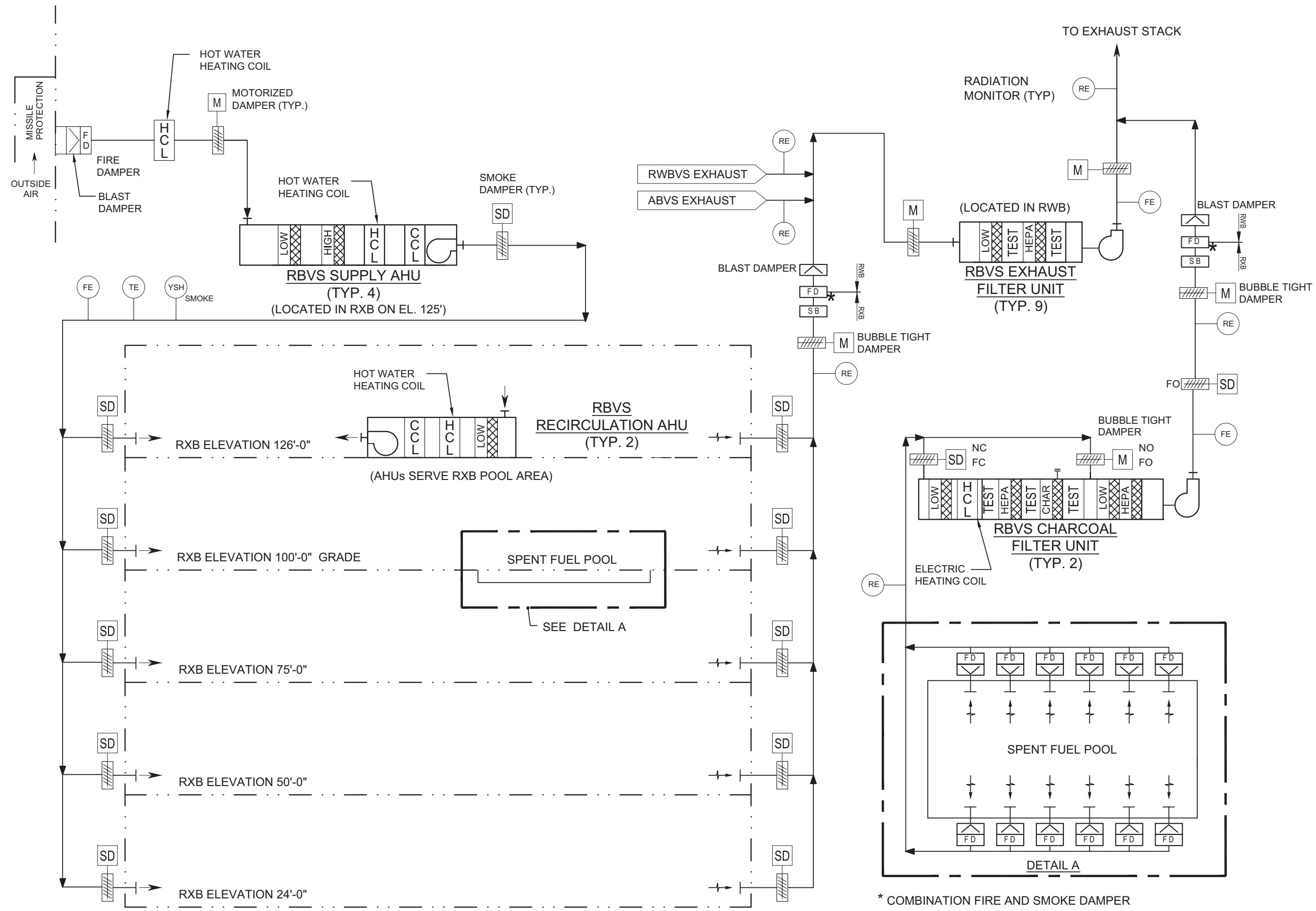
Table 9.4.2-4: Major Reactor Building Ventilation System Instruments

Type	Instrument Location	Local Indication
Radiation monitors	Duct mounted - spent fuel pool exhaust, plant exhaust stack, exhaust headers for annex building, reactor building, and radioactive waste building	No
Differential air pressure, filters	Unit mounted - located in AHU and local exhaust filter units	Yes
Differential air pressure, building pressure	Mounted in general building area and outside of building	No
Smoke detectors	Duct mounted - AHU supply and return ducts (as required per NFPA 90A)	No
Temperature sensors, duct mounted	Duct mounted - AHU supply ducts	No
Temperature sensors, room mounted	Room mounted - selected RXB internal spaces/rooms	Optional
Relative humidity sensors, room mounted	Room mounted - selected RXB internal spaces/rooms	Optional
Relative humidity sensors, unit mounted	Unit mounted - local charcoal filtration units	No
Air flow measuring stations	Duct mounted or in fan inlets	No
Damper position	All automatic dampers	Yes

Table 9.4.2-5: Reactor Building Areas with Air Change Rates Greater than 0.5 per Hour

Elevation	Room or Area	Minimum Air Changes per Hour
{{ Withheld - See Part 9 }}	Degasifier rooms	2
{{ Withheld - See Part 9 }}	Reactor coolant filter rooms	2
{{ Withheld - See Part 9 }}	Utilities area vault	2
{{ Withheld - See Part 9 }}	Heat exchanger rooms	2
{{ Withheld - See Part 9 }}	Utilities areas located between heat exchanger rooms	2
{{ Withheld - See Part 9 }}	Hot lab	8
{{ Withheld - See Part 9 }}	Module heatup system equipment rooms	2
{{ Withheld - See Part 9 }}	Reactor pool area	1
{{ Withheld - See Part 9 }}	Dry dock area	2
{{ Withheld - See Part 9 }}	New fuel area	1

Figure 9.4.2-1: Reactor Building HVAC System Diagram



9.4.3 Radioactive Waste Building Ventilation

The Radioactive Waste Building HVAC system (RWBVS) supports personnel access and equipment functions by maintaining a suitable operating environment in the Radioactive Waste Building (RWB), including the RWB control and monitoring room. The RWBVS also supports the control of radioactive contamination by maintaining airflow from areas of lesser potential contamination to areas of greater potential contamination, maintaining the RWB at a negative pressure with respect to the outside atmosphere, and collecting potentially contaminated discharges vented from equipment in the RWB.

The RWBVS does not perform atmospheric cleanup functions (i.e., it does not filter exhaust). However, exhaust portions of the system are considered to be an atmospheric cleanup system because they conduct potentially contaminated air to the Reactor Building HVAC system (RBVS) which filters the exhaust before releasing it to the atmosphere. See Section 9.4.2 for a description of the RBVS.

9.4.3.1 Design Bases

This section identifies the required or credited functions of the RWBVS, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The RWBVS serves no safety-related functions, is not credited for the mitigation of design basis accidents, and has no safe shutdown functions. The RWBVS is not credited to operate during abnormal plant conditions. General Design Criteria (GDC) 2, 3, and 5 were considered in the design of the RWBVS. Safety-related and risk-significant structures, systems, or components are not affected by the effects of natural phenomena such as earthquakes on the RWBVS. The RWBVS is Seismic Category III (nonseismic). Consistent with GDC 3, the RWBVS is designed to limit hydrogen concentration in battery rooms in accordance with Regulatory Position 6.1.7 of Regulatory Guide 1.189 by using guidance in section 52.3.6 of NFPA 1 (Reference 9.4.3-4). Consistent with GDC 5, the RWBVS does not have a function relative to shutting a unit down or maintaining a unit in a safe shutdown condition. See Section 9.4.3.3 for the RWBVS safety evaluation.

GDC 60 was considered in the design of the RWBVS. The exhaust from the RWBVS is monitored and filtered by the RBVS. Design of the RWBVS minimizes contamination of the facility and the environment, and therefore facilitates eventual plant decommissioning (10 CFR 20.1406).

The RWBVS is designed for outdoor conditions shown in Table 9.4.3-1, and conditions indoor spaces to the specifications shown in Table 9.4.3-2.

9.4.3.2 System Description

During normal operation, RWBVS maintains temperature and humidity control within ranges suitable for the comfort of personnel and to prevent degradation of equipment.

The system is designed to direct airflow from areas of lower potential contamination to areas of higher potential contamination.

The RWBVS main supply subsystem provides filtered and heated or cooled air to areas of the RWB including the following:

- trolley bay
- truck bay / loading dock
- warehouse
- pump and tank rooms
- liquid radwaste equipment room
- mechanical equipment room (contains the RBVS general exhaust filtration units and fans)

In addition to the main supply subsystem, the RWBVS has dedicated units which provide HVAC service to the following rooms of the RWB:

- electrical equipment room
- RWB control and monitoring room
- telecommunications room
- battery room and battery charger room

A simplified diagram of the RWBVS is shown in Figure 9.4.3-1.

The RWBVS air intake is located so that plant discharges are not in the proximity of the intake. The outside air intake is not located near the main steam safety valves, other relief valves, diesel tractor parking areas, the plant exhaust stack, or other gas emitters that are projected to potentially cause a hazard to personnel or operations in the RWB.

The RWBVS air handling units (AHUs), fan coil units (FCUs), supply air fans, and unit heaters are located in dedicated low radiation areas in the RWB to maintain exposures ALARA to personnel maintaining the equipment. The HVAC ducting is routed outside of pipe chases containing radwaste system piping. The HVAC ducting does not penetrate pipe chase walls, which could compromise shielding.

Exhaust from the RWBVS is combined with the RBVS exhaust in the mechanical room of the RWB where the RBVS general area exhaust fans and filter units are located. These exhaust fans and filter units are part of the RBVS even though the system's components are physically located within the RWB. The plant exhaust stack, also part of the RBVS, is also located on the RWB.

For reliability, the system is designed with redundancy. The main RWBVS supply subsystem consists of a single AHU with two 100 percent capacity external supply fans, which ensures that the RWBVS is able to maintain outdoor air ventilation airflow rates and ensures supply of conditioned air (heated or cooled) to the necessary locations in the building. The heating and cooling coils each consist of independent sections which can be individually isolated. Failure of a single coil section will not result in a total loss of heating or cooling. Similarly, the AHU filter bank consists of independent sections that can be replaced with minimal impact to the system operation.

Potentially contaminated condensation from RWBVS cooling coils is routed to the radioactive waste drain system.

Atmospheric cleanup portions of the RBVS are designed, fabricated, installed, tested, and maintained in accordance with ASME AG-1 (Reference 9.4.3-1). System maintenance and inspection are considered in the design, and the design allows for convenient access to components for necessary inspection, maintenance, testing, or replacement as needed.

9.4.3.2.1 Component Description

Specifications for major equipment are listed in Table 9.4.3-3 and described below.

Air Intake Louvers

The RWBVS supply air intake louvers are aluminum construction drainable blade louvers.

Main Supply Air Handling Unit and Fans

Cooling and heating of the ventilation air serving the RWB is provided by one AHU with two external variable speed 100 percent capacity (one primary, one standby) supply air fans. The AHU housing consists of a prefilter bank, a high efficiency filter bank, hot water heating coils, and a chilled water cooling coil bank. During winter conditions, outdoor air below 40 degrees F is pre-heated by a duct-mounted pre-heat coil to precondition the air before entering the AHU. Additional heating in the spaces served by the main supply AHU is provided by local electrical heaters mounted in the space. Fans are designed and rated in accordance with AMCA 210 and AMCA 300 (Reference 9.4.3-2 and Reference 9.4.3-3). The main supply AHU and fans are located on the north end of the RWB building on a mezzanine.

Electrical Equipment Room Air Handling Units

The electrical equipment room is served by two dedicated 100-percent capacity recirculating AHUs (one primary, one standby). Supply and return air is conveyed from the AHU through ductwork distributed in the room. The AHUs each include a low efficiency filter bank, an electric heating coil, a chilled water cooling coil bank, and a variable speed supply fan.

Radioactive Waste Building Control and Monitoring Room Air Handling Units

Cooling and heating of the RWB control and monitoring room is provided by two 100 percent capacity (one primary, one standby) AHUs. The AHUs each include a low efficiency filter bank, an electric heating coil, a chilled water cooling coil bank, and a variable speed supply fan. Humidification is provided by dedicated, redundant space mounted humidification units.

Telecommunication Room Fan Coil Units

The telecommunications and data room is served by two dedicated 100 percent recirculating FCUs (one primary, one standby). Supply and return air is conveyed from the FCU through ductwork distributed in the room. The FCUs each include, at a minimum, a low efficiency filter, a chilled water cooling coil, an electric heating coil, and a supply fan.

Battery Charger Room Fan Coil Units

The battery charger room is served by two dedicated 100 percent recirculating FCUs (one primary, one standby). Supply and return air is conveyed from the FCU through ductwork distributed in the room. The FCUs each consist of, at a minimum, a low efficiency filter, a chilled water cooling coil, an electric heating coil, and a supply fan.

Air Handling Unit and Fan Coil Unit Chilled Water Cooling Coils

The AHU and FCU chilled water cooling coils are designed and rated in accordance with ASHRAE 33(Reference 9.4.3-18) and AHRI 410 (Reference 9.4.3-19).

Air Handling Unit and Fan Coil Unit Filters

The medium efficiency and high efficiency filters have a rated dust spot efficiency based on ASHRAE 52.2 (Reference 9.4.3-17). The filters meet UL 900 (Reference 9.4.3-11) Class I construction criteria, non-burning.

Electric Heating Coils

The electric heating coils meet the requirements of UL 1995 (Reference 9.4.3-12).

Electric Unit Heaters

Electric unit heaters controlled by local thermostats are provided for general space heating. The electric unit heaters are single-stage or multi-stage fin tubular type. The electric unit heaters are UL-listed and meet the requirements of UL 1995 and the National Electric Code NFPA 70 (Reference 9.4.3-5).

Duct and Accessories

Ductwork, supports, and accessories meet the design and construction requirements of Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Rectangular and Round Industrial Duct Construction Standards and SMACNA HVAC Duct Construction Standards - Metal and Flexible (Reference 9.4.3-14, Reference 9.4.3-15, and Reference 9.4.3-16). Ductwork subject to fan shutoff pressure is structurally designed to withstand fan shutoff pressures.

Ducting interior and exterior surfaces have relatively smooth finishes to reduce localized collection of radioactive contamination. The lengths of ducting runs are minimized, as are abrupt changes in direction. These measures are good ALARA practices and facilitate eventual site decommissioning.

Isolation Dampers

Isolation dampers are low leakage, single or parallel-blade type. The automatic dampers have spring return actuators which fail in the safe position. Isolation dampers are used to isolate components for maintenance or replacement.

Fire Dampers

Fire dampers are provided at duct penetrations through fire barriers to maintain the fire resistance ratings of the barriers. The fire dampers meet the design and installation requirements of UL 555 (Reference 9.4.3-9).

Smoke Dampers

Smoke dampers are provided to provide smoke isolation of areas or AHUs. The smoke dampers meet the design and installation requirements of UL 555S (Reference 9.4.3-10).

Combination Fire and Smoke Dampers

Combination fire and smoke dampers are provided at duct penetrations through fire barriers to maintain the fire resistance ratings of the barriers and isolation of smoke. The combination fire and smoke dampers meet the design and installation requirements of UL 555 & 555S (Reference 9.4.3-9 and Reference 9.4.3-10).

9.4.3.2.2 System Operation

9.4.3.2.2.1 Normal Operation

During normal operation, air enters the RWBVS via an intake located in the exterior wall of the RWB. Air proceeds through the main supply AHU and then through one of the two supply fans operating continuously to perform the following:

- provide sufficient ventilation air to maintain the minimum air change rate of 2.0 times per hour throughout the main portions of the building
- pressurize designated rooms requiring positive pressure in relation to surrounding spaces within the RWB
- provide conditioned air to maintain necessary indoor design conditions to areas not served by local recirculation AHUs or FCUs

The RWBVS main AHU supply airflow remains constant while the RBVS general exhaust fans modulate speed in response to pressure indicators, flow elements, or both to maintain the RWB negative pressure at set point. The temperature of the air supplied by the main RWBVS supply AHU is controlled by a duct mounted temperature sensor located downstream of the AHU. This temperature sensor modulates the AHUs chilled water cooling coils and heating coils to maintain the supply air temperature at set point.

Pressurization air for the electrical equipment room, RWB control and monitoring room, telecommunications room, and battery charging room is provided from the main supply unit. Pressurization air is provided to these spaces to ensure air flows from clean spaces to potentially contaminated spaces. The RWBVS maintains the hydrogen concentration levels in the battery rooms containing batteries below one percent by volume.

9.4.3.2.2.2 Off-Normal Operation

Loss of Normal AC Power

On a loss of normal AC power, the RWBVS supply fans stop. The RBVS general area exhaust fans, which remove air from the Radioactive Waste Building, also stop. Under these conditions there is no forced airflow through the RWB. If available, the backup power supply system can be used to power the RWBVS supply fans and the RBVS general area exhaust fans as needed.

High Radiation Alarm in Exhaust

Exhaust monitoring is a function of the RBVS. For information on related actions, refer to Section 9.4.2.

High Radiation Alarm in RWB General Area

Radiation monitors located in the plant exhaust stack discharge and in each main exhaust duct from the Reactor Building, Radioactive Waste Building, and Annex Building alarm to the main control room in the event radiation levels exceed allowable limits. Upon high limit detection of radiation in the RWB exhaust air, the system will continue to provide ventilation and HEPA filtered exhaust while the source of the contamination is isolated and the release terminated.

Fire or Smoke Detection Alarm

The respective RWBVS equipment will automatically shut down upon detection of smoke per NFPA 90A (Reference 9.4.3-7) requirements. The affected RWBVS can be manually re-activated to aid with smoke removal as needed.

In the event that smoke is detected within the building, the stairwells and elevator are pressurized by dedicated pressurization fans, to minimize smoke infiltration. The pressurization fans are activated upon activation of the building fire detection system.

9.4.3.3 Safety Evaluation

The RWBVS has no safety-related function, and there are no safety-related components in the RWB. Failure of the RWBVS to operate does not prevent SSC from performing safety-related functions.

GDC 2 was considered in the design of the RWBVS. The RWBVS is fully contained in the RWB, and there is no safety-related or Seismic Category I equipment in the RWB; therefore, the failure of the RWBVS will not affect the performance of safety-related functions. The RWBVS is Seismic Category III (nonseismic).

GDC 3 was considered in the design of the RWBVS. In accordance with Regulatory Position 6.1.7 of Regulatory Guide 1.189 (see Table 1.9-2), the RWBVS prevents explosive levels of hydrogen from forming in the RWB battery rooms.

GDC 5 was considered in the design of the RWBVS. The RWBVS is a common support system, providing service to all NPMs. Operation of the RWBVS system does not effect the safe and orderly shutdown and cooldown of the NPMs. The RWBVS does not have a function relative to shutting a module down or maintaining a module in a safe shutdown condition.

GDC 60 was considered in the design of the RWBVS. The RWBVS exhaust is filtered by the RBVS general exhaust filter units which utilize HEPA filters to remove contaminated particulate. The plant exhaust stack discharge containing the RWBVS and RBVS exhaust air is monitored for radiation by a radiation monitor in the RBVS. These provisions ensure that the release of radioactive materials entrained in gaseous effluents during normal reactor operation, including anticipated operational occurrences, is controlled. See Section 9.4.2 for a description of the RBVS.

RWBVS ducting runs are kept to a minimum and abrupt changes in ducting direction are avoided. Inner and outer surfaces of ducting have relatively smooth finishes. These design considerations facilitate the eventual decommissioning of the plant. Exhaust from the RWBVS is filtered by the RBVS before being released to the atmosphere. Based on these design features, the RWBVS system satisfies the requirements of 10 CFR 20.1406.

9.4.3.4 Inspection and Testing

Fans, cooling coils, and electric heating coils are factory tested and certified. A system air balance test and adjustment to design conditions is conducted in the course of the plant preoperational test program (Section 14.2). Airflow rates are measured and balanced in accordance with the guidelines of SMACNA HVAC systems - Testing, Adjusting and Balancing (Reference 9.4.3-13).

Fire dampers are periodically tested and inspected in accordance with NFPA 80 (Reference 9.4.3-6). Smoke and fire dampers are periodically tested and inspected in accordance with NFPA 105 (Reference 9.4.3-8).

The RWBVS is designed to permit periodic inspection and testing of major components, such as fans, motors, dampers, coils, filters, ducts, piping and valves to verify their integrity and capability. Equipment layout provides access for inspection and maintenance.

COL Item 9.4-3: A COL applicant that references the NuScale Power Plant design certification will specify periodic testing and inspection requirements for the Radioactive Waste Building heating ventilation and air conditioning system.

9.4.3.5 Instrumentation and Controls

The RWBVS includes instrumentation and controls essential to its performance. Principal instruments are listed in Table 9.4.3-4. The RWBVS human-system interface is developed with human factors engineering functional allocations, task analyses, and alarm philosophies to determine the functions of the RWBVS that are monitored or controlled locally, in the MCR, or both.

The RWBVS design incorporates automatic HVAC controls accessible from the main control room. During normal operating conditions, the RWBVS is operated in the automatic mode with local manual override capabilities. Major RWBVS components designed with local controls have manual control capabilities. Local controls are primarily for system diagnostics, repair, and maintenance. The HVAC controller is designed such that it does not bypass local manual controls for maintenance safety.

The instrumentation and associated indications and alarms used to monitor the RWBVS include the items listed in Table 9.4.3-4.

9.4.3.6 References

9.4.3-1 American Society of Mechanical Engineers, *Code on Nuclear Air and Gas Treatment*, ASME AG-1, 2015 Edition, New York, NY.

9.4.3-2 Air Movement and Control Association International, Inc., "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating," AMCA Standard 210-07, Rev. 2007, Arlington Heights, IL.

9.4.3-3 Air Movement and Control Association International, Inc., "Reverberant Room Method for Sound Testing of Fans," AMCA Standard 300-14, Revision 2014, Arlington Heights, IL.

9.4.3-4 National Fire Protection Association, "Fire Code," NFPA 1, 2015 Edition, Quincy, MA

9.4.3-5 National Fire Protection Association, "National Electric Code (NEC)," NFPA 70, 2014 Edition, Quincy, MA.

9.4.3-6 National Fire Protection Association, "Standard for Fire Doors and Other Opening Protectives," NFPA 80, 2016 Edition, Quincy, MA.

9.4.3-7 National Fire Protection Association, "Standard for the Installation of Air-Conditioning and Ventilating Systems," NFPA 90A, 2015 Edition, Quincy, MA.

9.4.3-8 National Fire Protection Association, “Standard for Smoke Door Assemblies and Other Opening Protectives,” NFPA 105, 2016 Edition, Quincy, MA.

9.4.3-9 Underwriters Laboratories, Inc. (UL), “Fire Dampers,” UL 555, 7th Edition.

9.4.3-10 Underwriters Laboratories, Inc. (UL), “Smoke Dampers,” UL 555S, 5th Edition.

9.4.3-11 Underwriters Laboratories, Inc. (UL), “Test Performance of Air Filter Units,” UL 900, 8th Edition.

9.4.3-12 Underwriters Laboratories, Inc. (UL), “Heating and Cooling Equipment,” UL 1995, 4th Edition.

9.4.3-13 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), “HVAC Systems - Testing, Adjusting and Balancing,” SMACNA 1780, Third Edition, 2002, Chantilly, VA.

9.4.3-14 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), “Rectangular Industrial Duct Construction Standards,” SMACNA 1922, Second Edition, 2004, Chantilly, VA.

9.4.3-15 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), “Round Industrial Duct Construction Standards,” SMACNA 1520, Second Edition,1999, Chantilly, VA.

9.4.3-16 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), “HVAC Duct Construction Standards - Metal and Flexible,” SMACNA 1966, Third Edition, 2005, Chantilly, VA.

9.4.3-17 American Society of Heating, Refrigerating and Air-Conditioning Engineers, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," ASHRAE Standard 52.2-2012, Atlanta, GA.

9.4.3-18 American Society of Heating, Refrigerating and Air-Conditioning Engineers, "Methods of Testing Forced Circulation Air Cooling and Air Heating Coils,” ASHRAE Standard 33-2000, Atlanta, GA.

9.4.3-19 Air-Conditioning, Heating, and Refrigeration Institute, "Forced-Circulation Air-Cooling and Air-Heating Coils," AHRI 410-2001, Arlington, VA.

Table 9.4.3-1: Outside Air Design Temperature for the Radioactive Waste Building HVAC System

Parameter	Temperature*
Maximum outdoor design dry bulb temperature	100°F
Maximum coincident design wet bulb temperature	77°F
Minimum outdoor design dry bulb temperature	-10°F

*Table 9.4.3-1 temperatures are one percent annual exceedance values

Table 9.4.3-2: Radioactive Waste Building HVAC System Indoor Design Conditions

Area	Temperature	Relative Humidity
Occupied areas; light work (control rooms, offices, laboratories, etc.) without special electronic equipment.	73°F to 78°F	35% to 50%
Occupied areas; moderate work (shops, maintenance facilities)	65°F to 85°F	35% to 60% (See Note 2 below)
Inaccessible areas (without sensitive electronic equipment)	50°F to 130°F	Not controlled
Areas with frequent inspections or maintenance (without sensitive electronic equipment)	50°F to 105°F	Not controlled (See Note 2 below)
Areas with electronic equipment	65°F to 85°F	30% to 55% (See Note 1 below)
Battery rooms	68°F to 77°F	30% to 55% (See Note 1 below)

Note1: The relative humidity for areas with electronic equipment, including the battery rooms, is in accordance with manufacturer's requirements.

Note2: For areas where heat stress on personnel is a concern, the design includes local cooling, as needed, to maintain working conditions in-line with the NuScale HFE program management plan.

Table 9.4.3-3: Major Radioactive Waste Building HVAC System Equipment

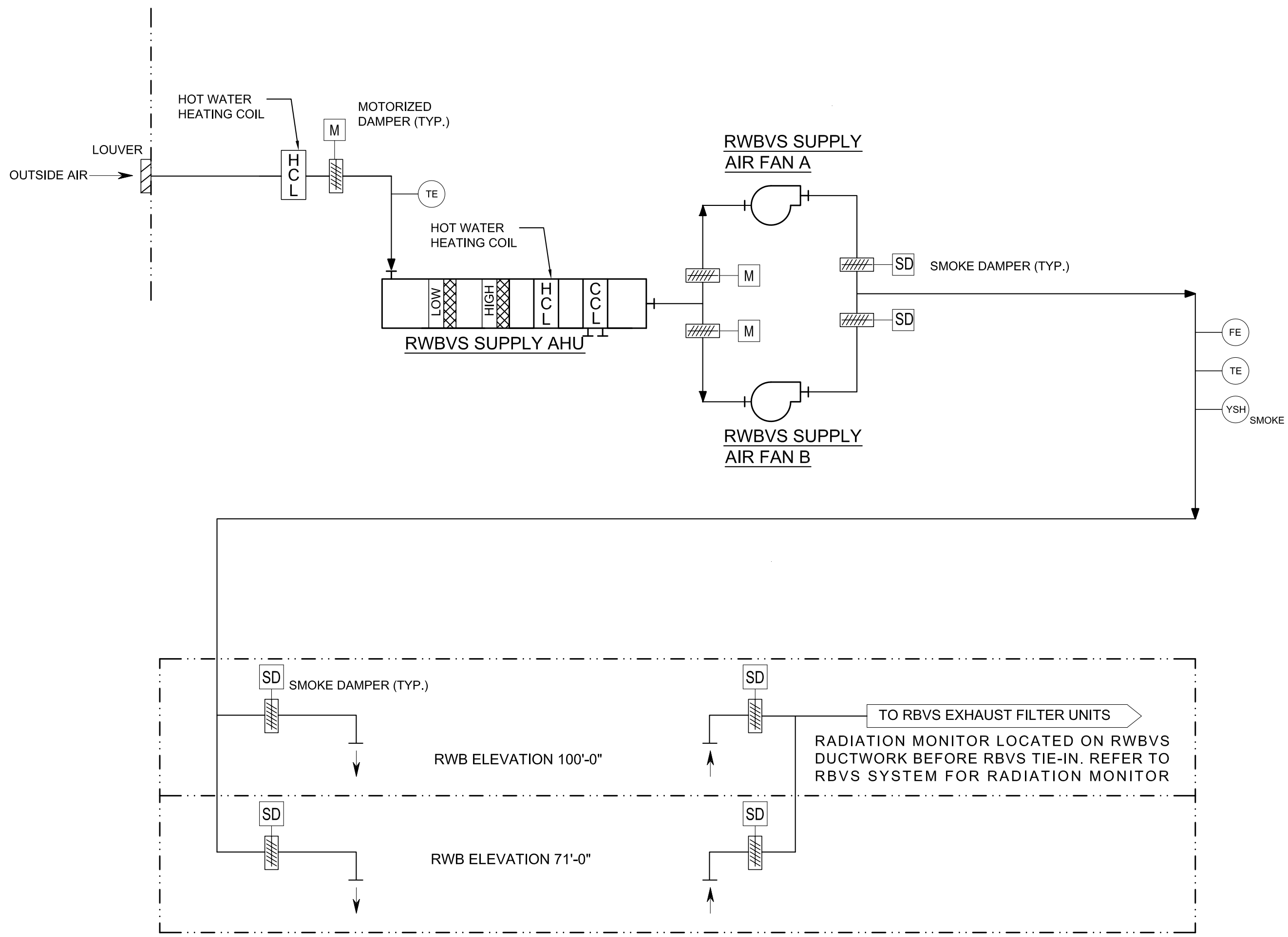
RWBVS Main Supply Air Handling Unit			
Component	Quantity per AHU	Capacity*	Units
Fan, variable speed	2 (100% each)	67,000	cfm
Cooling coil	1	5400	MBH**
Heating coil, primary	1	430	kW
Heating coil, pre-heat or snow melt	1	1080	kW
Electrical Equipment Room Air Handling Unit (100% capacity each)			
Component	Quantity (per AHU)	Capacity*	Units
Fan, variable speed	1	2500	cfm
Cooling coil	1	67	MBH**
Heating coil, electric	1	7	kW
RWB Control and Monitoring Room Air Handling Unit (100% capacity each)			
Component	Quantity (per AHU)	Capacity*	Units
Fan	1	2500	cfm
Cooling coil	1	62	MBH**
Heating coil, electric	1	14	kW
Telecommunication Room Fan Coil Unit (100% capacity each)			
Component	Quantity (per FCU)	Capacity*	Units
Fan	1	1490	cfm
Cooling coil, chilled water	1	53	MBH**
Heating coil, electric	1	2	kW

*Nominal values for each fan or coil **MBH - Thousand BTUs per hour

Table 9.4.3-4: Radioactive Waste Building HVAC System Instrumentation

Type	Sensor Location	Local Indication
Radiation monitors	Duct-mounted in exhaust header and plant exhaust stack	No
Differential air pressure, filters	Unit-mounted in AHUs and local exhaust filter units	Yes
Differential air pressure, building pressure	Mounted in general building area and outside of building	No
Smoke detectors	Duct-mounted in AHU supply ducts	No
Temperature sensors	Duct-mounted in AHU supply ducts Room-mounted in selected rooms	Optional
Air flow measuring stations	Duct-mounted in AHU supply ducts	No
Damper position	Provided for all automatic dampers	Yes

Figure 9.4.3-1: Radioactive Waste Building HVAC System Diagram



9.4.4 Turbine Building Ventilation System

The Turbine Building HVAC system (TBVS) provides heating, cooling, and ventilation service to the Turbine Generator Building (TGB). The TBVS contains fans, ductwork, dampers, heaters, air conditioning units, and supporting control equipment to maintain environmental conditions within ranges suitable for personnel occupancy and equipment reliability.

9.4.4.1 Design Bases

This section identifies the TBVS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The TBVS serves no safety-related functions, is not credited for mitigation of design basis accidents, and has no safe shutdown functions. The TBVS is not credited to operate during any abnormal plant conditions. General Design Criteria (GDC) 2 and 5 were considered in the design of the TBVS. See Section 9.4.4.3 for the safety evaluation.

Consistent with GDC 2, no safety-related or risk significant structures, systems, or components (SSC) are affected by natural phenomena such as earthquakes. The TBVS is Seismic Category III (nonseismic). Consistent with GDC 5, even though the TBVS is a common support system (for up to six NuScale Power Modules (NPMs) in each TGB) the system does not have a safety function or any function relative to shutting a unit down or maintaining a unit in a safe shutdown condition.

GDC 60 was considered in the design of the TBVS. During normal operation, radioactive material is not expected to be present in the TGB; therefore, the TBVS does not include radioactivity monitoring and filtration.

The TBVS maintains the turbine building temperature at acceptable levels during all phases of plant operation.

The TBVS is designed to meet the following design bases:

- provide ventilation for areas of the TGB to maintain a suitable environment for plant equipment and personnel
- maintain hydrogen levels in battery rooms below explosive concentrations
- prevent migration of smoke, hot gases, and fire suppressants from areas affected by fires to non-affected areas

9.4.4.2 System Description

The TBVS contains fans, ductwork, dampers, heaters, air conditioning units, and supporting control equipment to maintain environmental conditions within ranges suitable for personnel occupancy and equipment reliability. The NuScale Power Plant contains two turbine buildings, each of which has a dedicated TBVS.

The TBVS serves the turbine operating room, TGB battery room, TGB battery charging room, and turbine maintenance room. Figure 9.4.4-1 shows the layout of the TBVS for one of the two turbine buildings.

Turbine operating room ventilation is provided by nine roof mounted exhaust fans (eight operating, one standby) which pull make-up air from exterior wall mounted louvers with associated dampers. The exhaust fans are direct drive fans. Heating during the winter is provided by room mounted electric unit heaters arranged around the perimeter of the operating room.

Fire dampers are provided at duct penetrations through fire barriers to maintain the fire resistance ratings of the barriers. The fire dampers meet the design and installation requirements of UL 555 (Reference 9.4.4-6). Smoke dampers are provided to provide smoke isolation of areas or air handling units. The smoke dampers meet the design and installation requirements of UL 555S (Reference 9.4.4-7). Combination fire and smoke dampers are provided at duct penetrations through fire barriers to maintain the fire resistance ratings of the barriers and provide isolation of smoke. The combination fire and smoke dampers meet the design and installation requirements of UL 555 & 555S.

Cooling and heating for the TGB battery room is provided by two split system air conditioning units (one primary, one standby). For extremely low temperatures, a room mounted electric heater provides supplemental heating. Humidification is provided by a standalone humidifier dedicated to the space. Dehumidification is also provided by a standalone dehumidifier dedicated to the space. An exhaust fan is provided in the battery room to maintain hydrogen concentration in the space to less than one percent by volume in accordance with Section 52.3.6 of NFPA 1 (Reference 9.4.4-4). Air is exhausted directly to outside the TGB and make-up air for the exhaust fan is pulled through a vent path in the door.

Ductwork, dampers, and supports are primarily constructed of galvanized steel and meet the requirements of the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Round and Rectangular Industrial Duct Construction Standards (Reference 9.4.4-1 and Reference 9.4.4-2) or SMACNA HVAC Duct Construction Standards - Metal and Flexible (Reference 9.4.4-3).

The TBVS is designed for outdoor conditions summarized in Table 9.4.4-1 and indoor conditions summarized in Table 9.4.4-2.

Cooling and heating for the TGB battery charging room is provided by two package air conditioning units (one primary, one standby). Supplemental heating is provided by a room mounted electric heater. Humidification is provided by a standalone humidifier dedicated to the space. Dehumidification is also provided by a standalone dehumidifier dedicated to the space.

In the turbine maintenance room cooling, primary heating, and ventilation air is provided by a dedicated air conditioning unit. For extremely low temperatures, room mounted electric heaters provide supplemental heating.

The turbine buildings are not directly connected to the Reactor Building, the Radwaste Building, or any other areas that may contain radioactive contaminants. The TBVS is independent of other heating, ventilation, and air conditioning (HVAC) systems and is not directly connected to other SSC that may contain radioactive contaminants. Therefore, the TBVS does not include radiation monitoring capabilities, and does not need to re-align due to radioactive conditions.

9.4.4.3 Safety Evaluation

The TBVS serves no safety-related functions, is not credited for mitigation of design basis accidents, and has no safe shutdown functions. The TBVS is not credited to operate during any abnormal plant conditions.

GDC 2 was considered in the design of the TBVS. There are no safety-related SSC in the TGB; therefore, no safety-related SSC are affected by natural phenomena such as earthquakes. Also, failure of the TBVS will not affect safety-related SSC. The TBVS is Seismic Category III (nonseismic).

GDC 5 was considered in the design of the TBVS. The TBVS does not have any function relative to shutting a unit down or maintaining a unit in a safe shutdown condition.

GDC 60 was considered in the design of the TBVS. During normal operation, radioactive material is not expected to be present in the TGB; therefore, the TBVS does not include radioactivity monitoring and filtration. The only potential source of radioactive material in the TGB is from a postulated steam generator tube failure. The main steam system and the Condensate and Feedwater System, described in Chapter 10, have process radiation monitors to detect radioactive material introduced to the TGB.

9.4.4.4 Inspection and Testing

Components are tested and inspected prior to installation and as an integrated system following installation. System airflows are measured and adjustments are made to ensure compliance with design requirements. Preoperational testing of the TBVS is performed in accordance with the requirements of Section 14.2.

COL Item 9.4-4: A COL applicant that references the NuScale Power Plant design certification will specify periodic testing and inspection requirements for the Turbine Building heating ventilation and air conditioning system.

9.4.4.5 Instrumentation and Controls

The TBVS includes instrumentation to monitor its performance, and controls to operate the system during normal operation and system testing. Information regarding the TBVS instrumentation and controls is found in Table 9.4.4-3.

Duct-mounted smoke detectors are provided in HVAC ductwork, as needed per NFPA 90A (Reference 9.4.4-5), and automatically shut down the respective HVAC equipment upon detection of smoke.

9.4.4.6 References

9.4.4-1 Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA), “Round Industrial Duct Construction Standards,” Second Edition, 1999, Chantilly, VA.

9.4.4-2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), “Rectangular Industrial Duct Construction Standards,” Second Edition, 2004, Chantilly, VA.

9.4.4-3 Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA), “HVAC Duct Construction Standards - Metal & Flexible,” Third Edition, 2005, Chantilly, VA.

9.4.4-4 National Fire Protection Association, “Fire Code,” NFPA 1, 2015 Edition, Quincy, MA.

9.4.4-5 National Fire Protection Association, “Standard for the Installation of Air-Conditioning and Ventilating Systems,” NFPA 90A, 2015 Edition, Quincy, MA.

9.4.4-6 Underwriters Laboratories, Inc. (UL), UL 555, “Standard for Fire Dampers,” 7th Edition, July 2006, Northbrook, IL.

9.4.4-7 Underwriters Laboratories, Inc. (UL), UL 555S, “Standard for Smoke Dampers,” 5th Edition, February 2014, Northbrook, IL.

Table 9.4.4-1: Turbine Building HVAC System Outdoor Air Design Conditions

Parameter	Temperature*
Maximum Outdoor Design Dry Bulb Temperature	95°F
Maximum coincident Design Wet Bulb Temperature	77°F
Minimum Design Dry Bulb Temperature	-5°F

*Table 9.4.4-1 temperatures are five percent annual exceedance values

Table 9.4.4-2: Turbine Building HVAC System Indoor Air Design Conditions

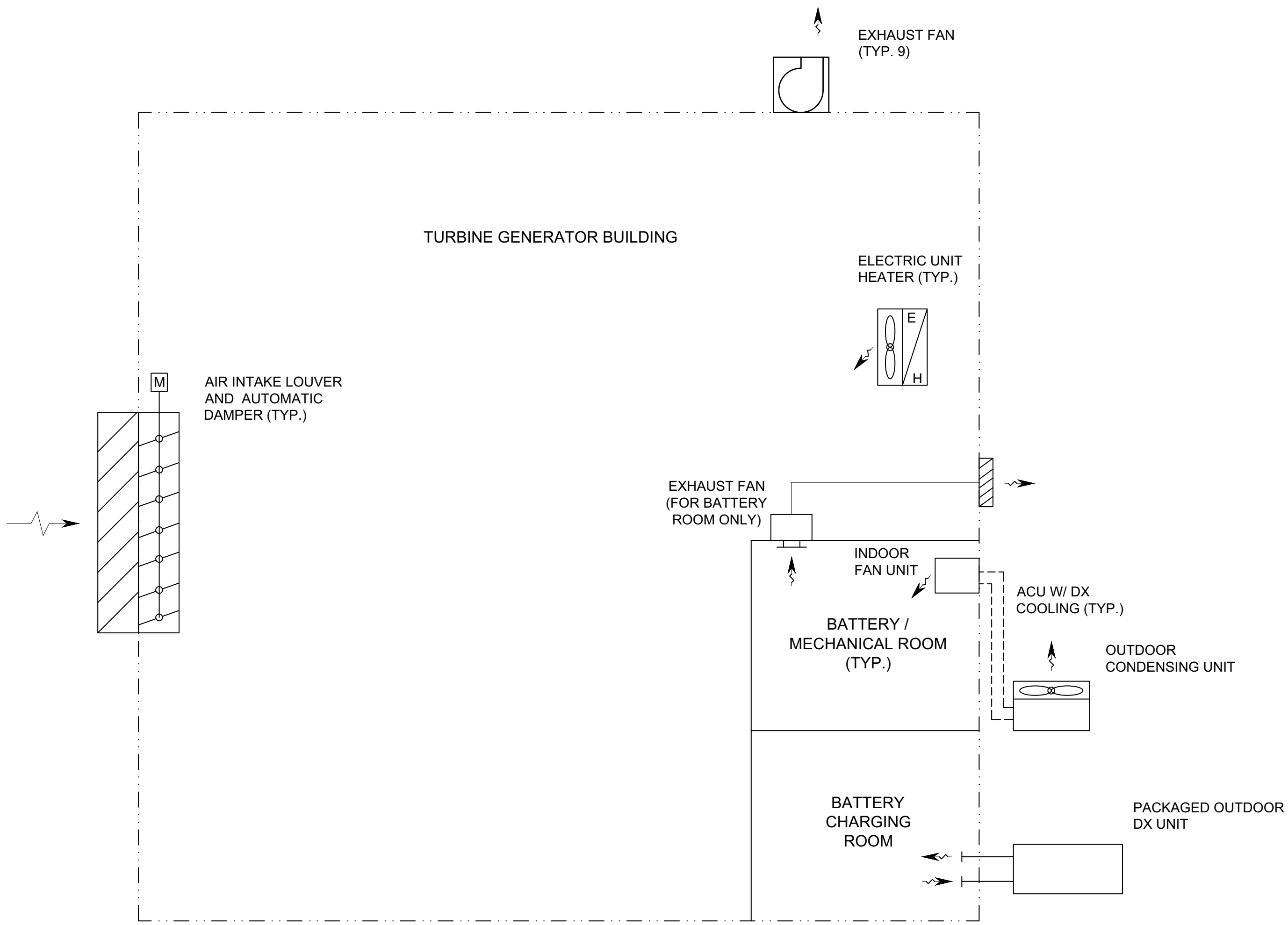
Description	Temperature	Relative Humidity
Occupied areas; moderate work (shops, maintenance facilities)	65°F to 85°F	35% to 60%
Areas with frequent inspections and maintenance (without sensitive electronic equipment)	50°F to 105°F	Not Controlled (See Note 1 below)
Areas with sensitive electronic equipment	65°F to 85°F	(See Note 2 below)
Battery Rooms	68°F to 77°F	(See Note 2 below)

Note 1: For areas where heat stress on personnel is a concern, the design includes local cooling as needed to maintain working conditions.
Note 2: The battery and battery charging room humidity is based on equipment manufacturer information.

Table 9.4.4-3: Turbine Building HVAC System Instruments

Type	Location	Indication	
		Local	Control Room
Temperature Sensors, Room Mounted	Wall mounted in turbine generator operating room, maintenance room, battery room, and charging room	Yes	Optional
Temperature Sensors, Vendor Supplied	Located on or hard wired directly to unit heaters.	Yes	No
Humidity Sensors, Room Mounted	Wall mounted in turbine generator operating room, maintenance room, battery room, and charging room	Yes	Optional
Humidity Sensors, Vendor Supplied	Located on or hard wired directly to dedicated dehumidification or humidification units for the battery and charging room.	Yes	Yes
Fan Status Signal	Located on exhaust fans serving turbine operating room exhaust fans	Yes	Yes
Damper Open/Close Indicator	Located on outside air intake dampers in turbine operating room	No	Yes

Figure 9.4.4-1: Turbine Building HVAC System Diagram



9.4.5 Engineered Safety Feature Ventilation System

The NuScale Power Plant does not utilize engineered safety features for ventilation systems to mitigate the consequences of a design basis accident.

There are no design basis events that result in significant core damage in the NuScale Power Plant design. The only ESF fission product control system credited to mitigate the consequences of a design basis accident or maximum hypothetical accident described in Section 15.0.3 is the containment vessel in conjunction with the containment isolation system.

9.5 Other Auxiliary Systems

9.5.1 Fire Protection Program

The Fire Protection Program (FPP) is comprised of the integrated effort involving components, procedures, analyses, and personnel used in defining and carrying out all activities of fire protection. It includes system and facility design, fire prevention, fire detection, annunciation, confinement, suppression, administrative controls, fire brigade organization, inspection and maintenance, training, quality assurance, and testing.

The Fire Protection System (FPS) is a subset of the FPP and includes the fire detection, notification, and suppression systems, as designed, installed, and maintained in accordance with applicable codes and standards.

Section 13, Conduct of Operations, identifies the FPP as an Operational Program. Combined License (COL) Item 13.1-2 will include the organizational responsibilities for implementing the FPP. COL Item 13.1-3 will include qualification requirements for the organizational positions implementing the FPP. COL Item 13.4-1 requires site-specific information, including the implementation schedule, for the FPP. COL Item 13.5-1 requires a description of the site specific administrative control procedures consistent with Regulatory Guide 1.33, Revision 3, which includes those described for fire protection.

In addition plant Technical Specification 5.4.1d. requires a licensee to establish, implement, and maintain written procedures covering the Fire Protection Program implementation.

Appendix 9A presents the fire hazards analysis (FHA) and the fire safe shutdown plan.

Quality and safety classification of FPS structures, systems, and components (SSC) is addressed in Section 3.2.

The internal flood analysis evaluating the impact of inadvertent actuation or breaks in the FPS water supply piping is evaluated in Section 3.4. In this evaluation, no credit was taken for the floor drains of the radioactive waste drain system or the balance of plant drain system of Section 9.3.3 in removing fire water.

Heating, ventilation, and air conditioning system design as related to fire protection is described in Section 9.4.1, Section 9.4.2 and Section 9.4.3.

Communication system design with respect to fire protection activities is presented in Section 9.5.2.

Emergency lighting system design with respect to fire protection activities is presented in Section 9.5.3.

Fire protection features provided to prevent explosion of a potential hydrogen-oxygen mixture in the gaseous radwaste system are described in Section 11.3.

9.5.1.1 Design Basis

This section identifies the FPP required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The hardware associated with the FPP is not safety related. Consistent with GDC 1, and as indicated in Section 3.2, the hardware does not have a Quality Classification and is Seismic Class III.

The hardware associated with the FPS is not safety-related. Consistent with GDC 2, however, the capability for manual fire fighting of safe shutdown equipment following a seismic event is provided in the reactor building via seismically analyzed hose standpipes. Fire Protection system components are seismically designed as described in Section 3.2.1.2 including the guidance of RG 1.29.

As required by 10 CFR 50.48(a)(1), a Fire Protection Program has been developed that conforms to GDC 3 in minimizing the probability and effect of fires and explosions. Noncombustible and heat resistant materials are used to the extent practical. The reactor building (RXB), control building (CRB), and radioactive waste building (RWB) floors, walls and ceilings are constructed almost entirely of reinforced concrete. The FPS, through detection and suppression, minimizes adverse effects of fires on structures, systems, and components. Rupture or inadvertent operation of firefighting systems is considered in the design to assure it does not significantly impair the safety capability of structures, systems, and components.

GDC 5 was considered in the design of the FPS. The modules are located in the RXB which is serviced by a common, shared fire protection system. Redundant divisions of safe shutdown equipment for the modules are located in separate fire areas where practicable so that fires or a spurious discharge or a failure of the FPS can only affect one division of safe shutdown equipment per module. There are fire areas in the RXB where one fire could affect multiple modules although only one division per module would be affected leaving an alternative division intact. With one success path of safe shutdown equipment available for each module, safe shutdown functions can still be performed for all modules and therefore the effectiveness of the FPS is not compromised by the sharing.

Consistent with PDC 19 the FPS provides control room fire protection with manual suppression and automatic detection. The FPS protects the control building which houses the control room; therefore, isolating the control room from fire. By protecting the building, the FPS protects the cables, switching and transmitting type equipment, and display components from fire damage allowing the control room to function. In the reactor building, the FPS protects sensing, switching and transmitting type equipment, and cabling which contributes to the functionality of the control room in the case of fire in the reactor building. The design also incorporates a remote shutdown station that permits monitoring of systems related to safe shutdown when the MCR has been abandoned due to fire.

Consistent with GDC 23, functional requirements have been imposed on the design of the Module Protection System (MPS) that addresses safe failure states when exposed to the effects of fire and water.

10 CFR 52.47(b)(1) information pertaining to the methodology for the development of ITAAC is presented in Section 14.3.

9.5.1.2 System Description

In accordance with RG 1.189, Revision 2, fire protection for nuclear power plants uses the concept of defense-in-depth to achieve the required degree of reactor safety by using administrative controls, fire protection systems and features, and safe shutdown capability.

These defense-in-depth principles achieve the following objectives:

- To prevent fires from starting;
- To rapidly detect, control, and extinguish promptly those fires that do occur; and
- To provide protection for structures, systems, and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities does not prevent the safe shutdown of the plant.

The FPS is principally related to the second bullet above and is designed to perform the following functions:

- Detect fires and provide indication of the location
- Provide the capability to extinguish fires in plant areas, protect site personnel, limit the impact of fires and protect safe shutdown capabilities
- Provide a suppression water volume sufficient to meet the largest hydraulic demand of the automatic sprinkler or spray system with an additional 500 gpm for fire hose use, for a minimum of two hours
- Maintain 100 percent fire pump design capability assuming a failure of the largest fire pump or a loss of offsite power.
- Provide water to hose stations for firefighting activities in areas containing safe shutdown equipment, following a safe shutdown earthquake (SSE) as specified in the FHA.
- Provide automatic fire suppression in plant areas where the FHA or fire safe shutdown analysis of Appendix 9A has determined a single fire area could prevent the plant from achieving and maintaining a safe shutdown condition. Appendix 9A addresses special cases involving the containment and the fire areas enclosed by the bioshields of each NPM.
- Plant areas protected by an automatic fire suppression system are also provided with manual fire suppression capability, based on the fire hazard analysis.
- Manual suppression is provided in areas that do not require an automatic fire suppression system, based on the fire hazard analysis.

- Automatic fixed water suppression protection is provided for fire areas identified by the fire hazard analysis as containing a sufficient quantity of combustible material.
- A sufficient number of fire hydrants are installed on the yard main to provide two streams for every part of the interior of the buildings not covered by standpipe protection.
- Each fire hydrant has its own isolation valve.
- Fire suppression systems are installed to protect ventilation filters which collect combustible material and are potential exposure fire hazards, as determined by the FHA.
- Automatic fire detection systems that are installed in areas that present an exposure fire hazard to SSC important to safety are capable of operating with or without offsite power.
- Two or more fire pumps are provided to assure 100 percent of design fire protection design flows are available, assuming failure of the largest pump or loss of off-site power. At least 100 percent of design fire protection design flows are supplied by a diesel-driven fire pump(s).
- Fire pumps start automatically to maintain fire main pressure. Shutdown of the fire pumps is by manual stop only.
- Fire detection and alarm systems give audible and visible alarms and annunciation in the MCR. Where zoned detection systems are used in a given fire area, local means are used to identify which detector zone has actuated.
- Provide the appropriate fire detection and annunciation for selected areas of the plant as required by the FHA for personnel safety and fire brigade notification to extinguish fires quickly and promptly.

The FPS firewater source does not perform design functions or loss of all AC power functions other than fire protection purposes.

The FPS is classified as a nonsafety system. It does not perform safety-related functions nor is the FPS credited with providing emergency backup functions that support operation of safe-shutdown systems.

Portions of the FPS that are located in the areas of Seismic Category I SSC are subject to the Seismic Category II design requirements identified in Section 3.2.1.2, which are based on the guidance in RG 1.29.

NFPA 804 and other applicable codes and standards included in Table 9.5.1-1 are used for the design of the FPS. Where conflicts with RG 1.189 exist, the guidance of the RG is followed.

Figure 9.5.1-1 and Figure 9.5.1-2 provide simplified drawings of the fire water supply and fire pump arrangement and the fire main loop in the yard.

The FPS is part of the FPP and therefore the FPS functions described above are included in the following FPP goals and functions:

- The ability to safely shut down the reactor and keep it shut down by providing one train of redundant shutdown systems, to the extent practical, free from fire damage by use of fire protection features.
- The ability to minimize the probability of the spread of fire by the use of fire barriers between fire areas to isolate combustible materials.
- Prevent fires by controlling, separating and limiting combustible materials and sources of ignition.
- The ability to minimize the potential for radioactive releases to the environment in the event of a fire.
- Provide protection for structures, systems, and components with safety-related or risk-significant functions so that a fire that is not promptly extinguished by the fire suppression activities does not prevent the safe shutdown of the plant.
- Maintain the ability to safely shut down the reactor and keep it shut down by providing one success path of SSC needed to achieve safe shutdown conditions free of fire damage assuming that equipment in one fire area is rendered inoperable by fire and that post-fire reentry for repair work into the affect fire area is not possible (see discussion under safe shutdown capability for exceptions).
- Provide separation between redundant trains of safety-related equipment used to mitigate the consequences of a design basis accident (but not required for safe shutdown following a fire). This ensures that at least one train will be free of fire damage.
- Prevent inadvertent operation of the FPS from jeopardizing the capability to achieve safe shutdown of the plant.
- Provide design features to prevent smoke, hot gases or fire suppression agents from migrating to other fire areas to the extent that safe shutdown may be adversely impacted including operator actions.
- The structural design should consider the impacts of damage due to fire to the extent that a failure of the structural support would adversely impact safe shutdown capabilities.
- Ensure failure or inadvertent operation of fire protection systems does not adversely impact the ability of the SSC important to safety to perform their safety functions.
- Provide personnel with access and escape routes for each fire area.
- Provide emergency lighting to facilitate safe shutdown, evacuation activities and firefighting activities following a fire.
- Provide communications to facilitate safe shutdown, evacuation activities and firefighting activities following a fire.
- Limit the radiological release due to direct effects of fire suppression activities to as low as reasonable achievable and not exceed regulatory limits.

Codes and Standards

The standards of record related to the design and installation of fire protection systems and features sufficient to satisfy NRC requirements in new reactor designs are those NFPA codes and standards in effect 6 months prior to the submittal of the application under 10 CFR Part 50 or 10 CFR Part 52. The codes and standards of record are governed by the DC (Design Certification) (within 6 months of the DC document submittal date) for aspects of the FPP described in the DC.

A list of industry codes and standards considered in the development of the FPP is provided in Table 9.5.1-1.

Spurious Actuation

The FHA and fire safe shutdown plan address possible fire-induced failures, including multiple spurious actuations. The analysis considers hot shorts, open circuits and shorts to ground when evaluating possible fire induced circuit failures. Use of fiber optic cabling reduces the likelihood of spurious actuations due to fire. Refer to Appendix 9A for information pertaining to assumptions and bases applied to analyses of fire-induced multiple spurious actuations that could prevent safe shutdown.

Safe Shutdown Capability

Appendix 9A.6 provides the standard plant fire safe shutdown plan and identifies safe shutdown components for which fire-induced circuit failures could directly or indirectly prevent safe shutdown.

The enhanced fire protection criteria of RG 1.189 requires new reactor designs to demonstrate that safe shutdown can be achieved assuming that all equipment in one fire area will be rendered inoperable by the fire and that reentry into the area for repairs and operator actions is not possible.

The control room fire area is excluded from this criteria based on providing an independent alternative shutdown capability that is physically and electrically isolated from the control room.

For conventional reactor buildings, the fire area inside containment and the annulus are also excluded. In the NPM design this corresponds to the area inside containment and the fire area immediately outside the small containment dome above the surface of the UHS pool water enclosed by the bioshield.

The control room, containment, and area enclosed by the bioshield are identified and evaluated as special cases in the safe shutdown analysis of Appendix 9A.

Operator Actions

The results of the FHA demonstrate that safe and stable conditions can be maintained without the need for repairs or local operator action.

Fire Protection Program

The FPP has been developed using the guidance of RG 1.189, "Fire Protection for Nuclear Power Plants," and as stipulated in RG 1.189, the requirements of NFPA 804, "Standard for Fire Protection for Advanced Light-Water Reactor Electric Generating Plants."

Table 9.5.1-2 "Fire Protection Program Conformance with Regulatory Guide 1.189" is a point-by-point description of the conformance of the FPP with the guidelines of RG 1.189, including alternative designs.

NFPA 804 and other applicable codes and standards are used for the design of the FPS except for cases where no guidance is given or the guidance conflicts with RG 1.189 in which case guidance from RG 1.189 prevails.

The FPP consists of the FPS, the fire protection organization, administrative policies, fire prevention controls, administrative operations, maintenance and emergency procedures, quality assurance, access controls for firefighting and fire brigade and emergency response capability.

The primary objectives of the Fire Protection Program (FPP) are to minimize the probability of occurrence and the consequences of fire. To meet these objectives, the FPP is designed to provide reasonable assurance, through defense in depth, that a fire will not prevent the necessary safe-shutdown functions from being performed and that radioactive releases to the environment in the event of a fire will be minimized.

9.5.1.2.1 Fire Prevention

Plant Design and Modification Procedures

In accordance with RG 1.189 position 2.1.2, the plant design and modification procedures contain provisions that evaluate the impacts of modifications on the fire protection system, safe shutdown capabilities, fire induced radioactivity releases, and increases to the fire hazards in fire areas of the plant. These procedures and practices provide reasonable assurance that the modification process will not have adverse impacts on the fire protection of the plant and that an adequate fire protection impairment program has been established. The fire protection program is specified by COL Item 13.4-1. Site-specific procedures are addressed by COL Item 13.5-1.

Combustible Control Procedures

Combustible materials are strictly controlled and limited by administrative procedures in areas where there are SSC with safety-related or risk-significant functions. The storage of bulk combustible materials and hazardous materials inside buildings or adjacent to SSC with safety-related or risk-significant functions is not permitted. Transient combustibles and hazardous materials are controlled by administrative controls and procedures. The fire protection program is specified by COL Item 13.4-1. Site-specific procedures are addressed by COL Item 13.5-1.

Combustible materials in the MCR and the remote shutdown station areas are controlled and limited to materials necessary for operation.

In situ combustibles enclosed by the bio-shield are limited to cable insulation. The area is inaccessible during operation and transient combustibles cannot be introduced until the NPM is in safe shutdown (<420 degrees F) and the bio-shields removed. Combustible materials in the area around the containment penetrations and isolation valves is controlled and limited to those required for operation and maintenance activities.

Flammable and combustible liquids are stored in accordance with NFPA 30. Flammable gases are stored in accordance with the applicable NFPA codes. The Plant procedures clearly define the use, handling and storage requirements for flammable liquids and gases.

The storage and use of hydrogen are in accordance with NFPA 55. The design does not require bulk hydrogen storage. Local hydrogen cylinders used for chemistry control via the CVCS are provided with excess flow valves. Supports for the cylinders and excess flow valves are designed to ensure their integrity during a seismic event. Gas sensors and ventilation systems are provided in the CVCS equipment rooms where hydrogen additions are made.

Ventilation systems are designed to maintain the hydrogen concentration in the battery rooms below 1 percent by volume. The plant design uses valve regulated lead-acid batteries which significantly reduces the hydrogen and oxygen liberated by the batteries.

The turbine building contains no safe shutdown equipment and is not a radiological hazard area. Therefore the turbine building is not included in the FHA of Appendix 9A.

Transformers installed inside the buildings containing SSC that are with safety-related or risk-significant functions are dry type or insulated and cooled with non-combustible liquids to prevent fires from adversely impacting the ability to safely shut down the plant

Outside transformers are located either 50 ft from plant buildings or are separated from the plant buildings by a three hour fire barrier with no openings. The fire barriers used for the outside transformers are designed in accordance with NFPA 804. The transformer area is designed to provide oil spill confinement and is designed to confine fire water suppression that is used.

Diesel fuel oil storage tanks are separated from SSC with safety-related or risk-significant functions by either physical separation or a three hour fire barrier. Oil spills from the tanks are confined to areas surrounding the tanks to accommodate more than the inventory of the tanks.

Control of Radioactive Material

Materials, liquids, or gases that contain radioactivity are protected and stored in accordance with RG 1.189. The fire hazards analysis for the RWB is included in Appendix 9A and describes the fire protection features provided to reduce the potential for radioactive materials to be spread by fire. Drawings 1.2-28 through 1.2-33 indicate the 3-hour rated fire barriers provided in the RWB. The liquid, gaseous and solid radioactive waste processing and storage systems described in Sections 11.2, 11.3, and 11.4 rely almost exclusively on metal tanks or containers. Exceptions may include, for example, storage of radioactive wastes that are packaged for shipping in approved (nonmetal) high integrity containers (see Table 11.4-3). The radioactive drain waste system described in Section 9.3.3 provides for the containment and sampling of manual or automatic fire suppression water in areas with radioactive materials. The features and operation of ventilation systems and fire dampers to prevent the spread of radioactivity are described in Section 9.4.

Ignition Source Control

Potential ignition sources in the plant include welding, flame cutting, grinding, and smoking. Administrative Procedures specifically prohibit the use of open flame or combustion generated smoke for leak testing or air flow determination, and restrict smoking to designated areas. The fire protection program is specified by COL Item 13.4-1. Site-specific procedures are addressed by COL Item 13.5-1.

Plant Cleanliness Practices

Administrative controls and practices control the cleanliness of the plant with regards to fire hazards. Routine inspections are performed to ensure the plant does not have unnecessary fire hazards and maintain safe access and egress pathways from areas containing equipment with safety-related or risk-significant functions. Such hazards include overfilled trash cans, litter on the floor, blocked doorways, etc. Operational and maintenance practices provide for timely cleanup activities for chemical and flammable liquid spills, waste removal, and inspection of fire equipment egress and access lighting and equipment are in proper working conditions. The fire protection program is specified by COL Item 13.4-1. Site-specific procedures are addressed by COL Item 13.5-1.

9.5.1.2.2 Fire Protection Program Organizational Structure

The FPP addresses implementation plans to establish an organizational structure, train, and equip the site fire brigade to ensure adequate manual firefighting capability for areas with SSC with safety-related or risk-significant functions in accordance with RG 1.189. The organizational structure includes training, qualification, and documentation and maintenance of training and qualification records. Refer to Section 13.1, COL Items 13.1-2 and 13.1-3.

9.5.1.2.3 Quality Assurance

The plant quality assurance program includes the QA program for fire protection. This program provides assurance that the fire protection system is designed, fabricated, erected, tested, maintained and operated so that the system can perform its intended functions. The plant quality assurance program is implemented in accordance with RG 1.189 position 1.7. Refer to Section 17.5, including COL Item 17.5-1, for more information on the plant QA program including the site-specific QA program for construction and operations.

9.5.1.2.4 Plant Arrangement

Design and Passive Features-Building Compartmentalization

In accordance with GDC 3, SSC are designed and located to minimize the impacts from the fire. One method used is compartmentalizing of the buildings which contain equipment with safety-related or risk-significant functions. Buildings are divided and sub-divided to ensure adequate equipment and cable separation to meet the enhanced fire protection criteria. Compartmentalization is achieved by using properly rated fire barriers, fire doors, fire dampers and penetration seals to prevent the spread of fire between areas.

The FHA defines the locations of fire areas and fire barriers. Fire areas may be sub-divided into fire zones although this is not expected to be necessary in the as-built plant.

The plant layout provides means of access and egress to rooms and areas for manual firefighting, safe shutdown operator actions and emergency escape. The number and arrangement of exits are based on the maximum expected occupant load during maintenance, refueling and testing.

Stairwells serving as access or egress routes are enclosed in masonry or concrete with a minimum fire rating of 2 hours. Doors in egress stairwells swing in the direction of egress travel and have a minimum fire rating of 1 1/2 hour. Egress routes are clearly marked. The layout and travel distances of access and egress routes meet the requirements of NFPA 101.

Emergency lighting is provided in accordance with NFPA 101 to illuminate means of egress. Emergency lighting also illuminates access and egress routes for operator actions as well as to provide illumination on equipment used for safe shutdown.

Inside Containment

As described in Appendix 9A, no fire suppression or detection is provided inside containment. The containment interior remains inaccessible while operating. During operations, the containment for each NPM is partially immersed in the ultimate heat sink pool and maintained at vacuum conditions by the containment evacuation system described in Section 9.3.6. The highly evacuated state provides insufficient oxygen to sustain combustion in the unlikely event that combustion initiation conditions occur. The inability to maintain a high state of vacuum during operations results in a reactor trip and containment isolation at approximately 9 psia. Electrical conductors within the containment vessel are noncombustible or routed in conduit which results in no intervening combustible loading for an exposure fire impacting other cable or components in the containment. The RCS relies on natural circulation and therefore there are no pumps, with associated lube oil systems, located inside containment.

Fire suppression or detection is also not necessary during refueling outages. During a plant shutdown for refueling, the containment is flooded at essentially the same time containment pressure is being increased to atmospheric. The reactor core is then separated from the containment and moved to the refueling area of the pool. Significant maintenance including hotwork inside a containment vessel cannot be practically accomplished without removal of the reactor core and in any case would be accomplished with the reactor already shutdown, cooled down, and submerged for passive decay heat removal to the UHS pool.

The area inside containment is recognized by RG 1.189 as one in which divisional separation of safe shutdown components is not practicable and this is evaluated as a special case by the fire hazards analysis in Appendix 9A.

Containment Dome Enclosed by the Bioshield

The single reactor building houses the NPMs and maintains them partially immersed in the same UHS pool.

The exposed dome of each NPM containment is entirely enclosed by 3-hour rated fire barriers or the spread of fire to or from the area is eliminated by other means at the back by the structural pool wall, at either side by the integral, structural "wing" walls, and at the front and over the top by non-structural, removable bioshields. This configuration creates a separate fire area enclosing the top of each module thereby providing separation from other modules.

The fire area enclosed by the bioshield is a small area which cannot be practicably divided into multiple fire areas. This area must accommodate the mechanical and electrical penetrations, containment isolation valves and other valves required for safe shutdown. This area is therefore similar to the annulus area of a conventional reactor building in that it contains safe shutdown equipment for more than a single division. The arrangement of plant equipment and routing of conductors is such that redundant safe shutdown equipment cannot be divisionally separated by a 3 hour rated fire barrier. Practicable measures are taken under the bioshield to ensure that one division of safe shutdown equipment remains available to perform safe shutdown functions. Measures taken include:

- Divisional separation is provided to the extent practicable given the physical restraints of the area. Safe shutdown SSC are safety related; as a minimum, the separation guidance of RG 1.75 is followed.
- Minimal combustibles and no intervening combustibles are used. Cable is routed in suitable conduit or is of noncombustible construction.
- The use of redundant, hydraulically operated valves for safe shutdown are not dependent on power cables in the bioshield fire area.

- Divisionally separated hydraulic control units for the hydraulic valves are located outside of the bioshield fire area in separate 3-hour rated structural fire areas. The hydraulic fluid utilized is noncombustible.
- Smoke detection in the ventilation exhaust from each individual fire area enclosed by the bioshield alerts operators of the potential need for conservative actions.
- Use of a passive decay heat removal system allows safe shutdown (< 420 degrees F) prior to removal of bioshields for maintenance or refueling.
- Introduction of transient combustibles cannot occur until removal of the bioshields, which simultaneously allows manual fire suppression if necessary.
- The distance between NPMs in their operating bays eliminates the spread of fire from one NPM to another when a bioshield has been removed.

Like the area inside containment, the fire area enclosed by the bioshield is evaluated in Appendix 9A as a special case.

Control Room Complex

The control room complex is considered a single fire area and is separated from adjacent areas by minimum 3-hour fire rated barriers. The control room complex includes the control room itself plus a break room provided with automatic fire suppression and separated from the control room by 1-hour fire resistance rated construction.

Ventilation openings between peripheral rooms and the control room complex are provided with smoke dampers that automatically close upon operation of the fire detection or fire suppression system. A 3-hour fire rated duct shaft within the control room boundary is also provided. Combination fire and smoke dampers are provided at each duct shaft penetration to allow control room ventilation system isolation if fire or smoke is detected (see Section 9.4.1).

Where utilized, carpeting in the control room is tested in accordance with ASTM D2859, "Standard Test Method for Flammability of Finished Textile Floor Covering Materials" to determine the flammability characteristics of the material. The as-built fire hazards analysis discusses the flammability characteristics of carpet where used in the control room.

Manual fire suppression capability is provided in the control room to address fire hazards. Fire hazards in the control room include ordinary combustibles such as paper, plastics and cable insulation, and electrical hazards such as control consoles, electrical cabinets and energized cables. Portable Class A and C fire extinguishers of the appropriate size and quantity are provided in the control room. At least one hose station is provided inside or immediately outside the control room.

Automatic fire detection is provided in the control room, cabinets and consoles. Redundant safe shutdown equipment located in the same cabinet or console is protected with additional fire protection measures. Outside air intakes for control room ventilation are provided with smoke detection that alarms in the control room and isolates the control room ventilation system to prevent smoke from entering the control room.

Means are provided to ventilate smoke from the control room. Smoke purge exhaust is drawn from the ceiling plenum of the fire zone being purged into a smoke purge duct that is routed up through each floor of the building within a 3-hour fire rated shaft. Smoke purge air is discharged to the outside through a protected exhaust. Operators have the ability to manually align the ventilation system.

Structural Features

Structural Fire Barriers

Structural fire barriers are provided to separate redundant cables and equipment required for safe shutdown following a fire. Structural fire barriers include walls, floors and supports as well as beams, joists, columns, penetration seals, fire doors, and fire dampers that are rated by independent laboratories for the hourly resistance rating desired.

Walls, floors and ceiling assemblies are non-combustible and conform to the requirements of NFPA 221, "Standard for High- Challenge Fire Walls, Fire Wall, and Fire Barrier Walls." Reinforced concrete is the preferred choice for construction of structural fire barriers.

Structural Steel Fire Protection

Structural steel forming part of or supporting fire barriers is protected to provide fire resistance equivalent to the barrier. Structural steel whose only purpose is to carry dynamic loads from a seismic event is not required to be protected unless failure of the steel during a fire could cause failure of the fire barrier to maintain its integrity.

9.5.1.2.5 Electrical System Design

Electrical raceways are located, employing spatial separation for redundant components to the extent practical, to reduce the probability of common cause failure.

Only metal is used for cable trays. Cable trays are accessible for manual firefighting, and cables are designed to allow wetting down with fire suppression water without electrical faulting

Only metallic tubing is used for conduit. Thin-wall metallic tubing is not used. Flexible metallic tubing is used only in short lengths to connect components to equipment. Other raceways are made of noncombustible material. Cable raceways are used only for cables.

Two nonsafety systems serving a common system are physically separated to the maximum extent practical. This applies to the equipment, circuits, and cable routing of the two systems.

The independence of redundant safe shutdown circuits and equipment are such that a fire in a fire hazard area will not prevent the redundant circuits and equipment in a separate fire area from performing their safe shutdown functions.

Electric cable construction, as a minimum, shall pass the flame test in IEEE Standard 383, "IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations", or IEEE Standard 1202, "IEEE Standard for Flame Testing of Cables for Use in Cable Trays in Industrial and Commercial Occupancies". New reactor fiber optic cable insulation and jacketing, as a minimum, shall also meet the fire and flame test requirements of IEEE 1202.

Control Room

Energized electrical equipment and cabling in the control room is limited to that which is necessary for control room functions and is limited to low voltage control and instrumentation. Cabling in the control room complex terminates within the complex. No cabling passes through the control room complex from one area to another.

Cable Spreading Rooms

The design does not provide for cable spreading rooms. The building layout is designed to accommodate divisional separation of safe shutdown cabling for each NPM in separate fire areas until the cables enter the control room envelope in the under-floor area.

Switchgear Rooms

Switchgear rooms containing equipment with safety-related or risk-significant functions are separated from the remainder of the plant by barriers having a 3-hour fire rating. Redundant switchgear safety divisions are separated from each other by 3-hour fire rated barriers.

Automatic fire suppression for switchgear rooms is provided based on the fire hazards analysis. Fire hose stations and portable fire extinguishers are located outside the area and are readily available. Adequate floor drainage is provided to remove water from firefighting activities and suppression system actuation.

Battery Rooms

Battery rooms associated with the redundant separation trains are separated from each other and other areas of the plant by fire barriers having a minimum 3-hour fire rating. Battery rooms housing batteries that produce flammable off-gases are provided with ventilation systems designed to maintain the concentration of the gas to below 1% by volume. Automatic fire detection alarms annunciate in the control room and alarm locally. Loss of ventilation should alarm in the control room.

Battery rooms do not contain DC switchgear or inverters. Standpipes, hose stations, and portable extinguishers are readily available outside the room.

9.5.1.2.6 Fire Protection System Design features

Fire Detection and Suppression

The fire hazards analysis (FHA) identifies the extent to which fire detection and fixed manual and automatic fire suppression is required. Fire detection and suppression systems are installed in accordance with applicable industry codes and standards.

Fire Detection

a) Areas that contain or present a fire exposure to equipment with safety-related or risk-significant functions are provided with fire detection that alarms in the main control room. The following areas are provided with automatic detection:

    1) Plant computer rooms

    2) Switchgear rooms

    3) Remote shutdown panel

    4) Battery rooms

    5) Diesel generator areas

    6) Pump rooms

    7) New and spent fuel areas

    8) Radioactive waste and decontamination areas

b) Fire detection and alarm systems comply with the requirements of Class A systems, as defined in NFPA 72, "National Fire Alarm Code" and Class I circuits as defined in NFPA 70, "National Electrical Code."

c) Fire detectors are selected and installed in accordance with NFPA 72.

d) Primary and secondary power supplies are provided for the fire detection and alarm system as well as electrically operated valves in the fire suppression system. The primary and secondary power supplies comply with NFPA 72.

e) The fire detection and alarm system remains operable under the following conditions:

1) Natural phenomena of less severity and greater frequency than the most severe natural phenomena (approximately once in 10 years), such as tornadoes, floods, ice storms, or small-intensity earthquakes that are typical for the region.

2) Potential manmade site-related events that have a reasonable probability of occurring at the plant site.

f) Control room fire detection and alarms are provided in accordance with the guidance in Regulatory Position 6.1.2 of RG 1.189.

Fire Suppression

The fire suppression system agent selected for areas is described by the FHA. Several fire suppression agents are available and are selected based on the hazard to be protected.

A water based system requires a water supply, fire pumps, piping, valves and automatic fire sprinklers. The recommendations, per RG 1.189, for the components in a water based system are described below.

a) Water Supply

The water supply system is designed in accordance with NFPA 22, "Standard for Water Tanks for Private Fire Protection," and NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances." The water supply meets the following criteria:

1) Two separate fresh water supplies are available.

2) The water supplies are sized to provide the largest expected flow rate for a minimum of 2 hours, but the size of the supplies are not less than 300,000 gallons. The flow rate is based on the largest flow demand from a single fire suppression system or multiple systems that have the potential for operating simultaneously, plus 500 gpm for hose streams.

3) Two 100 percent capacity tanks are installed and interconnected so that the fire pumps can take suction from either or both tanks. A failure in one tank will not cause both tanks to drain. The tanks are connected to a water supply capable of refilling the tank in 8-hours or less.

4) Fire water supplies are filtered and treated as necessary to prevent and control bio-fouling or microbiologically induced corrosion of the fire water systems.

b) Fire Pumps

Fire pump installations conform to NFPA 20, "Standard for the Installation of Stationary Pumps for Fire Protection." Consistent with NFPA 13, each pump is capable of delivering the demand from the largest sprinkler or deluge system plus an additional 500 gpm for fire hoses.

The following recommendations from RG 1.189 are met:

1) Fire pumps are provided so that failure of one pump will not affect the ability of the remaining pump to supply 100 percent rated capacity to the fire distribution system. The fire pumps are two 100 percent capacity fire pumps, one electric and one diesel.

2) Individual fire pump connections to the yard fire main loop are separated with sectionalizing valves between connections.

3) Each fire pump and its driver and controls are separated from remaining fire pumps, drivers and controls by a fire barrier having a minimum 3-hour fire rating.

4) Diesel fire pump fuel is separated from equipment with safety-related or risk-significant functions.

5) Indication for the fire pumps identifying pump running, driver availability, failure to start, and low fire main pressure is provided in the control room.

6) The over current protection device for motor controllers are rated to carry indefinitely the sum of the locked rotor current of the largest pump motor and the full-load current of all of the other pump motors and accessory equipment.

7) For the purpose of providing fire water flow to the seismically analyzed standpipes located in the RXB, the diesel fire pumps including appurtenances required for operation (start batteries, fuel day tank, start and run instrumentation, etc.) are designed in accordance with ASCE 43-05, SDC-1 limit state C. The diesel fire pump is housed in the Firewater Building, which is seismically designed based on its seismic classification in Table 3.2-1.

c) Fire Mains

An underground yard fire main loop is installed in accordance with NFPA 24 and appropriate referenced codes and standards. The following criteria is utilized per RG 1.189:

1) Means are provided for flushing and inspecting the fire main.

2) Sectional isolation valves are visually indicating such as post indicating type.

3) Control and sectionalizing valves in fire mains and water-based fire suppression systems are electrically supervised or administratively controlled. Administrative control is accomplished using locked valves with key control or tamper proof seals. Electrical supervision indicates in the control room.

4) The fire main system piping is separate from service or sanitary water system piping.

5) Sectional control valves are provided to permit isolation of portions of the fire main for maintenance and repair without affecting the water supply to primary and backup fire suppression systems serving areas that contain or expose equipment with safety-related or risk-significant functions.

6) Isolation valves are provided to isolate outside fire hydrants from the fire main.

7) Sprinkler systems (primary) and manual hose station standpipes (backup) have connections to the yard main system, so that a single active failure or a line break cannot impair both the primary and backup fire suppression systems.

   Alternatively, headers inside buildings and fed from each end are used to supply both sprinklers and standpipe systems. Where these headers supply sprinklers and the seismically analyzed standpipes in the reactor building, steel piping and fittings meeting the requirements of ASME B31.1, "Power Piping", are used for the headers, up to and including the first valve supplying the sprinkler systems.

8) For the purpose of supplying fire water to the seismically analyzed standpipes, the piping system serving the reactor building from the fire water storage tanks to the diesel fire pump, then from the diesel fire pump to the reactor building's seismically analyzed piping up to and including sectional isolation valves supplying buildings and systems other than the reactor building, are designed to the requirements of ASME B31.1.

d) Automatic Fire Suppression

Automatic fire suppression systems are designed to detect fires and provide the capability to extinguish them using fixed automatic suppression systems.

Automatic fire suppression systems are used where necessary to protect redundant systems or components required for safe shutdown and SSC with safety-related or risk-significant functions. The fire protection analysis provided in Appendix 9A determines the suppression systems provided for the fire areas.

Plant areas that have an automatic suppression system also have manual backup fire suppression capability. Manual fire suppression capabilities include the yard main fire hydrants and hose stations.

Automatic fixed water suppression protection over the fire area is provided for equipment identified by the fire hazard analysis as containing a sufficient quantity of combustible material to warrant an automatic fire suppression system.

Water-Based Systems

Where water-based systems are used, adequate drainage and shielding is provided to prevent damage to equipment with safety-related or risk-significant functions in the event of accidental discharge or rupture of the fire suppression system piping.

Sprinkler and Water Spray Systems

Automatic sprinkler and water spray systems are used to protect a variety of hazards such as cable areas, lubrication oil hazards, computer rooms and transformers. Automatic sprinkler systems are installed in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems. Automatic water spray systems are installed in accordance with NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection.

Water Mist Systems

Water mist systems may be used where water is appropriate for the hazard but where excessive water use is not desired. Water mist systems utilize water at high pressure usually in bottles and high pressure piping and specialized spray nozzles to distribute a fine water mist into the area upon detection of a fire. Where provided, water mist systems are designed and installed in accordance with NFPA 750, "Standard on Water Mist Fire Protection Systems."

Foam-Water Sprinkler and Spray Systems

Foam-water sprinkler and spray systems are employed where flammable and combustible liquid hazards are present and where a large pool fire could occur due to rupture of a storage tank or piping. Foam-water systems are also used for the protection of large flammable and combustible liquid storage tanks. Foamwater systems are designed and installed in accordance with NFPA 11, "Standard for Low, Medium, and High Expansion Foam" and NFPA 16, "Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems."

Gaseous Fire Suppression

Fire areas where gaseous agent fire suppression systems are utilized are reviewed for habitability and air tightness. Some gaseous agents are not appropriate for areas that need to be occupied during and after an agent discharge. Also, in order for gaseous agent fire suppression systems to be effective, they must achieve a design concentration and maintain that concentration over a specified period of time. Therefore, openings in the protected area are sealed to minimize agent loss, and the agent quantity needs to be sized to account for openings that cannot be sealed.

The design of gaseous fire suppression systems considers the following per RG 1.189:

1) Minimum required gas concentration, distribution, soak time, and ventilation control.

2) The anoxia and toxicity hazards associated with the agent.

3) The possibility of secondary thermal shock (cooling) damage

4) Conflicting requirements for venting during system discharge to prevent over-pressurization versus sealing to prevent loss of agent

5) Location and selection of the fire detectors.

6) The toxicity and corrosive characteristics of the thermal decomposition products of the agent.

The fire protection analysis provided in Appendix 9A describes the suppression systems provided for the fire areas.

Carbon Dioxide Systems

Carbon dioxide systems are designed in accordance with NFPA 12, "Standard on Carbon Dioxide Extinguishing Systems."

Halon Fire Suppression Systems

Clean agents, as described below, have been developed to replace Halon systems. Availability of Halon agent is limited since these agents are not currently being produced and supply is limited to that available in use or storage. For locations where Halon is desired, the system is designed and installed in accordance with NFPA 12A, "Standard on Halon 1301 Fire Extinguishing Systems."

Clean Agent Fire Suppression Systems

Clean agents are chosen based on the hazard to be protected and whether total flooding or local application systems are desired. Where provided, clean agent fire suppression systems are designed and installed in accordance with NFPA 2001, "Standard for Clean Agent Fire Suppression Systems.

e) Manual Fire Suppression

Manual firefighting capability is provided throughout the plant to allow the fire brigade the ability to limit fire damage to SSC with safety-related or risk-significant functions. Manual firefighting capability is supported by properly spaced standpipe connections, fire hoses and nozzles, exterior fire hydrants and hose houses, and portable fire extinguishers.

The fire protection analysis provided in Appendix 9A describes the suppression systems provided for the fire areas.

Fire Hydrants

Outside fire hydrants and hose installations are provided to allow manual firefighting for outside hazards that could impact equipment with safety-related or risk-significant functions. Fire hydrants are provided every 250 feet along the yard main system.

The hydrants provide hose stream protection for every part of the buildings and 2 hose streams for every part of the interior of the buildings not covered by standpipe protection. The lateral to the hydrants is controlled by an isolation valve.

Threads used on fire hydrants are compatible with those used by the local fire department.

Standpipes and Hose Stations

Hose houses equipped with the required equipment per NFPA 24 are provided as needed but at least every 1000 feet.

Where provided, interior hose installations are capable of reaching areas with 100 feet of hose and an effective hose stream. The length of hose stream is dependent on the type of nozzle being used but is generally 30 feet.

Standpipe and hose systems are designed and installed in accordance with NFPA 14, "Standard for the Installation of Standpipe and Hose Systems" for sizing, spacing and pipe support requirements for Class III standpipes. Fire hose meets the requirements of NFPA 1961, "Standard on Fire Hose."

At least two standpipes and hose connections are provided for manual firefighting in areas containing equipment required for safe plant shutdown in the event of an SSE. The piping is analyzed for SSE loading and provided with supports to ensure system pressure integrity. The piping and valves for these seismically analyzed standpipes satisfy ASME B31.1.

Fire Extinguishers

Fire extinguishers are provided in areas that could present a fire exposure hazard to equipment with safety-related or risk-significant functions. Fire extinguishers are the appropriate size and type for the fire hazards in the area. NFPA 10, "Standard for Portable Fire Extinguishers" provides guidance on the installation of portable fire extinguishers.

Fire Doors

Door openings are protected to maintain the fire rating of the barrier in which it is installed. Fire doors are provided that have been tested by an independent testing laboratory to meet the desired fire resistance characteristics. Fire doors are self-closing to ensure reliable fire protection. NFPA 80, "Standard for Fire Doors and Other Opening Protectives" provides requirements for fire doors.

Fire Dampers

Fire dampers are provided in ventilation openings through fire barriers to seal off the opening in the event of a fire. The fire resistance rating of fire dampers is equivalent to the rating of the fire barrier in which it is installed. NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems" provides guidelines for installation of fire dampers. In addition UL 555, "Fire Dampers" provides criteria for the design, fabrication and testing of fire dampers.

Penetration Seals

Openings in fire barriers for pipes, conduits and cable trays that separate fire areas are sealed to provide a fire resistance rating at least equivalent to the barrier rating. Openings inside conduit greater than 4 inches in diameter are sealed at the barrier penetration. Openings in conduit less than 4 inches are sealed at the penetration unless the conduit extends at least 5 feet beyond the barrier on both sides then the conduit is sealed either at the barrier or at both ends. The internal conduit seals are sufficient to prevent the propagation of smoke and hot gases between areas.

Penetration seals are tested in the configuration in which it is intended to be used or in a configuration that bounds the intended installation. Testing is conducted in accordance with NFPA 251, "Standard Methods of Tests of Fire Endurance of Building Construction and Materials" and ASTM E-119, "Standard Test Methods for Fire Tests of Building Construction and Materials." In addition, ASTM-E-814, "Standard Test Method for Fire Tests of Through-Penetration Fire Stops" and IEEE 634, "IEEE Standard Cable Penetration Fire Stop Qualification Test" are used for guidance.

Heating, Ventilating and Air Conditioning (HVAC) Design

The design of the plant and ventilation systems is such that smoke, hot gases and fire suppressant in a single fire area will not migrate into other fire areas and adversely impact safe shutdown capability. Performance of the ventilation systems is described in Section 9.4.1, Section 9.4.2 and Section 9.4.3.

Filters that include combustible materials and are a potential exposure fire hazard that may affect components with safety-related or risk-significant functions are protected as determined by the fire hazard analysis. The ventilation system is also used to discharge smoke and corrosive gases directly outside to an area that will not affect areas containing safety-related or risk-significant functions. Ventilation duct penetrations of fire barriers are protected by means of fire dampers that are arranged to automatically close in the event of fire.

Fire suppression systems are installed to protect ventilation filters which collect combustible material and are potential exposure fire hazards, as determined by the fire hazard analysis (FHA).

Fire suppression for charcoal ventilation filters, are developed as defined in the fire hazard analysis and in accordance with NFPA 804. A manually operated deluge system employing open sprinklers, or spray nozzles, attached to a dry piping network protect the filters. Fire detector(s) are installed in the same areas as the sprinklers or spray nozzles and alarm to the Main Control Room. Operation of the deluge valve permits water to flow into the sprinkler piping network and to be discharged from the sprinklers or spray nozzles. System operation is terminated manually by shutting the water-supply valve.

Refer to Section 9.4 for information related to fire hazards provisions for ventilation systems.

Floor Drains

Adequately sized floor drains are provided in areas where automatic or manual water-based fire suppression system piping is present to direct water away from equipment important to safety. Equipment that is required to be protected from water as discussed in Section 3.4.1 is mounted on pedestals or qualified for submergence to protect from floor level water damage. Floor drains are sized to remove firefighting water but are not credited with protecting equipment important to safety.

In rooms or areas where gaseous fire suppression systems are installed, floor drains are provided with seals or the gaseous agent supply is sized to account for leakage through the floor drains.

Floor drains in areas containing flammable or combustible liquids have provisions to trap the flammable or combustible liquids to prevent the spread of burning liquids beyond the fire area.

Water drainage from areas that may contain radioactivity is collected, sampled, and analyzed before discharge to the environment.

9.5.1.2.7 Multi-Module Fire Protection

The design of the FPP and the FHA are for the entire facility and provide fire protection for the installed modules.

9.5.1.2.8 Post Fire Design functions

Post-Fire Safe Shutdown Performance Goals

Performance goals applicable to the design are as follows:

1) The reactivity control function is capable of achieving and maintaining the passive plant shutdown conditions.

2) The process monitoring function is capable of providing direct readings of the process variables necessary to perform and control safe shutdown functions.

3) The supporting functions are capable of providing the process cooling, lubrication, and other activities necessary to permit the operation of the equipment used for safe-shutdown functions.

Post-Fire Safe Shutdown Analysis

An analysis of the capability to safely shut down the plant after a fire is required to evaluate the effects of a fire in the fire areas of the plant and identify a safe shutdown success path that is free of fire damage. The analysis is required to identify fire-induced circuit failures that could directly or indirectly prevent safe shutdown.

Local operator manual actions are not relied on to achieve safe shutdown, except in cases involving control room fires. The enhanced fire protection criteria assume that entry into the fire area for repairs and operator manual actions is not possible.

Alternative Shutdown Capability

Alternative shutdown capability is provided so that in the event of a fire in the control room safe shutdown can be achieved from outside the control room. The alternative capability is physically and electrically independent of the control room. Means are provided to isolate circuits in the control room to ensure equipment can be controlled from outside the control room.

Emergency lighting is provided for access to and illumination of equipment necessary to implement the alternative shutdown capability. Emergency lighting is also provided for egress from these areas. Emergency lighting used for the purposes of illuminating alternative safe shutdown equipment as well as access and egress routes is provided with minimum 8-hour battery power as discussed in Section 9.5.3

Passive Plant Safe Shutdown Condition

Based on SECY-94-084, the passive decay heat removal systems are capable of achieving and maintaining 215.6 degrees Celsius (420 degrees Fahrenheit) or below for non-LOCA events. This safe-shutdown condition is predicated on demonstration of acceptable passive safety system performance. The cold shutdown condition required by RG 1.139 (93.3 degrees Celsius or 200 degrees Fahrenheit) is not applicable to passive plant designs.

9.5.1.3 Safety Evaluation

The FPP and the FPS as described herein, taken together with the FHA and fire safe shutdown plan of Appendix 9A, establish the basis for concluding that a fire will not prevent the safe shutdown of any reactor in the plant and that radioactive releases to the environment will be minimized in the event of a fire.

The FHA of Appendix 9A was performed for the buildings associated with safe shutdown equipment and radiological hazards i.e., the reactor and control buildings and the radioactive waste building. Other buildings and their locations do not contain safe shutdown equipment or represent radiological hazards and therefore these buildings have not been included in the FHA. The safety of SSC associated with the analyzed buildings is assured by the requirement to maintain a minimum separation distance of 50 ft between these structures and the exterior, 3 hour rated walls of the RXB and main control room. Similarly, other equipment external to the analyzed structures such as transformers and diesel fuel oil tanks are required to maintain the same 50 ft separation distance. The 50 ft separation distance derives from RG 1.189 for fuel oil tanks and transformers and from NFPA 804 for transformers, fuel oil tanks and building structures that have not been shown to have 3 hour rated walls.

The ventilation systems for the RXB, CRB and RWB are provided with smoke detectors and design features to ensure that the outside air intakes do not admit smoke to the building interiors during a fire outside these structures.

9.5.1.4 Inspection and Testing Requirements

Preoperational inspection and testing requirements for the fire protection system is described in Section 14.2. Periodic inspection and testing to assure system functionality is conducted in accordance with applicable codes and approved procedures.

9.5.1.5 Instrumentation and Control Requirements

Instrumentation

Vane Type Water Flow Detectors

Vane type water flow detectors, which monitor the flow of water in a wet pipe sprinkler system, send an alarm when a continuous flow of water occurs from an activated sprinkler head or from a leak in the system.

Supervisory/Tamper Switches

Supervisory switches are used primarily to monitor the open position of valves in a fire sprinkler system. Supervisory switches are required to send a signal if a valve is closed one-fifth of its total travel distance. Valves that can affect the flow of water in a fire sprinkler system are monitored.

Pressure Switches

There are two main types of pressure switches, alarm pressure switches and supervisory pressure switches. Alarm pressure switches are suitable for use in wet, dry, deluge and pre-action automatic fire sprinkler systems to indicate a discharge of water from one or more sprinkler heads. Alarm pressure switches are used to detect the flow of water in dry pipe, preaction and deluge sprinkler systems.

Supervisory pressure switches monitor the status of system conditions, primarily the status of air pressure in dry pipe and pre-action systems.

Alarm Bells and Horn Strobes

The fire detection system provides audible and visual alarms and trouble annunciation in the main control room and in the security central alarm station. Annunciation circuits connecting zone, main, and remote annunciation panels are electrically supervised.

Controls

Fire Pump Controller

Fire pumps are automatic starting with manual shutdown. The manual shutdown is located at the pump controllers only. The fire pump controllers are equipped with a separate pressure switch (transducer) and sensing line that actuates the pump unit when pressure in the underground system drops to a preset level. The pumps can be manually controlled at a remote station (control room) by opening a remote contact independent of the pressure transducer. The pump can only be manually stopped at the pump controller (provided the system pressure is above the cut out pressure adjustment).

For the diesel fire pump a loss in system pressure will cause the controller to open or close circuits necessary to automatically start the engine by performing the following functions:

- Actuate the fuel pump.
- Open the cooling water solenoid valve.
- Crank the engine in a series of crank-reset cycles, automatically alternating between the dual batteries on each cycle.
- Disconnect cranking motor upon engine start.
- Once the engine is started, it shall remain in operation until shut down manually.

If the engine should fail to start after several cranking attempts, the controller disconnects the starting circuits and energizes an audible and visual alarm to indicate over-crank. In addition, there are audible and visual alarms to indicate high jacket water temperature and low lube oil pressure. The engine does not shut down for either of these faults.

9.5.1.6 Quality Assurance

Appropriate Quality Assurance requirements for fire protection are included in the Quality Assurance Program Descriptions of Section 17.

Table 9.5.1-1: Lists of Applicable Codes, Standards and Regulatory Guidance for Fire Protection

Item	Applicable Codes, Standards and Regulatory Guidance
1	American Society of Mechanical Engineers, ASME B31.1, “Power Piping,” ASME Code for Pressure Piping. ASME B31.1
2	American Society of Testing and Materials, ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, ASTM Standard E84-15a
3	American Society of Testing and Materials, ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials, ASTM Standard E119-14
4	Electric Power Research Institute, EPRI Utility Requirements Document URD, Approved Version 13, Tier 2, Electric Power Research Institute, Palo Alto, CA, 2014.
5	Institute of Electrical and Electronic Engineers, Inc, IEEE C2, National Electric Safety Code, 2012 Edition
6	National Fire Protection Association, NFPA 10, Standard for Portable Fire Extinguishers, 2014 Edition, Quincy, MA
7	National Fire Protection Association, NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam, 2016 Edition, Quincy, MA
8	National Fire Protection Association, NFPA 12, Standard on Carbon Dioxide Extinguishing Systems, 2015 Edition, Quincy, MA
9	National Fire Protection Association, NFPA 13, Standard for the Installation of Sprinkler Systems, 2016 Edition, Quincy, MA
10	National Fire Protection Association, NFPA 14, Standard for the Installation of Standpipe and Hose Systems, 2016 Edition, Quincy, MA
11	National Fire Protection Association, NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection, 2017 Edition, Quincy, MA
12	National Fire Protection Association, NFPA 16, Standard for Installation of Foam-Water Sprinkler and Foam-Water Spray Systems, 2015 Edition, Quincy, MA
13	National Fire Protection Association, NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, 2016 Edition, Quincy, MA
14	National Fire Protection Association, NFPA 22, Standard for Water Tanks for Private Fire Protection, 2013 Edition, Quincy, MA
15	National Fire Protection Association, NFPA 24, Standard for Installation of Private Fire Service Mains and Their Appurtenances, 2016 Edition, Quincy, MA
16	National Fire Protection Association, NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2017 Edition, Quincy, MA
17	National Fire Protection Association, NFPA 30, Flammable and Combustible Liquids Code, 2015 Edition, Quincy, MA
18	National Fire Protection Association, NFPA 37, Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines, 2015 Edition, Quincy, MA
19	National Fire Protection Association, NFPA 55, Standard for the Storing, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks, 2016 Edition, Quincy, MA
20	National Fire Protection Association, NFPA 69, Standard on Explosion Prevention Systems, 2014 Edition, Quincy, MA.
21	National Fire Protection Association, NFPA 70, National Electric Code, 2017 Edition, Quincy, MA
22	National Fire Protection Association, NFPA 72, National Fire Alarm and Signaling Code, 2016 Edition, Quincy, MA
23	National Fire Protection Association, NFPA 80, Standard for Fire Doors and Other Opening Protectives, 2016 Edition, Quincy, MA
24	National Fire Protection Association, NFPA 80A, Recommended Practice for Protection of Buildings from Exterior Fire Exposures, 2017 Edition, Quincy, MA
25	National Fire Protection Association, NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, 2015 Edition, Quincy, MA
26	National Fire Protection Association, NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids, 2015 Edition, Quincy, MA
27	National Fire Protection Association, NFPA 92, Standard for Smoke-Control Systems Utilizing Barriers and Pressure Differences, 2015 Edition, Quincy, MA
28	National Fire Protection Association, NFPA 101, Life Safety Code, 2015 Edition, Quincy, MA

Table 9.5.1-1: Lists of Applicable Codes, Standards and Regulatory Guidance for Fire Protection (Continued)

Item	Applicable Codes, Standards and Regulatory Guidance
29	National Fire Protection Association, NFPA 105, Standard for Smoke Door Assemblies and Other Opening Protectives, 2016 Edition, Quincy, MA
30	National Fire Protection Association, NFPA 204, Standard for Smoke and Heat Venting, 2016 Edition, Quincy, MA
31	National Fire Protection Association, NFPA 214, Standard on Water-Cooling Towers, 2016 Edition, Quincy, MA
32	National Fire Protection Association, NFPA 221, Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls, 2015 Edition, Quincy, MA.
33	National Fire Protection Association, NFPA 251, Standard Methods of Tests of Fire Resistance of Building Construction and Materials, 2006 Edition, Quincy, MA
34	National Fire Protection Association, NFPA 252, Standard Methods of Fire Tests of Door Assemblies, 2012 Edition, Quincy, MA
35	National Fire Protection Association, NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials, 2006 Edition, Quincy, MA
36	National Fire Protection Association, NFPA 750, Standard on Water Mist Fire Protection Systems, 2015 Edition, Quincy, MA
37	National Fire Protection Association, NFPA 804, Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants , 2015 Edition, Quincy, MA
38	National Fire Protection Association, NFPA 1961, Standard on Fire Hose, 2013 Edition, Quincy, MA
39	National Fire Protection Association, NFPA 1963, Standard on Fire Hose Connections, 2014 Edition, Quincy, MA
40	National Fire Protection Association, NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems, 2015 Edition, Quincy, MA
41	Nuclear Energy Institute, NEI 00-01, Guidance for Post Fire Safe Shutdown Circuit Analysis, Rev. 2, May 2009
42	Underwriter Laboratories, Inc., UL 555, Standard for Fire Dampers, 7th Edition
43	Underwriter Laboratories, Inc., UL 555S, Standard for Smoke Dampers, 5th Edition

Table 9.5.1-2: Compliance Table versus RG 1.189

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
1.	**Fire Protection Program** In accordance with 10 CFR 50.48, each operating nuclear power plant must have a fire protection plan. The plan should establish the fire protection policy for the protection of SSCs important to safety at each plant and the procedures, equipment, and personnel required to implement the program at the plant site.	Conform	COL Applicant will be required to develop and maintain the site-specific elements of the fire protection program. Note: NFPA 805 as referenced by 10 CFR 50.48(c) is not utilized in the development of the FPP.
1.1	**Organization, Staffing, and Responsibilities** The FPP should describe the organizational structure and responsibilities for its establishment and implementation. These responsibilities include FPP policy; program management (including program development, maintenance, updating, and compliance verification); fire protection staffing and qualifications; engineering and modification; inspection, testing, and maintenance of fire protection systems, features, and equipment; fire prevention; emergency response (e.g., fire brigades and offsite mutual aid); and general employee, operator, and fire brigade training.	Conform	COL Applicant
1.2	**Fire Hazards Analysis** A fire hazards analysis should be performed to demonstrate that the plant will maintain the ability to perform safe-shutdown functions and minimize radioactive material releases to the environment in the event of a fire. This analysis should be revised as necessary to reflect plant design and operational changes. The fire hazards analysis has the following objectives:	Conform	COL Applicant FHA is completed and maintained to reflect the as-built configuration of the plant.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position [(1)]	Conformance [(2)]	Comment
1.3	**Safe-Shutdown Analysis** In accordance with 10 CFR 50.48, each operating nuclear power plant must provide the means to limit fire damage to SSCs important to safety, to ensure the ability to safely shut down the reactor. Licensees should develop a safe-shutdown analysis to demonstrate the ability of the plant to safely shut down for a fire in any given area. Regulatory Position 5.1 of this guide identifies the safe-shutdown performance goals. The licensee should demonstrate the ability of the selected systems to accomplish these performance goals. The analysis should identify the safe-shutdown components and circuits for each fire area and demonstrate that the plant meets the guidelines in Regulatory Position 5.3 or that it provides an alternative or dedicated shutdown, in accordance with Regulatory Position 5.4 of this guide. For each plant, the combinations of systems that provide the shutdown functions may be unique for each area; however, the shutdown functions provided should ensure that the plant achieves its safe-shutdown performance objectives. The licensee should also develop and implement procedures necessary to implement safe shutdown as appropriate. (See Regulatory Position 5.5 of this guide.)	Conform	COL Applicant Fire safe shutdown analysis is completed and maintained to reflect the as-built configuration of the plant.
1.4	**Fire Test Reports and Fire Data** The licensee should evaluate fire reports and data (e.g., fire barrier testing results and cable derating data) that are used to demonstrate compliance with NRC fire protection requirements, to ensure that the information is applicable and representative of the conditions for which the information is being applied.	Conform	COL Applicant Test Reports and Fire Data are evaluated for as-built materials
1.5	**Compensatory Measures** The licensee may implement compensatory measures for degraded and nonconforming conditions. In its evaluation of the impact of a degraded or nonconforming condition on plant and individual SSC operation, a licensee may decide to implement a compensatory measure as an interim step to restore operability or to otherwise enhance the capability of SSCs important to safety until the final corrective action is complete	Conform	COL Applicant
1.6	**Fire Protection Training and Qualifications** The FPP should be under the direction of an individual who has available staff personnel knowledgeable in both fire protection and nuclear safety. Plant personnel should be adequately trained in the administrative procedures that implement the FPP and the emergency procedures related to fire protection.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
1.6.1	**Fire Protection Staff Training and Qualifications** Fire protection staff should meet the following qualifications:	Conform	COL Applicant
1.6.2	**General Employee Training** Each nuclear plant employee has a responsibility to respond to plant fires. General site employee training should introduce all personnel to the elements of the site's FPP, including the responsibilities of the fire protection staff. Training should also include information on the types of fires and related extinguishing agents, specific fire hazards at the site, and actions in the event of a fire suppression system actuation.	Conform	COL Applicant
1.6.3	**Fire Watch Training** Fire watches provide for observation and control of fire hazards associated with hot work, and they may act as compensatory measures for degraded fire protection systems and features. Specific fire watch training should provide appropriate instruction on fire watch duties, responsibilities, and required actions for the different types of fire watches, such as continuous hot work fire watches, hourly fire watches, etc. Fire watch qualifications should include hands-on training on a practice fire with the extinguishing equipment to be used while on fire watch, if applicable. If fire watches are to be used as compensatory actions, the fire watch training should include record keeping requirements.	Conform	COL Applicant
1.6.4	**Fire Brigade Training and Qualifications** The fire brigade training program should establish and maintain the capability to fight credible and challenging fires. The program should consist of initial classroom instruction followed by periodic classroom instruction, firefighting practice, and fire drills. (See Regulatory Position 3.5.1.4 for drill guidance.) Numerous NFPA standards provide guidelines applicable to the training of fire brigades. The NRC staff considers the training recommendations of NFPA 600, "Standard on Industrial Fire Brigades", including the applicable NFPA publications referenced in NFPA 600, to be appropriate criteria for training the plant fire brigade. The licensee may also use NFPA 1410, "Standard on Training for Initial Emergency Scene Operations", and NFPA 1500, "Standard on Fire Department Occupational Safety and Health Program", as appropriate. The licensee may use the NFPA booklets and pamphlets listed in NFPA 600, as applicable, for training references and should use courses in fire prevention and fire suppression that are recognized or sponsored by the fire protection industry.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
1.6.4.1	**Qualifications** The brigade leader and at least two brigade members should have sufficient training in or knowledge of plant systems to understand the effects of fire and fire suppressants on safe-shutdown capability. The brigade leader should be competent to assess the potential safety consequences of a fire and advise control room personnel. Such competence by the brigade leader may be evidenced by possession of an operator's license or equivalent knowledge of plant systems. Nuclear power plants staffed with a dedicated professional fire department may use a fire team advisor to assess the potential safety consequences of a fire and advise the control room and incident commander. The fire team advisor should possess an operator's license or equivalent knowledge of plant systems and be dedicated to supporting the fire incident commander during fire emergency events. The fire team advisor does not need to meet the qualifications of a fire brigade member, but if he or she does not, there should be five available qualified fire brigade members, in addition to the fire team advisor. The qualification of fire brigade members should include an annual physical examination to determine their ability to perform strenuous firefighting activities.	Conform	COL Applicant
1.6.4.2	**Instruction** Instruction should be provided by qualified individuals who are knowledgeable, experienced, and suitably trained in fighting the types of fires that could occur and in using the types of equipment available in the nuclear power plant. The licensee should provide instruction to all fire brigade members and fire brigade leaders. The initial classroom instruction should include the following:	Conform	COL Applicant
1.6.4.3	**Fire Brigade Practice** The licensee should hold practice sessions for each shift fire brigade on the proper method of fighting the various types of fires that could occur in a nuclear power plant. These sessions should provide brigade members with experience in actual fire extinguishment and the use of self-contained breathing apparatuses under the strenuous conditions encountered in firefighting. The licensee should provide these practice sessions at least once a year for each fire brigade member.	Conform	COL Applicant
1.6.4.4	**Fire Brigade Training Records** The licensee should maintain individual records of training provided to each fire brigade member, including drill critiques, for at least 3 years to ensure that each member receives training in all parts of the training program. These training records should be available for NRC inspection.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
1.7	**Quality Assurance** The overall plant QA plan should include the QA program for fire protection. The licensee should maintain a QA program that provides assurance that the fire protection systems are designed, fabricated, erected, tested, maintained, and operated so that they will function as intended. Fire protection systems are not “safety-related” and, therefore, are not within the scope of Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” to 10 CFR Part 50, unless the licensee has committed to include these systems under the plant's Appendix B program. The NRC staff generally used guidance for an acceptable QA program for fire protection systems, previously given in Section C.4 of BTP CMEB 9.5-1, Revision 2, in the review and acceptance of approved FPPs for plants licensed after January 1, 1979. This regulatory guide incorporates that guidance, and the NRC staff will continue to use it in the review and acceptance of approved FPPs for new reactors. For plants licensed before January 1, 1979, APCSB 9.5-1, its Appendix A, and GL 77-02 contain similar guidance. The plant's QA organization should manage the fire protection QA program. This control consists of (1) formulating the fire protection QA program and verifying that it incorporates suitable requirements and is acceptable to the management responsible for fire protection, and (2) verifying the effectiveness of the QA program for fire protection through review, surveillance, and audits. Personnel outside the QA organization may perform other QA program functions to meet the FPP requirements. To implement the fire protection QA program in this regulatory position, licensees have the option of either (1) including the fire protection QA program as part of the plant's overall QA program under Appendix B to 10 CFR Part 50, or (2) providing, for NRC inspection, a description of the fire protection QA program and its implementation measure. The fire protection QA program should satisfy the specific criteria that apply to items within the scope of the FPP, such as fire protection systems and features, emergency lighting, communications equipment, self-contained breathing apparatuses, and the fire protection requirements of applicable equipment important to safety.	Conform	COL Applicant See Section 17.5, Quality Assurance Program Description
1.7.1	**Design and Procurement Document Control** The licensee should establish measures to include the guidance presented in this regulatory guide in its design and procurement documents. The licensee should also control deviations from this guidance to ensure that the following occurs:	Conform	COL Applicant
1.7.2	**Instructions, Procedures, and Drawings** Documented instructions, procedures, or drawings should prescribe inspections, tests, administrative controls, fire drills, and training that govern the fire protection program.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
1.7.3	**Control of Purchased Material, Equipment, and Services** The licensee should establish the following measures to ensure that purchased material, equipment, and services conform to the procurement documents: a. provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor, inspections at suppliers, or receipt inspections, and b. source or receipt inspection, at a minimum, for those items that, once installed, cannot have their quality verified.	Conform	COL Applicant
1.7.4	**Inspection** The licensee should establish and execute a program for independent inspection of activities affecting fire protection that allows the organization performing the activity to verify conformance to documented installation drawings and test procedures.	Conform	COL Applicant
1.7.5	**Test and Test Control** The licensee should establish and implement a test program to ensure that testing is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. The tests should be performed in accordance with written test procedures; test results should be properly evaluated and corrective actions taken as necessary. The test program should include the following:	Conform	COL Applicant
1.7.6	**Inspection, Test, and Operating Status** The licensee should establish measures to document or identify items that have satisfactorily passed required tests and inspections. These measures should include identification by means of tags, labels, or similar temporary markings to indicate operating status and completion of required inspections and tests.	Conform	COL Applicant
1.7.7	**Nonconforming Items** The licensee should establish measures to control items that do not conform to specified requirements to prevent inadvertent use or installation.	Conform	COL Applicant
1.7.8	**Corrective Action** The licensee should establish measures to ensure that conditions adverse to fire protection, such as failures, malfunctions, deficiencies, deviations, defective components, uncontrolled combustible materials, and nonconformances, are promptly identified, reported, and corrected. These measures should ensure the following:	Conform	COL Applicant
1.7.9	**Records** The licensee should prepare and maintain records to furnish evidence that the plant meets the criteria enumerated above for activities affecting the FPP, so that the following is true:	Conform	COL Applicant
1.7.10	**Audits** The licensee should conduct and document audits to verify compliance with the fire protection program.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
1.7.10.1	**Annual Fire Protection Audit** For those licensees who have relocated audit requirements from their technical specifications to the QA program, the annual fire protection audit frequency may be changed if a performance-based schedule is used. American National Standards Institute/American Nuclear Society (ANSI/ANS) 3.2-2006, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants"	Conform	COL Applicant
1.7.10.2	**24-Month Fire Protection Audit** The 24-month audit of the FPP and implementing procedures should ensure that the requirements for design, procurement, fabrication, installation, testing, maintenance, and administrative controls for the respective programs are included in the plant QA program for fire protection and meet the criteria of the QA/QC program established by the licensee, consistent with this guide. Personnel from the licensee's QA organization, who do not have direct responsibility for the program being evaluated, should perform these audits. These audits would normally include an evaluation of existing programmatic documents to verify continued adherence to NRC requirements.	Conform	COL Applicant
1.7.10.3	**Triennial Fire Protection Audit** The triennial audit is basically the same as the annual audit; the difference lies in the source of the auditors. Qualified utility personnel who are not directly responsible for the site FPP, or an outside independent fire protection consultant, may perform the annual audit. However, only an outside independent fire protection consultant should perform the triennial audit. The outside consultant may be an employee of another licensee but should not be an employee of the licensee of the plant being audited. These audits would normally include evaluating existing documents (other than those addressed under the 24-month audit) and inspecting fire protection system operability or functionality, inspecting the integrity of fire barriers, and witnessing the performance of procedures to verify that the licensee has fully implemented the FPP and that the plan is adequate for the objects protected. Duplicate audits are not required (i.e., the 3-year audit replaces the annual audit for the year in which it is performed).	Conform	COL Applicant
1.8	**Fire Protection Program Changes/Code Deviations** This section provides guidance concerning the regulatory mechanisms for addressing changes, deviations, exemptions, and other issues affecting compliance with fire protection requirements. Risk- informed, performance-based methodologies may be used to evaluate the acceptability of FPP changes; however, for this approach, the licensee should use methodologies and acceptance criteria that the NRC has reviewed and approved. Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis", includes guidance for risk-informed changes to a plant's CLB. This section provides guidance with respect to fire modeling, and Appendix B to this guide provides guidance on probabilistic risk assessment.	Information Statement	No specific action required.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
1.8.1	**Change Evaluations** If an existing plant has adopted the standard license condition for fire protection and incorporated the fire protection program in the FSAR, the licensee may make changes to the approved FPP without the Commission's prior approval only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. The FSAR should include or reference the evaluation that documents the change. In addition to planned changes, nonconforming conditions may also require an evaluation. The standard fire protection license condition recommended by GL 86-10 (Ref. 15) is not applicable to the FPP for new reactors that are licensed under 10 CFR Part 52. In the absence of a license condition within the combined operating license (COL), changes to new reactor FPPs that do not require exemption requests should be evaluated and processed in accordance with 10 CFR 50.59, to the extent that the FPP information is contained in (or incorporated by reference into) the COL FSAR. The appendices to 10 CFR Part 52 include additional requirements for processing changes and exemptions for new reactors that are based on a certified design.	Conform	COL Applicant change control procedures for the fire protection program.
1.8.2	**Exemptions to Appendix R to 10 CFR Part 50** For plants licensed before January 1, 1979, the NRC requires requests for exemption from the requirements of Appendix R for modifications or conditions that do not comply with the applicable sections of Appendix R. The exclusion of the applicability of sections of Appendix R other than Sections III.G, III.J, and III.O (and Section III.L, as applicable) is limited to those features accepted by the NRC staff as satisfying the provisions of Appendix A to BTP APCSB 9.5-1 reflected in staff fire protection SERs issued before the effective date of the rule. For these previously approved features, the NRC does not require an exemption request, except for proposed modifications that would alter previously approved features used to satisfy NRC requirements.	N/A	Applies to plants licensed before January 1, 1979
1.8.3	**Appendix R Equivalency Evaluations** The NRC's interpretations of certain Appendix R requirements allow a licensee to choose not to seek prior NRC review and approval of, for example, a fire-area boundary, in which case a fire protection engineer (assisted by others, as needed) should perform an evaluation. The licensee should ensure that such evaluations are written and organized to facilitate review by a person not involved in the evaluation. The evaluation should include all supporting calculations and clearly state all assumptions at the outset. The licensee should retain these evaluations for subsequent NRC inspections. Appendix A to this guide provides examples of previously accepted equivalency evaluations.	N/A	Appendix R does not apply.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
1.8.4	**License Amendments** Plants licensed after January 1, 1979, that have committed to meet the requirements of Sections III.G, III.J, and III.O of Appendix R to 10 CFR Part 50 or other NRC guidance (e.g., BTP CMEB 9.5-1), and are required to do so as a license condition, do not need to request exemptions for alternative configurations. However, the FSAR or fire hazards analysis should identify and justify deviations (i.e., departures from the approved FPP) from the requirements of Sections III.G, III.J, and III.O, or other applicable requirements or guidance, and these deviations may require a license amendment to change the license condition. Licensees should include a technical justification for the proposed alternative approach in any license amendment it submits to the NRC for review and approval. The technical justification should address the criteria described in Regulatory Position 1.8.1 for change evaluations and Regulatory Position 1.8.2 for exemptions.	N/A	Not applicable to new plant FPPs.
1.8.5	**10 CFR 50.72 Notification and 10 CFR 50.73 Reporting** The requirements of 10 CFR 50.72 and 10 CFR 50.73 apply to reporting certain events and conditions related to fire protection at nuclear power plants. Licensees should report to the NRC fire events or fire protection deficiencies that meet the criteria of 10 CFR 50.72 and 10 CFR 50.73, as appropriate, and in accordance with the requirements of these regulations. NUREG-1022, “Event Reporting Guidelines: 10 CFR 50.72 and 10 CFR 50.73,” issued October 2000, provides guidance for meeting the requirements of these two sections. The NRC staff prepared NUREG-1022 to clarify the implementation of 10 CFR 50.72 and 10 CFR 50.73 rules and consolidate important NRC reporting guidelines into one reference document. The document is structured to assist licensees in promptly and completely reporting specified events and conditions.	Conform	COL Applicant reporting requirements.
1.8.6	**NFPA Code and Standard Deviation Evaluations** For those fire protection SSCs installed to satisfy the NRC requirements and designed to NFPA codes and standards, the code of record is the code edition in force at the time of the design or at the time the commitment is made to the NRC for a fire protection feature. The FSAR or the fire hazards analysis should identify and justify deviations from the codes. Deviations should not degrade the performance of fire protection systems or features. The standards of record related to the design and installation of fire protection systems and features required to satisfy NRC requirements in all new reactor designs are those NFPA codes and standards in effect 180 days before the submittal of the application under 10 CFR Part 50 or 10 CFR Part 52.	Conform	COL Applicant will address for site specific design at the time of the combined license application.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
1.8.7	**Fire Modeling** Where the evaluation of an FPP change is based on fire modeling, licensees should document the fact that its fire models and methods meet the NRC requirements. The licensee should also document that the models and methods in the analyses were used within their limitations and with the rigor required by the nature and scope of the analyses. These analyses may use simple hand calculations or more complex computer models, depending on the specific conditions of the scenario being evaluated.	Conform	COL Applicant will address by their change process for the approved FPP.
2.	**Fire Prevention** Fire prevention is the first line of defense in depth for fire protection. The fire prevention attributes of the program are directly related to the fire protection objective to minimize the potential for fire to occur. These attributes involve design and administrative measures that provide a reasonable level of assurance that the plant is adequately protected against fire hazards, which are managed, and that fire consequences will be limited for those fires that do occur.	Information Statement	No specific action required.
2.1	**Control of Combustibles** Administrative controls for fire prevention should include procedures to control handling and use of combustibles, prohibit storage of combustibles in plant areas important to safety, establish designated storage areas with appropriate fire protection, and control use of specific combustibles (e.g., wood) in plant areas important to safety.	Conform	COL Applicant
2.1.1	**Transient Fire Hazards** Bulk storage of combustible materials should be prohibited inside or adjacent to buildings or systems important to safety during all modes of plant operation. Procedures should limit and govern the handling of transient fire hazards, such as combustible and flammable liquids, wood and plastic products, high-efficiency particulate air (HEPA) and charcoal filters, dry ion exchange resins, or other combustible materials in buildings containing systems or equipment important to safety during all phases of operation, particularly during maintenance, modification, or refueling operations. Licensees should control and provide suitable protection against transient fire hazards that cannot be eliminated.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
2.1.2	**Modifications** Fire prevention elements of the FPP should be maintained when plant modifications are made. The modification procedures should contain provisions that evaluate the impacts of modifications on the fire prevention design features and programs. The licensee should follow the guidelines of Regulatory Position 4.1.1 in the design of plant modifications. Personnel in the fire protection organization should review modifications of SSCs to ensure that fixed fire loadings are not increased beyond those accounted for in the fire hazards analysis, or if increased, suitable protection is provided and the fire hazards analysis is revised accordingly.	Conform	COL Applicant
2.1.3	**Flammable and Combustible Liquids and Gases** Flammable and combustible liquids and gases are potentially significant fire hazards and procedures should clearly define their use, handling, and storage, which should, at a minimum, comply with the provisions of NFPA 30, “Flammable and Combustible Liquids Code”. Miscellaneous storage and piping for flammable or combustible liquids or gases should not create a potential fire exposure hazard to systems important to safety.	Conform	COL Applicant
2.1.4	**External and Exposure Fire Hazards** When an SSC important to safety is near installations such as flammable liquid or gas storage, the licensee should evaluate the risk of exposure fires (originating in such installations) to the SSCs and take appropriate protective measures. NFPA 80A, “Recommended Practice for Protection of Buildings from Exterior Fire Exposures”, provides guidance on such exposure protection. NFPA 30 provides guidance on minimum separation distances from flammable and combustible liquid storage tanks. NFPA 55, “Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks”, gives separation distances for gaseous and liquefied hydrogen. (See Regulatory Position 7.5 of this guide.) NFPA 58, “Liquefied Petroleum Gas Code”, contains guidance for liquefied petroleum gas.	Conform	COL Applicant
2.2	**Control of Ignition Sources** Electrical equipment (permanent and temporary), hot-work activities (e.g., open flame, welding, cutting, and grinding), high-temperature equipment and surfaces, heating equipment (permanent and temporary installation), reactive chemicals, static electricity, and smoking are all potential ignition sources. Design, installation, modification, maintenance, and operational procedures and practices should control potential ignition sources.	Conform	COL Applicant
2.2.1	**Open Flame, Welding, Cutting, and Grinding (Hot Work)** Work involving ignition sources such as welding and flame cutting should be carried out under closely controlled conditions. Persons performing such work should be trained and equipped to prevent and combat fires. In addition, a person qualified in performing hot-work fire watch duties should directly monitor the work and function as a fire watch.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
2.2.2	**Temporary Electrical Installations** The use of temporary services at power reactor facilities is routine, especially to support maintenance and other activities during outages. In view of the magnitude and complexity of some temporary services, proper engineering and, once installed, maintenance of the design basis become significant. The temporary cables should be considered as transient combustibles and may represent ignition sources. Plant administrative controls should provide for an engineering review of temporary installations. These reviews should ensure that appropriate precautions, limitations, and maintenance practices are established for the term of such installations. The Institute of Electrical and Electronics Engineers (IEEE) Standard 835, “Standard Power Cable Ampacity Tables”, and ANSI/IEEE C.2, “National Electrical Safety Code”®, contain guidance on temporary electrical installations, including derating closely spaced cables.	Conform	COL Applicant
2.2.3	**Other Sources** Leak testing and similar procedures, such as airflow determination, should not use open flames or combustion-generated smoke. Procedures and practices should provide for control of temporary heating devices. Use of space heaters and maintenance equipment (e.g., tar kettles for roofing operations) in plant areas should be strictly controlled and reviewed by the plant's fire protection staff. Engineering procedures and practices should ensure that temporary heating devices are properly installed according to the listing, including required separations from combustible materials and surfaces. Temporary heating devices should be placed so as to avoid overturning and are installed in accordance with their listing, including clearance to combustible material, equipment, or construction. Asphalt and tar kettles should be located in a safe place or on a fire-resistive roof, at a point where they avoid ignition of combustible material below. Continuous supervision should be maintained while kettles are in operation, and metal kettle covers and fire extinguishers should be provided.	Conform	COL Applicant.
2.3	**Housekeeping** The licensee should establish administrative controls to minimize fire hazards in areas containing SSCs important to safety. These controls should govern removal of waste, debris, scrap, oil spills, and other combustibles after completion of a work activity or at the end of the shift. Administrative controls should also include procedures for performing and maintaining periodic housekeeping inspections to ensure continued compliance with fire protection controls. Housekeeping practices should ensure that drainage systems, especially drain hub grills, in areas containing fixed water-based suppression systems, remain free of debris to minimize flooding if the systems discharge. Regulatory Guide 1.39, “Housekeeping Requirements for Water-Cooled Nuclear Power Plants”, provides guidance on housekeeping, including the disposal of combustible materials.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
2.4	**Fire Protection System Maintenance and Impairments** The licensee should establish fire protection administrative controls to address Fire Protection System Maintenance and Impairments.	Conform	COL Applicant
3.	**Fire Detection and Suppression**		
3.1	**Fire Detection** In general, the fire hazards analysis and regulatory requirements determine the scope of fire detection and suppression in the plant, whereas the applicable industry codes and standards (generally NFPA codes, standards, and recommended practices) determine the design, installation, and testing requirements of the systems and components. The design of fire detection systems should minimize the adverse effects of fires on SSCs important to safety. Automatic fire detection systems should be installed in all areas of the plant that contain or present an exposure fire hazard to SSCs important to safety. These fire detection systems should be capable of operating with or without offsite power. With regard to protection of safe-shutdown systems, Regulatory Positions 5.3.1.1.b and 5.3.1.1.c of this guide state, “In addition, fire detectors and an automatic fire suppression system should be installed in the fire area.” Where automatic fire detection is installed, it should provide complete protection throughout the fire area. For those areas where only partial coverage is installed, the fire hazards analysis should demonstrate the adequacy of the design to provide the necessary protection. The fire detection and alarm system should be designed with the following objectives: a) Detection systems are to be provided for all areas that contain or present a fire exposure to equipment important to safety. b) Fire detection and alarm systems should comply with the requirements of Class A systems, as defined in NFPA 72, "National Fire Alarm Code" , and Class I circuits, as defined in NFPA 70. c) Fire detectors are selected and installed in accordance with NFPA 72. Preoperational and periodic testing of a pulsed-line type of heat detector demonstrates that the frequencies used will not affect the actuation of protective relays in other plant systems. d) Fire detection and alarm systems give audible and visible alarms and annunciation in the control room. Where zoned detection systems are used in a given fire area, local means identify which detector zone has actuated. e) Fire alarms are distinctive and unique to avoid confusion with any other plant system alarms.	Conform	The fire hazards analysis of Appendix 9A establishes the basis for not providing fire detection in the containment as recommended by 3.1.i.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
	f) Primary and secondary power supplies are provided for the fire detection system and for electrically operated control valves for automatic suppression systems. Such primary and secondary power supplies should satisfy the provisions of NFPA 72. This can be accomplished by using normal offsite power as the primary supply, with a 4-hour battery supply as a secondary supply, and by providing the capability for manual connection to the Class 1E emergency power bus within 4 hours of loss of offsite power. Such connection should follow the applicable guidance in Regulatory Guide 1.6, "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems"; Regulatory Guide 1.32, "Criteria for Power Systems for Nuclear Power Plants"; and Regulatory Guide 1.75, "Physical Independence of Electric Systems". g) In areas of high seismic activity, licensees should consider the need to design the fire detection and alarm systems to function following a safe-shutdown earthquake. h) The fire detection and alarm systems should retain their original design capability for (1) natural phenomena of less severity and greater frequency than the most severe natural phenomena (approximately once in 10 years), such as tornadoes, hurricanes, floods, ice storms, or small-intensity earthquakes that are characteristic of the geographic region, and (2) potential manmade site-related events, such as oil barge collisions or aircraft crashes, that have a reasonable probability of occurring at a specific plant site. i) Noninerted containments should have fire detection systems, in accordance with the guidance in Regulatory Position 6.1.1.3 of this guide. j) Control rooms should have fire detection systems and alarms, in accordance with the guidance in Regulatory Position 6.1.2 of this guide. k) The following areas that contain equipment important to safety should have automatic fire detectors that alarm and annunciate in the control room-plant computer rooms, switchgear rooms, alternative or dedicated shutdown panels, battery rooms, diesel generator areas, pump rooms, new and spent fuel areas, and radwaste and decontamination areas. (See also Regulatory Positions 6.1 and 6.2 of this guide).		

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
3.2	**Fire Protection Water Supply Systems**	Title	
3.2.1	**Fire Protection Water Supply** NFPA 22, “Standard for Water Tanks for Private Fire Protection,” and NFPA 24, “Standard for the Installation of Private Fire Service Mains and Their Appurtenances,” provide guidance on fire protection water supplies. The fire protection water supply system should meet the following criteria:	Conform	
3.2.1, a	Two separate, reliable freshwater supplies should be available. Saltwater or brackish water should not be used unless all freshwater supplies have been exhausted.	Conform	
3.2.1, b	The fire-water supply should be calculated on the basis of the largest expected flow rate for a period of 2 hours, but not less than 1,136,000 liters (L) (300,000 gallons (gal)). This flow rate should be based (conservatively) on 1,900 liters per minute (L/min) (500 gal/min) for manual hose streams, plus the largest design demand of any sprinkler or deluge system, as determined in accordance with NFPA 13, “Standard for the Installation of Sprinkler Systems,” or NFPA 15, “Standard for Water Spray Fixed Systems for Fire Protection.”	Conform	
3.2.1, c	If tanks are used for water supply, two 100-percent system capacity tanks (minimum of 1,136,000 L (300,000 gal) each) should be installed. They should be interconnected to allow pumps to take suction from either or both. However, a failure in one tank or its piping should not cause both tanks to drain. Water supply capacity should be capable of refilling either tank in 8 hours or less.	Conform	
3.2.1, d	Common water supply tanks are acceptable for fire and sanitary or service water storage. When they are used, however, minimum fire-water storage requirements should be dedicated by passive means; for example, use of a vertical standpipe for other water services. Administrative controls, including locks for tank outlet valves, are unacceptable as the only means to ensure minimum water volume.	N/A	The NuScale plant’s FPS uses two 100-percent system capacity tanks that are independent of other water systems.
3.2.1, e	Freshwater lakes or ponds of sufficient size may qualify as the sole source of water for fire protection but require separate redundant suctions in one or more intake structures. These supplies should be separated, so that a failure of one supply will not result in a failure of the other supply.	N/A	The NuScale plant’s FPS uses two 100-percent system capacity tanks.
3.2.1, f	When a common water supply is permitted for fire protection and the ultimate heat sink, the following conditions should also be satisfied:	N/A	The NuScale plant’s FPS is not connected to the ultimate heat sink, therefore 3.2.1, f, i and ii do not apply.
3.2.1, f, i	The additional fire protection water requirements are designed into the total storage capacity.	N/A	No connection to the UHS exists.
3.2.1, f, ii	Failure of the fire protection system should not degrade the function of the ultimate heat sink.	N/A	No connection to the UHS exists.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
3.2.1, g(3)	Other water systems that may be used as one of the two fire-water supplies should be permanently connected to the fire main system and should be capable of automatic alignment to the fire main system. Pumps, controls, and power supplies in these systems should satisfy the requirements for the main fire pumps. The use of other water systems for fire protection should be compatible with their safe-shutdown functions. Failure of the other system should not degrade the fire main system.	N/A	The NuScale plant's FPS uses two 100-percent system capacity tanks that are aligned to the fire main system. No other water systems are design to be used as fire water supplies.
3.2.1, h(3)	For multiunit nuclear power plant sites with a common yard fire main loop, common water supplies may be used.	N/A	The NuScale FPS is designed for a standalone plant that uses two 100-percent capacity tanks. If the NuScale plant was located on a site with a fire main loop that was common to other nuclear power plants, the NuScale power plant FP design does not prohibit connection to a common loop.
3.2.1, i(3)	Fire-water supplies should be filtered and treated as necessary to prevent or control biofouling or microbiologically induced corrosion of fire-water systems. If the supply is raw service water, fire-water piping runs should be periodically flushed and flow-tested.	Conform	
3.2.1, j(3)	Provisions should be made to supply water to at least two standpipes and hose connections for manual firefighting in areas containing equipment required for safe plant shutdown in the event of a safe-shutdown earthquake. The piping system serving such hose stations should be analyzed for safe-shutdown earthquake loading and should be provided with supports to ensure system pressure integrity. The piping and valves for the portion of the hose standpipe system affected by this functional requirement should, at a minimum, satisfy ASME B31.1, “Power Piping”. The water supply for this condition may be obtained by manual operator actuation of valves in a connection to the hose standpipe header from a normal seismic Category I water system, such as the essential service water system. The cross-connection should be (1) capable of providing flow to at least two hose stations (approximately 284 L/min (75 gal/min) per hose station), and (2) designed to the same standards as the seismic Category I water system (i.e., it should not degrade the performance of the seismic Category I water system).	Alternate Conformance	The fire water storage tanks are designed in accordance with AWWA D100-205, as referenced by NFPA-22. The fire water yard piping is designed in accordance with ASME B31.1.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
3.2.2	**Fire Pumps** Fire pump installations should conform to NFPA 20, "Standard for the Installation of Stationary Pumps for Fire Protection," and should meet the following criteria:	Conform	
3.2.2, a	If fire pumps are required to meet system pressure or flow requirements, a sufficient number of pumps is provided to ensure that 100-percent capacity will be available, assuming failure of the largest pump or loss of offsite power (e.g., three 50-percent pumps or two 100-percent pumps). This can be accomplished, for example, by providing either electric-motor-driven fire pumps and diesel-driven fire pumps or two or more seismic Category I Class 1E electric-motor-driven fire pumps connected to redundant Class 1E emergency power buses.	Conform	
3.2.2, b	Individual fire pump connections to the yard fire main loop are separated with sectionalizing valves between connections. Each pump and its driver and controls are located in a room separated from the remaining fire pumps by a fire wall with a minimum rating of 3 hours.	Conform	
3.2.2, c	The fuel for the diesel fire pumps is separated so that it does not provide a fire source that exposes equipment important to safety.	Conform	
3.2.2, d	The control room contains alarms or annunciators to indicate pump running, driver availability, failure to start, and low fire main pressure.	Conform	
3.2.3	**Fire Mains** An underground yard fire main loop should be installed to furnish anticipated water requirements. NFPA 24 provides appropriate guidance for such an installation. NFPA 24 references other design codes and standards developed by such organizations as ANSI and the American Water Works Association.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
3.2.3, a	The type of pipe and water treatment are design considerations, with tuberculation as one of the parameters. i. The means for inspecting and flushing the fire main are provided. ii. Sectional control valves should be visually indicating (e.g., post indicator valves). iii. Control and sectionalizing valves in fire mains and water-based fire suppression systems are electrically supervised or administratively controlled (e.g., locked valves with key control, tamper-proof seals). The electrical supervision signal indicates in the control room. All valves in the fire protection system are periodically checked to verify position. iv. The fire main system piping is separate from service or sanitary water system piping, except as described in Regulatory Position 3.2.1 of this guide, with regard to providing a seismically designed water supply for standpipes and hose connections. v. A common yard fire main loop may serve multiunit nuclear power plant sites if cross-connected between units. Sectional control valves permit independence of the individual loop around each unit. For multiple-reactor sites with widely separated plants (approaching 1.6 kilometer (km) (1 mile (mi)) or more), separate yard fire main loops are used. vi. Sectional control valves are provided to isolate portions of the fire main for maintenance or repair without shutting off the supply to primary and backup fire suppression systems serving areas that contain or expose equipment important to safety. vii. Valves are installed to permit isolation of outside hydrants from the fire main for maintenance or repair without interrupting the water supply to automatic or manual fire suppression systems in any area containing or presenting a fire hazard to equipment important to safety. viii. Sprinkler systems and manual hose station standpipes have connections to the yard main system, so that a single active failure or a line break cannot impair both the primary and backup fire suppression systems. Alternatively, headers fed from each end are permitted inside buildings to supply both sprinkler and standpipe systems, provided that steel piping and fittings meeting the requirements of ASME B31.1 are used for the headers, up to and including the first valve supplying the sprinkler systems, when such headers are part of the seismically analyzed hose standpipe system. When provided, such headers are considered an extension of the yard main system. Each sprinkler and standpipe system should be equipped with an outside screw and yoke gate valve or other approved shutoff valve and water flow alarm.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
3.3	**Automatic Suppression Systems** Automatic suppression systems should be installed as determined by the fire hazards analysis and as necessary to protect redundant systems or components necessary for safe shutdown and SSCs important to safety. In areas of high seismic activity, licensees should consider the need to design the fire suppression systems to be functional following a safe-shutdown earthquake. The fire suppression systems should retain their original design capability for (1) natural phenomena of less severity and greater frequency than the most severe natural phenomena (approximately once in 10 years), such as tornadoes, hurricanes, floods, ice storms, or small-intensity earthquakes that are characteristic of the geographic region, and (2) potential manmade site-related events, such as oil barge collisions or aircraft crashes, that have a reasonable probability of occurring at a specific plant site. For water suppression systems and fire detection systems that use metal plates for heat collection above individual sprinkler heads or detectors that are located well below the ceiling of a fire area (e.g., at some intermediate height in the room, below a ceiling-mounted pipe and cable tray), licensees should demonstrate that this design will ensure acceptable actuation times. In general, the use of such plates has not been shown to provide adequate heat collection to effectively activate the sprinkler head or detector and may impair system response.	Conform	
3.3.1	**Water-Based Systems** Equipment important to safety that does not itself require protection by water-based suppression systems, but is subject to unacceptable damage if wetted by suppression system discharge, should be appropriately protected (e.g., water shields or baffles). Drains should be provided as required to protect equipment important to safety from flooding damage.	Conform	
3.3.1.1	**Sprinkler and Spray Systems** Water sprinkler and spray suppression systems are the most widely used means of implementing automatic water-based fire suppression. Sprinkler and spray systems should, at a minimum, conform to requirements of appropriate standards such as NFPA 13 (and NFPA 15.	Conform	
3.3.1.2	**Water Mist Systems** Water mist suppression systems may be useful in specialized situations, particularly in those areas where the application of water needs to be restricted. Water mist systems should conform to appropriate standards, such as NFPA 750, “Standard on Water Mist Fire Protection Systems”.	Conform	
3.3.1.3	**Foam-Water Sprinkler and Spray Systems** Certain fires, such as those involving flammable liquids, respond well to foam suppression. Licensees should consider the use of foam sprinkler and spray systems, which should conform to appropriate standards, such as NFPA 16, “Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems”, and NFPA 11, “Standard for Low-, Medium-, and High- Expansion Foam”.	Conform (when utilized)	COL Applicant (where specified by as-built FHA)

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
3.3.2	**Gaseous Fire Suppression** Gaseous systems should be evaluated for potential impacts on the habitability of areas containing equipment important to safety where operations personnel perform safe-shutdown actions or where firefighting activities may become necessary. Where gas suppression systems are installed, openings in the area should be adequately sealed or the suppression system should be sized to compensate for the loss of the suppression agent through floor drains and other openings. (See also Regulatory Position 4.1.5 of this guide.)	Conform (when utilized)	COL Applicant (where specified by as-built FHA)
3.3.2.1	**Carbon Dioxide Systems** Carbon dioxide (CO2) extinguishing systems should comply with the requirements in NFPA 12. Where automatic CO2 systems are used, they should be equipped with a predischarge alarm system and a discharge delay to permit personnel egress. Provisions for locally disarming automatic CO2 systems should be key locked and under strict administrative control.	Conform (when utilized)	COL Applicant (where specified by as-built FHA)
3.3.2.2	**Halon** Halon fire extinguishing systems should comply with the requirements of NFPA 12A. Where automatic Halon systems are used, they should be equipped with a predischarge alarm and a discharge delay to permit personnel to exit. Provisions for locally disarming automatic Halon systems should be key locked and under strict administrative control.	Conform (when utilized)	COL Applicant (where specified by as-built FHA)
3.3.2.3	**Clean Agents** Halon alternative (or "clean agent") fire extinguishing systems should comply with applicable standards, such as NFPA 2001. Only listed or approved agents should be used. Provisions for locally disarming automatic systems should be key locked and under strict administrative control.	Conform (when utilized)	COL Applicant (where specified by as-built FHA)
3.4	**Manual Suppression Systems and Equipment** The licensee should provide a manual firefighting capability throughout the plant to limit the extent of fire damage. Standpipes, hydrants, and portable equipment consisting of hoses, nozzles, and extinguishers should be provided for use by properly trained firefighting personnel.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
3.4.1	**Standpipes and Hose Stations** Interior manual hose installations should be able to reach, with at least one effective hose stream, any location that contains, or could present, a fire exposure hazard to equipment important to safety. To accomplish this, all buildings on all floors should have standpipes with hose connections equipped with a maximum of 30.5 m (100 ft.) of 38-mm (1.5-in.) woven-jacket, lined fire hose and suitable nozzles. These systems should conform to NFPA 14, “Standard for the Installation of Standpipe and Hose Systems” , for sizing, spacing, and pipe support requirements for Class III standpipes. Water supply calculations should demonstrate that the water supply system can meet the standpipe pressure and flow requirements of NFPA 14. Hose stations should be located as dictated by the fire hazards analysis to facilitate access and use for firefighting operations. Alternative hose stations should be provided for an area if the fire hazard could block access to a single hose station serving that area. The proper type of hose nozzle to be supplied to each area should be based on the fire hazards analysis. The usual combination spray/straight-stream nozzle should not be used in areas where the straight stream can cause unacceptable mechanical damage. Fixed fog nozzles should be provided at locations where high-voltage shock hazards exist. All hose nozzles should have shutoff capability. Volume II, Section 10, Chapter 1, of the 19th Edition of the NFPA *Fire Protection Handbook*, issued in 2003, provides guidance on safe distances for water application to live electrical equipment. Fire hoses should meet the recommendations of NFPA 1961, “Standard on Fire Hose”, and should be hydrostatically tested in accordance with the recommendations of NFPA 1962, “Standard for the Inspection, Care, and Use of Fire Hose Couplings and Nozzles and the Service Testing of Fire Hose”.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
3.4.2	**Hydrants and Hose Houses** Outside manual hose installations should be sufficient to provide an effective hose stream to any onsite location where fixed or transient combustibles could jeopardize equipment important to safety. Hydrants should be installed approximately every 76 m (250 ft.) on the yard main system. A hose house equipped with hose and combination nozzle and other auxiliary equipment recommended in NFPA 24 should be provided as needed, but at least every 305 m (1,000 ft.). Alternatively, a mobile means of providing hose and associated equipment, such as hose carts or trucks, may be used. When provided, such mobile equipment should be equivalent to the equipment supplied by three hose houses. Mobile equipment should be maintained in good working order and should be readily available for firefighting activities. Threads compatible with those used by local fire departments should be provided on all hydrants, hose couplings, and standpipe risers. Alternatively, a sufficient number of hose thread adapters may be provided. Fire hoses should be hydrostatically tested in accordance with the recommendations of NFPA 1962. Fire hoses stored in outside hose houses should be tested annually.	Conform	
3.4.3	**Manual Foam** For flammable and combustible liquid fire hazards, licensees should consider the use of foam systems for manual fire suppression protection. These systems should comply with the requirements of NFPA 11.	Conform (when utilized)	COL Applicant (where specified by as-built FHA)
3.4.4	**Fire Extinguishers** Fire extinguishers should be provided in areas that contain or could present a fire exposure hazard to equipment important to safety. Extinguishers should be installed with due consideration given to possible adverse effects on equipment important to safety in the area. NFPA 10, “Standard for Portable Fire Extinguishers”, provides guidance on the installation (including location and spacing) and the use and application of fire extinguishers.	Conform	COL Applicant
3.4.5	**Fixed Manual Suppression** Some fixed fire suppression systems may be manually actuated (e.g., fixed suppression systems provided in accordance with Section III.G.3 of Appendix R to 10 CFR Part 50). Manual actuation is generally limited to water spray systems and should not be used for gaseous suppression systems, except when the system provides backup to an automatic water suppression system. Fixed manual suppression systems should be designed in accordance with applicable guidance in the appropriate NFPA standards. A change from an automatic system to a manually actuated system should be supported by an appropriate evaluation.	Conform	
3.5	**Manual Firefighting Capabilities**	Title	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
3.5.1	**Fire Brigade** A site fire brigade, trained and equipped for firefighting, should be established and should be on site at all times to ensure adequate manual firefighting capability for all areas of the plant containing SSCs important to safety. The fire brigade leader should have ready access to keys for any locked doors.	Conform	COL Applicant
3.5.1.1	**Fire Brigade Staffing** The fire brigade should include at least five members on each shift. The shift supervisor should not be a member of the fire brigade.	Conform	COL Applicant
3.5.1.2	**Equipment** The equipment provided for the brigade should consist of personal protective equipment, such as turnout coats, bunker pants, boots, gloves, hard hats, emergency communications equipment, portable lights, portable ventilation equipment, and portable extinguishers. Self-contained breathing apparatuses using full-face positive-pressure masks approved by the National Institute for Occupational Safety and Health (approval formerly given by the U.S. Bureau of Mines) should be provided for fire brigade, damage control, and control room personnel. At least 10 masks should be available for fire brigade personnel. Control room personnel may be furnished breathing air by a manifold system piped from a storage reservoir, if practical. Service or rated operating life should be at least 30 minutes for the self-contained units. NFPA 1404, "Standard for Fire Service Respiratory Protection Training", provides additional guidance. Fire brigade equipment should be stored in accordance with manufacturers' recommendations (e.g., firefighter clothing should not be stored where it will be subjected to ultraviolet light from the sun, welding, or fluorescent lights). At least a 1-hour supply of breathing air in extra bottles should be located on the plant site for each self-contained breathing apparatus. In addition, an onsite 6-hour supply of reserve air should be provided for the fire brigade personnel and arranged to permit quick and complete replenishment of exhausted air supply bottles as they are returned. If compressors serve as a source of breathing air, only units approved for breathing air should be used, and the compressors should be operable in the event of a loss of offsite power. Special care should be taken to locate the compressor in areas free of dust and contaminants.	Conform	COL Applicant
3.5.1.3	**Procedures and Prefire Plans** Procedures should be established to control actions by the fire brigade upon notification by the control room of a fire and to define firefighting strategies.	Conform	COL Applicant
3.5.1.4	**Performance Assessment and Drill Criteria** Fire brigade drills should be performed in the plant so that the fire brigade can practice as a team. Drills should be performed quarterly for each shift's fire brigade. Each fire brigade member should participate in at least two drills annually.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position [1]	Conformance [2]	Comment
3.5.2	**Offsite Manual Firefighting Resources** Onsite fire brigades typically fulfill the role of first responder but may not have sufficient personnel, equipment, and capability to handle all possible fire events. Arrangements with offsite fire services may be necessary to augment onsite firefighting capabilities, consistent with the fire hazards analysis and prefire planning documents. The FPP should describe the capabilities (e.g., equipment compatibility, training, drills, and command control) of offsite responders.	Conform	COL Applicant
3.5.2.1	**Capabilities** The local offsite fire departments that provide backup manual firefighting resources should have the following capabilities: 1) personnel and equipment with capacities consistent with those assumed in the plant's fire hazards analysis and prefire plans, and 2) hose threads or adapters to connect with onsite hydrants, hose couplings, and standpipe risers. (Regulatory Position 3.4.2 states that onsite fire suppression water systems should have threads compatible with those used by local fire departments or a sufficient number of thread adapters available.	Conform	COL Applicant
3.5.2.2	**Training** Local offsite fire department personnel who provide backup manual firefighting resources should be trained in the following:	Conform	COL Applicant
3.5.2.3	**Agreements and Plant Exercises** The licensee should establish written mutual aid agreements between the utility and the offsite fire departments that are listed in the fire hazards analysis and prefire plans as providing a support response to a plant fire. These agreements should delineate fire protection authorities, responsibilities, and accountabilities with regard to responding to plant fire or emergency events, including the fire event command structure between the plant fire brigade and offsite responders.	Conform	COL Applicant
4.	**Building Design and Passive Features**		
4.1	**General Building and Building System Design** This section provides guidance on building layout (e.g., fire areas and zones), materials of construction, and building system design (e.g., electrical, heating, ventilating, and air conditioning (HVAC), lighting, and communication systems) important to effective fire prevention and protection. Regulatory Position 4.2 provides guidance for passive fire barriers.	Information Statement	No specific action required.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.1	**Combustibility of Building Components and Features** According to GDC 3 in Appendix A to 10 CFR Part 50, noncombustible and heat-resistant materials must be used wherever practical throughout the unit. Interior wall and structural components, thermal insulation materials, radiation shielding materials, and soundproofing should be noncombustible. The fire hazards analysis should identify in situ combustible materials used in plant SSCs and specify suitable fire protection. Metal deck roof construction should be noncombustible and listed as “acceptable for fire” in the Underwriters Laboratories, Inc. (UL) “Building Materials Directory”, or listed as Class I in the “Factory Mutual Research Approval Guide—Equipment, Materials, and Services for Conservation of Property,” issued September 2000	Conform	
4.1.1.1	**Interior Finish** Interior finishes should be noncombustible. The following materials are acceptable for use as interior finish without evidence of test and listing by a recognized testing laboratory: 1) plaster, acoustic plaster, and gypsum plasterboard (gypsum wallboard), either plain, wallpapered, or painted with oil- or water-base paint, 2) ceramic tile and ceramic panels, 3) glass and glass blocks, 4) brick, stone, and concrete blocks, plain or painted, 5) steel and aluminum panels, plain, painted, or enameled, and 6) vinyl tile, vinyl-asbestos tile, linoleum, or asphalt tile on concrete floors. Suspended ceilings and their supports should be of noncombustible construction. Concealed spaces should be devoid of combustibles except as noted in Regulatory Position 6.1.2 of this guide. In situ fire hazards should be identified and suitable protection provided.	Conform	
4.1.1.2	**Testing and Qualification** Interior finishes should be noncombustible (see the “Glossary” of this guide) or listed by an approving laboratory.	Conform	
4.1.2	**Compartmentalization, Fire Areas, and Zones** In accordance with GDC 3, SSCs important to safety must be designed and located to minimize the probability and effect of fires and explosions. The concept of compartmentalization meets GDC 3, in part, by using passive fire barriers to subdivide the plant into separate areas or zones. The primary purpose of these fire areas or zones is to confine the effects of fires to a single compartment or area, thereby minimizing the potential for adverse effects from fires on redundant SSCs important to safety.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.2.1	**Fire Areas** A fire area is defined as that portion of a building or plant that is separated from other areas by fire barriers, including components of construction such as beams, joists, columns, penetration seals or closures, fire doors, and fire dampers. Fire barriers that define the boundaries of a fire area should have a fire-resistance rating of 3 hours or more and should achieve the following: 1) separation of SSCs important to safety from any potential fires in nonsafety-related areas that could affect their ability to perform their safety function, 2) separation of redundant trains of systems and components important to safety from each other so that both are not subject to damage from a single fire, and 3) separation of individual units on a multiunit site unless the requirements of GDC 5, "Sharing of Structures, Systems, and Components", are met with respect to fires. The fire hazards analysis should be used to establish fire areas. Particular design attention to the use of separate, isolated fire areas for redundant cables will help to avoid loss of redundant cables important to safety. Separate fire areas should also be employed to limit the spread of fires between components, including high concentrations of cables important to safety that are major fire hazards within a safety division. Where fire area boundaries are not 3-hour rated, or not wall-to-wall or floor-to-ceiling boundaries with all penetrations sealed to the fire rating of the boundaries, the licensee should evaluate the adequacy of the fire area boundaries (i.e., barriers) to determine whether the boundaries will withstand the hazards associated with the area and, as necessary, protect important equipment within the area from a fire outside the area. Unsealed openings should be identified and considered when evaluating the overall effectiveness of the barrier. (See Regulatory Position 4.2.1 of this guide for positions related to fire barrier testing and acceptance.) If a wall or floor/ceiling assembly contains major unprotected openings, such as hatchways and stairways, plant locations on either side of such a barrier should be considered part of a single fire area. If success path A is separated by a cumulative horizontal distance of 6.1 m (20 ft.) from success path B, with no intervening combustible materials or fire hazards, and both elevations are provided with fire detection and suppression, the area would be considered acceptable. Exterior walls, including penetrations, should be qualified as rated fire barriers if they are required to separate safe-shutdown equipment on the interior of the plant from the redundant equipment located in the immediate vicinity of the exterior wall, if they separate plant areas important to safety from nonsafety-related areas that present a significant fire exposure to the areas important to safety, or if otherwise designated by the FSAR or fire hazards analysis. An exterior yard area without fire barriers should be considered as one fire area. The area may consist of several fire zones. (See Regulatory Position 4.1.2.2 of this guide.)	Conform	See the FHA in Appendix 9A for special cases.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position [1]	Conformance [2]	Comment
4.1.2.2	**Fire Zones** Fire zones are subdivisions of a fire area and are typically based on fire hazards analyses that demonstrate that the fire protection systems and features within the fire zone provide an appropriate level of protection for the associated hazards. Fire zone concepts may be used to establish zones within fire areas where further subdivision into additional fire areas is not practical on the basis of existing plant design and layout (e.g., inside containment).	Conform	COL Applicant (if zones are specified by as-built FHA)
4.1.2.3	**Access and Egress Design** The plant layout should provide adequate means of access to all plant areas for manual fire suppression. The plant layout should also allow for safe access and egress to areas for personnel performing safe-shutdown operations. Considerations should include fire and postfire habitability in safe-shutdown areas, protection or separation from fire conditions of access and egress pathways to safe-shutdown SSCs, and potential restrictions or delays to safe-shutdown area access potentially caused by security locking systems. Stairwells outside primary containment serving as escape routes, access routes for firefighting, or access routes to areas containing equipment necessary for safe shutdown should be enclosed in masonry or concrete towers with a minimum fire rating of 2 hours and self-closing Class B fire doors. Fire exit routes should be clearly marked. Prompt emergency ingress into electrically locked areas by essential personnel should be ensured through the combined use and provision of the following features. a) reliable and uninterruptible auxiliary power to the entire electrical locking system, including its controls, b) electrical locking devices that are required to fail in the secure mode for security purposes, with secure mechanical means and associated procedures to override the devices upon loss of both primary and auxiliary power (e.g., key locks with keys held by appropriate personnel who know when and how to use them), and c) periodic tests of all locking systems and mechanical overrides to confirm their operability or functionality and their capability to switch to auxiliary power. Regulatory Positions 4.1.6 and 4.1.7 of this guide provide direction related to emergency lighting and communication capabilities during fires.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.3	**Electrical Cable System Fire Protection Design**		
4.1.3.1	**Cable Design** Electric cable construction should, as a minimum, pass the flame test in IEEE Standard 383, "IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations" , or IEEE Standard 1202, "IEEE Standard for Flame Testing of Cables for Use in Cable Trays in Industrial and Commercial Occupancies").6 (This does not imply that cables passing either test will not require additional fire protection.) For cable installations in operating plants and plants under construction before July 1, 1976, that do not meet the IEEE Standard 383 flame test requirements, all cables should be covered with an approved flame-retardant coating and properly derated or be protected by automatic suppression. Although cable coatings have been shown to reduce flame spread, coated cables are considered intervening combustibles when determining the protection requirements of Section III.G.2 of Appendix R to 10 CFR Part 50. Coated cables do not have higher damage thresholds and, therefore, are not equivalent to IEEE 383 or IEEE 1202 cables. In addition, coated cables can and do ignite in fires. Fire-retardant coatings alone may not be credited as equivalent to 1- or 3-hour fire barriers. New reactor fiber optic cable insulation and jacketing should, as a minimum, also meet the fire and flame test requirements of IEEE 1202.	Conform	
4.1.3.2	**Raceway/Cable Tray Construction** Only metal should be used for cable trays. Only metallic tubing should be used for conduit. Thin-wall metallic tubing should not be used. Flexible metallic tubing should be used only in short lengths to connect components to equipment. Other raceways should be made of noncombustible material. Cable raceways should be used only for cables.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.3.3	**Electrical Cable System Fire Detection and Suppression** Redundant cable systems important to safety outside the cable spreading room should be separated from each other and from potential fire exposure hazards in nonsafety-related areas by fire barriers with a minimum fire rating of 3 hours to the extent feasible. Those fire areas that contain cable trays important to safety should be provided with fire detection. Cable trays should be accessible for manual firefighting, and cables should be designed to allow wetting down with fire suppression water without electrical faulting. Manual hose stations and portable hand extinguishers should be provided. Manual hose standpipe systems may be relied on to provide the primary fire suppression (in lieu of automatic water suppression systems) for cable trays of a single division important to safety that are separated from redundant safety divisions by a fire barrier with a minimum rating of 3 hours and are normally accessible for manual firefighting if all of the following conditions are met: a. The number of equivalent standard 610-mm (24-in.)-wide cable trays (both important to safety and nonsafety related) in a given fire area is six or less. b. The cabling does not provide instrumentation, control, or power to systems required to achieve and maintain hot shutdown. c. Smoke detectors are provided in the area of these cable routings, and continuous line-type heat detectors are provided in the cable trays. In other areas where overriding design features necessary for nuclear safety prevent the separation of redundant cable systems important to safety by 3-hour-rated fire barriers, or if cable trays are not accessible for manual firefighting, an automatic fire suppression system should protect the cable trays.	Conform	
4.1.3.4	**Electrical Cable Separation** Redundant systems used to mitigate the consequences of design-basis accidents, but not necessary for safe shutdown, may be lost to a single exposure fire. However, protection should be provided so that a fire within only one such system will not damage the redundant system. Therefore, the separation guidelines of Regulatory Position 5.3.1.1 of this guide apply only to the electrical cabling needed to support the systems that are used for postfire safe shutdown. All other redundant Class 1E electrical cables should meet the separation guidelines of Regulatory Guide 1.75. When the electrical cabling is covered by separation criteria required for both postfire safe shutdown and accident mitigation, the more stringent criteria of Regulatory Position 5.3.1.1 apply. (Compliance with postfire safe-shutdown requirements may be achieved without separation of redundant Class 1E cabling by providing alternative or dedicated shutdown capability (see Regulatory Position 5.4); however, this does not preclude the separation criteria of Regulatory Guide 1.75 for redundant Class 1E cables used in accident mitigation.)	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.3.5	**Transformers** Transformers that present a fire hazard to equipment important to safety should be protected as described in Regulatory Position 7.3 of this guide.	Conform	
4.1.3.6	**Electrical Cabinets** Electrical cabinets present an ignition source for fires and a potential for explosive electrical faults that can result in damage not only to the cabinet of origin, but also to equipment, cables, and other electrical cabinets in the vicinity of the cabinet of origin. Fire protection systems and features provided for the general area containing the cabinet may not be adequate to prevent damage to adjacent equipment, cables, and cabinets following an energetic electrical fault. Energetic electrical faults are more of a concern with high-voltage electrical cabinets (i.e., 480 volts (V) and above). High-voltage cabinets should be provided with adequate spatial separation or substantial physical barriers to minimize the potential for an energetic electrical fault to damage adjacent equipment, cables, or cabinets important to safety. Rooms containing electrical cabinets important to safety should be provided with area wide automatic fire detection, automatic fire suppression, and manual fire suppression capability. Electrical cabinets containing a quantity of combustible materials (e.g., cabling) sufficient to propagate a fire outside the cabinet of fire origin should be provided with in-cabinet automatic fire detection.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.4	**Heating, Ventilation, and Air Conditioning Design** Suitable design of the ventilation systems can limit the consequences of a fire by preventing the spread of the products of combustion to other fire areas. It is important that means be provided to ventilate, exhaust, or isolate the fire area as required and that consideration be given to the consequences of ventilation system failure caused by the fire, resulting in a loss of control for ventilating, exhausting, or isolating a given fire area. Special protection for ventilation power and control cables may be necessary. The power supply and controls for mechanical ventilation systems should be run outside the fire area served by the system where practical. Release of smoke and gases containing radioactive materials to the environment should be monitored in accordance with emergency plans as described in the guidelines of Regulatory Guide 1.101, "Emergency Planning and Preparedness for Nuclear Power Reactors". Any ventilation system designed to exhaust potentially radioactive smoke or gases should be evaluated to ensure that inadvertent operation or single failures will not violate the radiologically controlled areas of the plant design. This should include containment functions for protecting the public and maintaining habitability for operations personnel. Fresh air supply intakes to areas containing equipment or systems important to safety should be located away from the exhaust air outlets and smoke vents of other fire areas to minimize the possibility of contaminating the intake air with the products of combustion. Where total-flooding gas-extinguishing systems are used, area intake and exhaust ventilation dampers should be controlled in accordance with NFPA 12, NFPA 12A, or NFPA 2001 to maintain the necessary gas concentration. (See also Regulatory Position 3.3.2 of this guide.)	Conform	COL Applicant (if total-flooding gas-extinguishing systems are specified by as-built FHA)
4.1.4.1	**Combustibility of Filter Media** Filters for particulate and gaseous effluents may be fabricated of combustible media (e.g., HEPA and charcoal filters). The ignition and burning of these filters may result in a direct release of radioactive material to the environment or may provide an unfiltered pathway upon failure of the filter. Filter combustion may spread fire to other areas. Engineered safety feature filters should be protected in accordance with the guidelines of Regulatory Guide 1.52, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup System Light-Water-Cooled Nuclear Power Plants". Any filter that includes combustible materials and is a potential exposure fire hazard that may affect components important to safety should be protected as determined by the fire hazards analysis.	Conform	Section 9.4 describes fire protection system features associated with filter media where applicable.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.4.2	**Smoke Control/Removal** Smoke from fires can be toxic, corrosive, and may obscure visibility for emergency egress and access to plant areas. Smoke control and removal may be necessary to support manual suppression activities and safe-shutdown operations. The installation of automatic suppression systems to limit smoke and heat generation should be considered. Smoke and corrosive gases should generally be discharged directly outside to an area that will not affect plant areas important to safety. The normal plant ventilation system may be used for this purpose, if capable and available. To facilitate manual firefighting, separate smoke and heat vents should be considered in areas such as cable spreading rooms, diesel fuel oil storage areas, switchgear rooms, and other areas where the potential exists for heavy smoke conditions. (See NFPA 204, "Standard for Smoke and Heat Venting")	Conform	
4.1.4.3	**Habitability** Protection of plant operations staff from the effects of fire and fire suppression (e.g., gaseous suppression agents) may be necessary to ensure safe shutdown of the plant. For control room evacuation, egress pathways and remote control stations should also be habitable. The protection of safe-shutdown areas from infiltration of gaseous suppression agents should be considered. The capability to ventilate, exhaust, or isolate is particularly important to ensuring the habitability of rooms or spaces that should be attended in an emergency. The design should provide for personnel access to and escape routes from each fire area. Habitability of the following areas should be considered: a. control room, b. postfire safe-shutdown areas, and c. personnel access and egress pathways. Stairwells should be designed to minimize smoke infiltration during a fire. Staircases may serve as escape routes and access routes for firefighting. Fire exit routes should be clearly marked. Stairwells, elevators, and chutes should be enclosed in fire-rated construction with automatic fire doors at least equal to the enclosure construction at each opening into the building. Elevators should not be used during fire emergencies.	Conform	
4.1.4.4	**Fire Dampers** Redundant safe-shutdown components may be separated by fire-resistant walls, floors, enclosures, or other types of barriers. For the fire barriers to be effective in limiting the propagation of fire, ventilation duct penetrations of fire barriers should be protected by means of fire dampers that are arranged to automatically close in the event of fire. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems", provides additional guidance. (See also Regulatory Position 4.2.1.3 of this guide.)	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.5	**Drainage** Floor drains sized to remove expected firefighting water without flooding equipment important to safety should be provided in areas where fixed water fire suppression systems are installed. Floor drains should also be provided in other areas where hand hose lines may be used if such firefighting water could cause unacceptable damage to equipment important to safety in the area. Facility design should ensure that fire-water discharge in one area does not impact equipment important to safety in adjacent areas. Housekeeping procedures should ensure that accumulated dirt or other debris does not block drains. Where gaseous suppression systems are installed, the drains should be provided with adequate seals, or the gas suppression system should be sized to compensate for the loss of the suppression agent through the drains. (See Regulatory Position 3.3.2 of this guide.) Drainage in areas containing equipment important to safety should be designed to minimize the potential to propagate fire from areas containing flammable or combustible liquids via the drainage system. Water drainage from areas that may contain radioactivity should be collected, sampled, and analyzed before discharge to the environment.	Conform	COL Applicant to address housekeeping procedures. Floor drains in the RXB, RWB and CRB are provided as described in Section 9.3.3. These drains were not credited for water removal (including from suppression systems) by the flooding analysis of Section 3.4.1.
4.1.6	**Emergency Lighting** Emergency lighting should be provided throughout the plant as necessary to support fire suppression actions and safe-shutdown operations, including access and egress pathways to safe-shutdown areas during a fire event.	Conform	See Section 9.5.3.
4.1.6.1	**Egress Safety** Emergency lighting should be provided in support of the emergency egress design guidelines outlined in Regulatory Position 4.1.2.3 of this guide.	Conform	See Section 9.5.3.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.6.2	**Postfire Safe Shutdown** Lighting is vital to postfire safe shutdown and emergency response in the event of fire. The licensee should provide suitable fixed and portable emergency lighting, as follows: a) Fixed, self-contained lighting consisting of fluorescent or sealed-beam units with individual 8-hour minimum battery power supplies should be provided in areas needed for operation of safe-shutdown equipment and for access and egress routes to these areas. The level of illumination provided by emergency lighting in access routes to and in areas where shutdown functions are performed is sufficient to enable an operator to reach that area and perform the shutdown functions. At the alternative or dedicated shutdown panels, the illumination levels should be sufficient for control panel operators. If a licensee has provided emergency lighting in accordance with Section III.J of Appendix R to 10 CFR Part 50, the licensee should verify by field testing that this lighting is adequate to perform the intended tasks. Routine maintenance and initial and periodic field testing of emergency lighting systems should ensure their ability to support access, egress, and operations activities for the full 8-hour period accounting for anticipated environmental conditions, battery conditions, and bulb life. b) Suitable sealed-beam battery-powered portable hand lights should be provided for emergency use by the fire brigade and other operations personnel required to achieve safe plant shutdown. If a central battery or batteries power the emergency lights, the distribution system should contain protective devices necessary to preclude a fire in one area from causing a loss of emergency lighting in any unaffected area required for safe-shutdown operations.	Conform	COL Applicant will provide portable emergency lighting.
4.1.7	**Communications** The communication system design should provide effective communication between plant personnel in all vital areas during fire conditions under maximum potential noise levels. Two-way voice communications are vital to safe shutdown and emergency response in the event of fire. Suitable communication devices should be provided, as follows: a) Fixed emergency communications independent of the normal plant communication system should be installed at preselected stations. b) A portable radio communications system should be provided for use by the fire brigade and other operations personnel required to achieve safe plant shutdown. This system should not interfere with the communications capabilities of the plant security force. Fixed repeaters installed to permit use of portable radio communication units should be protected from exposure or fire damage. Preoperational and periodic testing should demonstrate that the frequencies used for portable radio communication will not affect the actuation of protective relays.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.1.8	**Explosion Prevention** In situ and transient explosion hazards should be identified and suitable protection provided. Transient explosion hazards that cannot be eliminated should be controlled and suitable protection provided. (See Regulatory Position 2.1 of this guide regarding control of combustibles.) Miscellaneous storage and piping for flammable or combustible liquids or gases should not create a potential exposure hazard to systems important to safety or the fire protection systems that serve those areas. (See also Regulatory Positions 2.1.3 and 7.5 of this guide.) Systems or processes that involve hydrogen supplies (e.g., generator cooling systems and reactor coolant hydrogen addition systems) and those that may give off hydrogen or explosive gases (e.g., waste gas and solid radioactive waste processing systems) should be designed to prevent development of explosive mixtures by limiting the concentration of explosive gases and vapors within enclosures to less than 50 percent of the lower explosive limit, or by limiting oxygen within systems containing hydrogen. Hydrogen distribution and supply systems should include design features that mitigate the consequences of system damage, such as excess flow valves or flow restrictors, double-walled pipe with annulus leak detection, and rupture diaphragms. (See also Regulatory Position 7.5 of this guide.) The construction, installation, operation, and maintenance of bulk gas (including liquefied gas) storage and the related loading and dispensing systems should comply with good industry practice and the relevant NFPA standards, as applicable (e.g., NFPA 54, "National Fuel Gas Code", and NFPA 55). If the potential for an explosive mixture of hydrogen and oxygen exists in offgas systems, the systems should either be designed to withstand the effects of a hydrogen explosion or be provided with dual gas analyzers with automatic control functions to preclude the formation or buildup of explosive mixtures. Regulatory Guide 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants", includes information for explosion protection for offgas systems. Revision 1 of Regulatory Guide 1.91, "Evaluations of Explosions Postulated To Occur on Transportation Routes Near Nuclear Power Plants", provides guidance for the assessment of explosion hazards related to transportation near the plant site.	Conform	COL Applicant (transient and transporation related explosion hazards) Waste gas system meets RG 1.143 by use of gas analyzers and automatic nitrogen purge system as described in Section 11.3. Local hydrogen storage bottles used by the CVCS for chemistry control of reactor coolant are provided with supports designed to withstand seismic effects. This includes any excess flow preventers and isolation valves provided as part of the storage tank assembly. This prevents CVCS hydrogen injection line breaks from creating combustible gas mixtures in reactor building spaces.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position [1]	Conformance [2]	Comment
4.2	**Passive Fire-Resistive Features**		
4.2.1	**Structural Fire Barriers** Fire barriers are those components of construction (walls, floors, and their supports), including beams, joists, columns, penetration seals or closures, fire doors, and fire dampers that are rated by approving laboratories in hours of resistance to fire and are used to prevent the spread of fire. Where exact replication of a tested configuration cannot be achieved, the field installation should meet all of the following criteria: a) The continuity of the fire barrier material is maintained. b) The thickness of the barrier is maintained. c) The nature of the support assembly is unchanged from the tested configuration. d) The application or “end use” of the fire barrier is unchanged from the tested configuration. e) A qualified fire protection engineer has reviewed the configuration and found that it provides an equivalent level of protection. For new reactor designs, see the enhanced fire protection criteria for new reactors described in Regulatory Position 8.2 of this guide. See Regulatory Position 4.1.2 of this guide for additional guidance on the design of fire barriers relative to compartmentalization and separation of equipment.	Conform	See Regulatory positon 8.2 for new plants
4.2.1.1	**Wall, Floor, and Ceiling Assemblies** Wall, floor, and ceiling construction should be noncombustible. (See Regulatory Position 4.1.1 of this guide.) NFPA 221, “Standard for High-Challenge Fire Walls, Fire Walls, and Fire Barrier Walls”, can be used as guidance for the construction of fire barrier walls. Materials of construction for walls, floors, and ceilings serving as fire barriers should be rated by approving laboratories in hours of resistance to fire. Building design should ensure that openings through fire barriers are properly protected. Openings through fire barriers that separate fire areas should be sealed or closed to provide a fire-resistance rating at least equal to that required of the barrier itself. The construction and installation techniques for penetrations through fire barriers should be qualified by fire endurance tests. (See Regulatory Position 4.2.1.5 of this guide.)	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.2.1.2	**Fire Doors** Building design should ensure that door openings are properly protected with fire doors that have been qualified by a fire test. The construction and installation techniques for doors and door openings through fire barriers should be consistent with the door manufacturer's recommendations and the tested configuration. Modifications to fire doors should be evaluated. Where a door is part of a fire area boundary, and a modification does not affect the fire rating (e.g., installation of security "contacts"), no further analysis need be performed. If the modifications could reduce the fire rating (e.g., installation of a vision panel), the fire rating of the door should be reassessed to ensure that it continues to provide a level of protection equivalent to a rated fire door. Fire doors should be self-closing or provided with closing mechanisms and should be inspected semiannually to verify that automatic hold-open, release, and closing mechanisms and latches are operable. One of the following measures should be provided to ensure that the fire doors will protect the opening as required in case of fire: a) Fire doors should be kept closed and electrically supervised at a continuously manned location. b) Fire doors should be locked closed and inspected weekly to verify that the doors are in the closed position. c) Fire doors should be provided with automatic hold-open and release mechanisms and inspected daily to verify that doorways are free of obstructions d) Fire doors should be kept closed and inspected daily to verify that they are in the closed position. Areas protected by automatic total flooding gas suppression systems should have electrically supervised self-closing fire doors or should satisfy option (a) above. NFPA 80, "Standard for Fire Doors and Other Opening Protectives," provides additional guidance for fire doors.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.2.1.3	**Fire Dampers** Building design should ensure that ventilation openings are properly protected. These openings should be protected with fire dampers that have been fire tested. In addition, the construction and installation techniques for ventilation openings through fire barriers should be qualified by fire endurance tests. For ventilation ducts that penetrate or terminate at a fire wall, guidance in NFPA 90A indicates that ventilation fire dampers should be installed within the fire wall penetration for barriers with a fire rating greater than or equal to 2 hours. NFPA 90A requires that fire dampers be installed in all air transfer openings within a rated wall. Until recently, the only industry standard governing the design, fabrication, and testing of fire dampers was UL Standard 555, “Fire Dampers”. That standard does not evaluate whether fire dampers will close under airflow conditions. Therefore, the UL fire damper rating indicates only whether a fire damper in the closed position will maintain its integrity under fire conditions for a specific time period. Fire damper testing methods that do not simulate the actual total differential pressure at the damper (i.e., visual inspection or drop testing with duct access panels open) may not show operability or functionality under airflow conditions. Fire damper surveillance testing should model airflow to ensure that the dampers will close fully when called to do so. This can be addressed by (1) type testing “worst-case” airflow conditions of plant-specific fire damper configurations, (2) testing under airflow conditions all dampers installed in required fire barriers, or (3) administratively shutting down the ventilation systems to an area upon confirmation of a fire. The plant emergency procedures should incorporate the latter approach.	Conform	
4.2.1.4	**Penetration Seals** Openings through fire barriers for pipe, conduit, and cable trays that separate fire areas should be sealed or closed to provide a fire-resistance rating at least equal to that required of the barrier itself. Openings inside conduit larger than 102 mm (4 in.) in diameter should be sealed at the fire barrier penetration. Openings inside conduit 102 mm (4 in.) or less in diameter should be sealed at the fire barrier unless the conduit extends at least 1.5 m (5 ft.) on each side of the fire barrier and is sealed either at both ends or at the fire barrier with material to prevent the passage of smoke and hot gases. Fire barrier penetrations that maintain environmental isolation or pressure differentials should be qualified by test to maintain the barrier integrity under such conditions. Qualified individuals who are trained and certified by the manufacturer should install penetration seals. Appropriate QA/QC methods should be in force during installation. As part of the installation process, penetration seals should be specifically labeled and documented and then inspected to ensure that the seal does not contain voids or gaps and has been installed in accordance with its design.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.2.1.5	**Testing and Qualification** a) Structural fire barriers—The design adequacy of fire barrier walls, floors, ceilings, and enclosures should be verified by fire endurance testing. The NRC fire protection guidance refers to the guidance of NFPA 251 and ASTM E119, "Standard Test Methods for Fire Tests of Building Construction and Materials", as acceptable test methods for demonstrating fire endurance performance. The guidance of NFPA 251 and ASTM E119 should be consulted with regard to construction, materials, workmanship, and details such as dimensions of parts and the size of the specimens to be tested. In addition, NFPA 251 and ASTM E119 should be consulted with regard to the placement of thermocouples on the specimen. b) Penetration fire barriers—An independent testing authority should qualify penetration fire barriers by tests conducted in accordance with the provisions of NFPA 251 or ASTM E119. In addition, ASTM E814, "Standard Test Method for Fire Tests of Penetration Fire Stops", or IEEE Standard 634, "IEEE Standard Cable Penetration Fire Stop Qualification Test" could be used in the development of a standard fire test. The construction and installation techniques for door and ventilation openings and other penetrations through fire barriers should be qualified by fire endurance tests. The test specimen should be truly representative of the construction for which classification is desired, in terms of materials, workmanship, and details such as dimensions of parts, and should be built under conditions representative of those practically applied in building construction and operation. The physical properties of the materials and ingredients used in the test specimen should be determined and recorded. In view of the many possible penetration seal configurations, it may not be practical to test every penetration configuration. The following section provides guidance on evaluating penetration seal designs against the results of limited fire test programs.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.2.1.6	**Evaluation of Penetration Seal Designs with Limited Testing** The results of fire test programs that include a limited selection of test specimens that have been specifically designed to encompass or bound the entire population of in-plant penetration seal configurations may be acceptable. In such cases, the engineering evaluation performed to justify the seal designs should consider the following: a) Size of sealed opening—In some cases, a successful fire endurance test of a particular fire barrier penetration seal configuration for a particular size opening may be used to justify the same configuration for smaller openings. b) Penetrating items—A satisfactory test of a seal configuration that contains a particular pattern of penetrating items can be used to qualify variations on the tested pattern. Acceptable variations include eliminating or repositioning one or more of the penetrating items, reducing the size (cross-sectional area) of a particular penetrating item, or increasing the spacing between penetrating items. However, since penetrating items provide structural support to the seal, the free area of the seal material and the dimensions of the largest free span may also be factors that affect the fire-resistive performance of the seal assembly. The thickness of the seal material needed to obtain a particular fire rating may also be a function of the free area or the distance between the penetrating items and the outside edge of the seal assembly. In other cases, consideration of the penetrating items takes on special importance because of the heat sink they provide. c) Cable type and fill—A satisfactory test of a seal configuration with certain electrical penetrations containing a specified fill ratio and cable type can be used to qualify similar configurations containing the same or a smaller cable fill ratio and the same cable jacket material or a less-combustible jacket material. The thermal conductivity of the penetrating cables is also important. d) Damming materials—The fire-resistive performance of a given seal configuration can be improved if a fire-resistant damming material covers one or both surfaces of the seal. A satisfactory test of a seal configuration without a permanent fire-resistant dam can be used to qualify the same configuration with a permanent fire-resistant dam, all other seal attributes being equal. The converse is not true.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
	e) Configuration orientation-A satisfactory test of a particular seal configuration in the horizontal orientation (with the test fire below the seal) can be used to qualify the same configuration in a vertical orientation if the symmetry of the design configurations is comparable. For example, if a nonsymmetrical penetration seal configuration (e.g., a seal with a damming board on the bottom but not on the top) is qualified for a floor-ceiling orientation with the damming board on the fire side of the test specimen, the configuration could only be qualified for a wall orientation if a damming board was installed on both sides of the seal or if the potential fire hazard is limited to the side with the damming board. f) Material type and thickness-Satisfactory testing of a particular seal configuration with a specific seal material thickness can be used to qualify the same configuration with a greater seal material thickness of the same type of seal material. The converse is not tru g) Type testing-In cases in which a single test of a particular seal configuration is to serve as a qualification test for the same or similar design configurations with different design parameters, the tested configuration should be the worst-case design configuration with the worst-case combination of design parameters. This would test and qualify a condition that would fail first, if failure occurs at all. Successful testing of the worst-case condition can then serve to qualify the same or similar design configurations for design parameters within the test range. It would be appropriate to conduct multiple tests to assess a range of design parameters.		
4.2.2	**Structural Steel Protection** Structural steel forming a part of or supporting fire barriers should be protected to provide fire resistance equivalent to that required of the barrier. Where the structural steel is not protected and has a lower fire rating than the required rating of the fire barrier, the fire hazards analysis should justify the configuration by demonstrating the temperature that the steel will reach during fire and the ability of the steel to carry the required loads at that temperature. The need to protect structural steel that forms a part of or supports fire barriers is consistent with sound fire protection engineering principles as delineated in NFPA codes and standards and in the NFPA *Fire Protection Handbook*. Structural steel whose sole purpose is to carry dynamic loads from a seismic event need not be protected to meet fire barrier requirements, unless the failure of any structural steel member owing to a fire could result in significant degradation of the fire barrier.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
4.2.3	**Fire-Resistive Protection for Electrical Circuits**		
4.2.3.1	**Electrical Raceway Fire Barrier Systems** Redundant cable systems important to safety should be separated from each other and from potential fire exposure hazards in accordance with the separation means of Regulatory Position 5.3.1.1.a, b, and c of this guide. In areas where electrical circuits important to postfire safe shutdown cannot be separated by means of rated structural fire barriers, cable protection assemblies should be applied to conduit and cable trays to meet 1-hour and 3-hour separation requirements, as required. Where 1-hour fire-resistive barriers are applied, automatic fire detection and suppression should also be installed. The design of fire barriers for horizontal and vertical cable trays should meet the requirements of ASTM E119, including a hose stream test. Regulatory Position 4.3 of this guide discusses the acceptance criteria for raceway fire barriers.	Conform	
4.2.3.2	**Fire-Rated Cables** Pre-1979 licensees should request an exemption when relying on fire-rated cables to meet NRC requirements for protection of safe-shutdown systems or components from the effects of fire. Post-1979 licensees relying on fire-rated cables should perform an evaluation to demonstrate that the use of fire-rated cables does not adversely affect safe shutdown in accordance with their license condition and submit a license amendment if required. (See Regulatory Position 1.8 of this guide.)	N/A	
4.3	**Testing and Qualification of Electrical Raceway Fire Barrier Systems** Fire barriers relied on to protect postfire shutdown-related systems and to meet the separation means discussed in Regulatory Position 5.3 should have a fire rating of either 1 or 3 hours. Fire rating is defined as the endurance period of a fire barrier or structure, which relates to the period of resistance to a standard fire exposure before the first critical point in behavior is observed. Fire endurance ratings of building construction and materials are demonstrated by testing fire barrier assemblies in accordance with the provisions of the applicable sections of NFPA 251 and ASTM E119. Assemblies that pass specified acceptance criteria (e.g., standard time-temperature fire endurance exposure, unexposed side temperature rise, hose stream impingement) are considered to have a specific fire-resistance rating. The basic premise of the fire-resistance criteria is that those fire barriers that do not exceed 163 degrees C (325 degrees F) cold-side temperature and pass the hose stream test provide reasonable assurance that the shutdown capability is protected without further analyses. If the temperature criterion is exceeded, sufficient additional information is needed to permit an engineering evaluation to demonstrate that the shutdown capability is protected. Appendix C to this guide provides detailed guidance for the testing and qualification of electrical raceway fire barrier systems.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
5.	**Safe-Shutdown Capability** When considering the consequences of a fire in a given fire area during the evaluation of the safe-shutdown capabilities of the plant, licensees should demonstrate that one success path of SSCs that can be used to bring the reactor to hot-shutdown or hot-standby conditions remains free of fire damage. Some plant designs (those that use low-pressure systems for their success path) pass through hot shutdown in a short time and then proceed directly to cold shutdown. For the purpose of this guide, the term "safe shutdown" will be used to indicate bringing a plant to safe-shutdown condition, either hot shutdown or cold shutdown (when low-pressure systems are used as the success path), as applicable to each reactor design and as defined by the plant technical specifications. The analysis should also demonstrate that fire damage to one success path of SSCs needed for achieving cold shutdown will be limited so that a success path will be returned to an operating condition within 72 hours, or for areas requiring alternative or dedicated shutdown, the licensee should demonstrate that cold-shutdown capability can be restored and cold shutdown achieved within 72 hours. For reactor designs that cannot safely remain in hot shutdown for 72 hours, the analysis should demonstrate that a cold-shutdown condition can be achieved and maintained within the required period of time. The FPP should include a safe-shutdown analysis to demonstrate that the SSCs important to safety can accomplish their respective postfire safe-shutdown functions. The safe-shutdown analysis should demonstrate that the success path SSCs, including electrical circuits, remain free of fire damage in the event of postulated fires. As required by applicable regulations, fire barriers, physical separation with no intervening combustibles, and/or automatic detection and suppression should provide this protection. Where a success path cannot be adequately protected, an alternative or dedicated shutdown success path should be identified and protected to the extent necessary to ensure postfire safe shutdown. The safe-shutdown analysis for new reactor designs should demonstrate that safe shutdown can be achieved, assuming that all equipment in any one fire area (except for the control room and containment) will be rendered inoperable by fire and that reentry into the fire area for repairs and operator actions is not possible. (See Regulatory Position 8.2 of this guide.) The control room is excluded from this approach, provided that the design includes an independent alternative shutdown capability that is physically and electrically independent of the control room. New reactors should provide fire protection for redundant shutdown systems in the reactor containment building that will ensure, to the extent practicable, that at least one postfire shutdown success path will be free of fire damage. The safe-shutdown analysis should evaluate a fire in each fire area containing SSCs important to safety and identify a postfire safe-shutdown success path. The analysis should also identify all fire-induced circuit failures that could directly or indirectly (e.g., by causing spurious actuations) prevent safe shutdown.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position [(1)]	Conformance [(2)]	Comment
5.1	**Postfire Safe-Shutdown Performance Goals** Licensees should ensure that fire protection features are provided for SSCs important to safe shutdown that are capable of limiting fire damage, so that one success path necessary to achieve and maintain hot-shutdown conditions from either the control room or the emergency control station(s) is free of fire damage.	Conform	
5.2	**Cold Shutdown and Allowable Repairs** For normal safe shutdown, redundant systems necessary to achieve cold shutdown may be damaged by a single fire. Fire damage must be limited so that at least one success path can be repaired or made operable within 72 hours using onsite capability or within the time period required to achieve a safe-shutdown condition, if less than 72 hours.	Alternate Conformance	Passive plant design; follows guidance of Regulatory Position 8.2 and does not credit repairs to equipment to achieve safe shutdown.
5.3	**Fire Protection of Safe-Shutdown Capabilities** The postfire safe-shutdown analysis should ensure that one success path remains free of fire damage for a single fire in any single plant fire area. Chapter 3 of industry guidance document NEI 00-01 provides an acceptable deterministic methodology for the analysis of postfire safe-shutdown circuits, when applied in conjunction with this regulatory guide.	Conform	See Regulatory Positions 5.3.1 and 5.3.1.1 through 5.3.1.5 below.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
5.3.1	**Identification and Evaluation of Postfire Safe-Shutdown Circuits** Two classifications of equipment in the plant are important when evaluating the ability to achieve and maintain shutdown during and following a fire. Regulatory Position 5.3.1.1 describes the equipment on the success path necessary to achieve and maintain hot-shutdown conditions. This equipment is a subset of the second and more general set of SSCs important to safe shutdown described in Position 5.3.1.2. These classifications are not applicable to alternative or dedicated shutdown systems credited for postfire safe shutdown as defined in Appendix R, Section III.G.3. Position 5.4 discusses alternative or dedicated shutdown. The information included in Appendix H of NEI 00-01 may be used in classifying components on the success path required for hot shutdown and those important to safe shutdown, when applied in conjunction with this regulatory guide. Note, the NRC will treat the phrase “required for hot shutdown” in NEI 00-01 as having the same meaning as the phrase “the safe- shutdown success path” used in this guide. The postfire safe-shutdown circuit analysis should address all possible fire-induced failures that could affect the safe-shutdown success path, including multiple spurious actuations. Some licensees have based this analysis on the assumption that multiple spurious actuations will not occur simultaneously or in rapid succession. This is known as the “one-at-a-time” assumption. Cable fire testing performed by the NRC and industry has demonstrated that multiple cable faults occur when cables are exposed to fire. These faults depend on multiple factors, including cable insulation or jacketing materials and cable configurations. The success path SSCs and the components important to safe shutdown should be protected from fire damage so that the capability to shut down the plant safely is ensured; specifically, all spurious actuations that could affect safe-shutdown success path SSCs are required to be protected in accordance with Position 5.3.1.1. The one-at-a-time assumption may still pertain to the protection of components important to safe shutdown as applied using the information in Position 5.3.1.2. However, use of this assumption must be supported by a safety and technical analysis that demonstrates the assumption's validity for each application.	Conform	COL Applicant (safe shutdown equipment is identified in Appendix 9A and postfire safe-shutdown circuit analysis will be based on the as-built cable configuration)
5.3.1.1	**Protection for the Safe-Shutdown Success Path** For the success path of SSCs necessary to achieve and maintain hot-shutdown conditions, fire barriers, physical separation, or automatic suppression should protect redundant systems or components.	Conform	Design follows Regulatory Posiiton 8.2.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
5.3.1.2	**Protection for Components Important to Safe Shutdown** The protection options described in Regulatory Position 5.3.1.1 are available but not required for the protection of SSCs (including circuits) important to safe shutdown. Additional protection options available for this category are, for example, operator manual actions (Position 5.3.1.3) and fire modeling (Position 5.3.1.4). These additional options are not available for safe-shutdown success path equipment without prior NRC approval (Position 5.3.1.1). The approach outlined in Chapter 4 of NEI 00-01, which relies on the Expert Panel Process and the Generic List of Multiple Spurious Operations contained in Appendix G, provides an acceptable methodology for the analysis of multiple spurious operations for protection of components important to safe shutdown, when applied in conjunction with this regulatory guide.	Conform	Design follows Regulatory Posiiton 8.2
5.3.1.3	**Operator Manual Actions** When one of the redundant safe-shutdown trains in a fire area is maintained free of fire damage by one of the means specified in Regulatory Position 5.3.1.1, then the use of operator manual actions may be credited with mitigating fire-induced operation or maloperation of components that are not part of the protected success path. The crediting of operator manual actions should be in accordance with the licensee's FPP and license condition. Operator manual actions may also be credited when an alternative or dedicated shutdown capability is provided as described in Position 5.4. All postfire operator manual actions should be feasible and reliable. NUREG-1852 provides the technical bases in the form of criteria and technical guidance that may be used to demonstrate that operator manual actions are feasible and can be performed reliably under a wide range of plant conditions that an operator might encounter during a fire. The use of feasible and reliable manual actions alone may not be sufficient to address all levels of defense in depth. Therefore, fire prevention, detection, and suppression should be considered, in addition to the feasibility and reliability of operator manual actions. Because the fire protection requirements, including the protection of safe-shutdown capability and the prevention of radiological release, can be integrated in the planning and design phase, a new reactor plant should have minimal reliance on operator manual actions and alternative or dedicated shutdown systems (protection for fires in the main control room will require alternative shutdown capability).	Conform	Design follows Regulatory Posiiton 8.2

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
5.3.1.4	**Fire Modeling** When one of the redundant safe-shutdown trains in a fire area is maintained free of fire damage by one of the specified means in Regulatory Position 5.3.1.1, then fire modeling may be used to demonstrate that components important to safe shutdown, including SSCs that are not part of the success path, are protected from fire damage. The use of fire modeling should be in accordance with the licensee's FPP and license condition. Regulatory Position 1.8.7 of this guide provides information regarding fire modeling. When fire modeling is used to demonstrate that components important to safe shutdown are protected from fire damage, the analysis should consider in situ and transient fire sources in the area and all targets that involve components important to safe shutdown. The fire models should be used within the bounds of their capability. By considering expected room configurations (e.g., doors open or closed), the fire modeling analysis should show that the largest expected fire will not affect the components important to safe shutdown. In addition, the area being analyzed should include effective automatic suppression in the fire area, a significant margin between the expected fire and the damage threshold of the target, or other features to provide an adequate safety margin and defense in depth.	Conform	COL Applicant (when utilizing fire modeling)
5.3.1.5	**Examples of Safe-Shutdown Success Path Components and Components Important to Safe Shutdown** The following table provides general examples of components that should be considered part of the safe-shutdown success path and components that are important to safe shutdown. Appendix H to NEI 00-01 provides additional information regarding the classification of safe-shutdown equipment when applied in conjunction with this guide.	General Information	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
5.3.2	**High-Low Pressure Interface** The licensee should evaluate the circuits associated with high-low pressure interfaces for the potential to adversely affect safe shutdown. For example, the residual heat removal (RHR) system is generally a low-pressure system that interfaces with the high-pressure primary coolant system. Thus, the interface most likely consists of two redundant and independent motor-operated valves. Both of these motor-operated valves and their power and control cables may be subject to damage from a single fire. This single fire could cause the two valves to spuriously open, resulting in an interfacing system loss-of-coolant accident (LOCA) through the subject high-low pressure systems interface. To ensure adequate protection of this interface and other high-low pressure interfaces from the effects of a single fire, the licensee should perform an evaluation, as follows: a) Identify each high-low pressure interface that uses redundant, electrically controlled devices (such as two series motor-operated valves) to isolate or preclude the rupture of any primary coolant boundary. b) For each set of redundant valves, verify that the redundant cabling (power and control) has adequate physical separation, as stated in Regulatory Positions 5.3 or 6.1.1.1 of this guide, as applicable. c) Where adequate separation is not provided, demonstrate that fire-induced failures (multiple hot shorts, open circuits, and shorts to ground) of the cables will not cause maloperation and result in an interfacing system LOCA that would adversely affect safe shutdown. The approach outlined in Appendix C to NEI 00-01 provides an acceptable methodology for the determination of components as high-low pressure interface components, when applied in conjunction with this regulatory guide.	Conform	Design follows Regulatory Posiiton 8.2.
5.4	**Alternative and Dedicated Shutdown Capability**		
5.4.1	**General Guidelines** Appendix R to 10 CFR Part 50 defines alternative shutdown capability as being provided by rerouting, relocating, or modifying existing systems, whereas dedicated shutdown is defined as being provided by installing new structures and systems for the function of postfire shutdown. Since postfire repairs cannot be credited for achieving and maintaining hot shutdown, the licensee should implement the required rerouting, relocating, or modifying of the existing system for alternative shutdown capability in existing plants when the need for additional alternative shutdown capability is identified.	Conform	General information.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
5.4.2	**Associated Circuits of Concern** When alternative or dedicated shutdown systems are credited for achieving postfire safe shutdown, a specific category of circuits has been defined (referred to as "associated circuits of concern") and acceptable approaches to mitigating the consequences of fire-induced failure of these circuits have been identified. The licensee should evaluate these circuits, which are nonsafety or safety circuits that could adversely affect the identified shutdown equipment by feeding back potentially disabling conditions (e.g., hot shorts or shorts to ground) to power supplies or control circuits of that equipment. Such disabling conditions should be prevented to ensure that the identified safe-shutdown equipment will function as designed.	Conform	Design follows Regulatory Posiiton 8.2
5.4.3	**Protection of Associated Circuits of Concern** The shutdown capability may be protected from the adverse effect of damage to associated circuits of concern by the separation and protection guidelines of Regulatory Position 5.3 of this guide (or Regulatory Position 6.1.1.1 for cables inside a noninerted containment) or, alternatively, by the following methods, as applied to each type of associated circuit of concern.	Conform	Design follows Regulatory Posiiton 8.2
5.4.3.1	**Common Power Source** It may be necessary to coordinate a load fuse or breaker (i.e., interrupting devices) with a feeder fuse or breaker to prevent the loss of the redundant or alternative shutdown power source. IEEE Standard 242, "IEEE Recommended Practices for Protection and Coordination of Industrial and Commercial Power Systems", provides detailed guidance on achieving proper coordination.	Conform	
5.4.3.2	**Spurious Actuation Circuits** Spurious actuation is considered to be mitigated if one of the following criteria is met (the fire-induced spurious actuations of components included in the safe-shutdown success path should be prevented using the methods described in Regulatory Position 5.3.1): a) Provide a means to isolate the equipment and components from the fire area before the fire (i.e., remove power, open circuit breakers). b) Provide electrical isolation that prevents spurious actuation. Potential isolation devices include breakers, fuses, amplifiers, control switches, current transformers, fiber optic couplers, relays, and transducers. c) Provide a means to detect spurious actuations and develop procedures to mitigate the maloperation of equipment (e.g., closure of the block valve if a power-operated relief valve spuriously operates, opening the breakers to remove the spurious actuation of safety injection).	Conform	
5.4.3.3	**Common Enclosures** a. Provide appropriate measures to prevent propagation of the fire. b. Provide electrical protection (e.g., breakers, fuses, or similar devices).	Conform	Design follows Regulatory Posiiton 8.2

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
5.4.4	**Control Room Fires** The control room fire area contains the controls and instruments for redundant shutdown systems in proximity. (Separation is usually a few inches.) Alternative or dedicated shutdown capability for the control room and its required circuits should be independent of the cables, systems, and components in the control room fire area. The damage to systems in the control room for a fire that causes evacuation of the control room cannot be predicted. The licensee should conduct a bounding analysis to ensure that safe conditions can be maintained from outside the control room. This analysis is dependent on the specific design. The following assumptions usually apply: a) The reactor is tripped in the control room. b) Offsite power is lost, as well as automatic starting of the onsite ac generators and the automatic function of valves and pumps with control circuits that could be affected by a control room fire. The analysis should demonstrate that the capability exists to manually achieve safe-shutdown conditions from outside the control room by restoring ac power to designated pumps, ensuring that valve lineups are correct, and assuming that any malfunctions of valves that permit the loss of reactor coolant can be corrected before unrestorable conditions occur. The only operator action in the control room before evacuation for which credit is usually given is reactor trip. For any additional control room actions deemed necessary before evacuation, a licensee should be able to demonstrate that such actions can be performed. Additionally, the licensee should ensure that such actions cannot be negated by subsequent spurious actuation signals resulting from the postulated fire. The design basis for the control room fire should consider one spurious actuation or signal to occur before control of the plant is achieved through the alternative or dedicated shutdown system. After control of the plant is achieved by the alternative or dedicated shutdown system, single or multiple spurious actuations that could occur in the fire-affected area should be considered, in accordance with the plant's approved FPP.10 Postfire return to the control room should be governed by those procedures and conditions described in Regulatory Position 5.5.2. After returning to the control room, the operators can take any actions compatible with the condition of the control room. Controls in any area (cabinet where the fire occurred) may not be available. Smoke and fire suppressant damage in other areas (cabinets) should also be assessed and corrective action taken before controls in such cabinets are deemed functional. Controls in undamaged areas (cabinets) may be operated as required. Repairs inside the control room may be performed to reach cold shutdown.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
5.5	**Postfire Safe-Shutdown Procedures** Procedures for effecting safe shutdown should reflect the results and conclusions of the safe-shutdown analysis. Implementation of the procedures should not further degrade plant safety functions. Time-critical operations for effecting safe shutdown identified in the safe-shutdown analysis and incorporated in postfire procedures should be validated.	Conform	COL Applicant
5.5.1	**Safe-Shutdown Procedures** Postfire safe-shutdown operating procedures should be developed for those areas where alternative or dedicated shutdown is required. For other areas of the plant, shutdown would normally be achieved using the normal operating procedures, plant emergency operating procedures, or other abnormal operating procedures. (See also Regulatory Position 5.3.1.3 for a discussion of the feasibility and reliability of operator manual actions.)	Conform	COL Applicant
5.5.2	**Alternative or Dedicated Shutdown Procedures** Procedures should be in effect that describe the tasks to implement alternative or dedicated shutdown capability when offsite power is available and when offsite power is not available for 72 hours. These procedures should also address necessary actions to compensate for spurious actuations and high-impedance faults, if such actions are necessary to affect safe shutdown. Information in NEI 00-01, Appendix B.1, may be used to address multiple high-impedance faults when used in a manner consistent with this guide. The NRC does not endorse the information in NEI 00-01, Appendix B.1, for analysis of Kapton cables. Kapton is a specific cable insulation material that has been shown to experience arc tracking phenomena. Procedures governing the return to the control room should consider the following conditions: a) The fire has been extinguished and so verified by appropriate fire protection personnel. b) Appropriate fire protection personnel and the shift supervisor have deemed the control room to be habitable. c) Damage has been assessed and, if necessary, corrective action has been taken to ensure that necessary safety, control, and information systems are functional (some operators may assist with these tasks), and the shift supervisor has authorized the return of plant control to the control room. d) Turnover procedures that ensure an orderly transfer of control from the alternative or dedicated shutdown panel to the control room have been completed.	Conform	COL Applicant

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
5.5.3	**Repair Procedures** The licensee should develop procedures for performing repairs necessary to achieve and maintain cold-shutdown conditions. For alternative shutdown, procedures should be in effect to accomplish repairs necessary to achieve and maintain cold shutdown within 72 hours. For plants that must proceed to cold shutdown within 72 hours, the procedures should support the required time for initiation of cold shutdown. The performance of repair procedures should not adversely affect operating systems needed to maintain hot shutdown.	Conform	COL Applicant
5.6	**Shutdown and Low-Power Operations** Safe-shutdown requirements and objectives are focused on achieving shutdown conditions for fires occurring during normal at-power operations. During shutdown operations (i.e., maintenance or refueling outages), fire risk may increase significantly as a result of work activities. In addition, redundant systems important to safety may not be available as allowed by plant technical specifications and plant procedures. The FPP should be reviewed to verify that fire protection systems, features, and procedures will minimize the potential for fire events to affect safety functions (e.g., reactivity control, reactor decay heat removal, spent fuel pool cooling) or result in the unacceptable release of radioactive materials, under the differing conditions that may be present during shutdown operations.	Conform	COL Applicant
6.	**Fire Protection for Areas Important to Safety** Several areas within a nuclear power plant present unique hazards or design issues related to fire protection and safe shutdown. This section provides guidance applicable to specific plant areas.	Title and information Statement	
6.1	**Areas Related to Power Operation**		
6.1.1	**Containment** Fire protection for the primary and secondary containment areas should be provided for the hazards identified in the fire hazards analysis. Under normal conditions, containment fire hazards may include lubricating oils, hydraulic fluids, cables, electrical penetrations, electrical cabinets, and charcoal filters. During refueling and maintenance operations, additional hazards may be introduced, including contamination control and decontamination materials and supplies, scaffolding, plastic sheathing, wood planking, chemicals, and hot work. The fire hazards analysis should evaluate the effects of postulated fires within the primary containment to ensure that the performance objectives described in Regulatory Position 5.1 of this guide are met. Regulatory Position 7.1 provides guidance for RCP oil collection.	Conform	No fire protection needed for containment for NuScale design based on FHA. No intervening combustibles exist. Reactor Pool ensure core remains covered during refueling.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.1.1.1	**Containment Electrical Separation** For secondary containment areas, cable fire hazards that could affect safety should be protected as described in Regulatory Position 4.1.3.3 of this guide. Inside noninerted containments, one of the fire protection means specified in Regulatory Position 5.3.1.1, or one of the following, should be provided: a) separation of cables and equipment and associated nonsafety circuits of redundant trains by a horizontal distance of more than 6.1 m (20 ft.) with no intervening combustibles or fire hazards, b) installation of fire detectors and an automatic fire suppression system in the fire area, or c) separation of cables and equipment and associated nonsafety circuits of redundant trains by a noncombustible radiant energy shield having a minimum fire rating of 30 minutes, as demonstrated by testing or analysis.	Conform	Separation in containment will be maximized to the extent practicable. Details of cable routing in containment have not been determined. Electrical cables outside of containment are contained in conduit under the bioshield. Separate and separated cable trays are used outside of under the bioshield.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.1.1.2	**Containment Fire Suppression** The licensee should provide fire suppression systems on the basis of a fire hazards analysis. During normal operations, containment is generally inaccessible, and therefore, fire protection should be provided by automatic fixed systems. Automatic fire suppression capability need not be provided in primary containment atmospheres that are inerted during normal operations. However, inerted containments should have manual firefighting capability, including standpipes, hose stations, and portable extinguishers, to provide protection during refueling and maintenance operations. Standpipe and hose stations should also be installed inside PWR containments and BWR containments that are not inerted. Standpipe and hose stations inside containment may be connected to a high-quality water supply of sufficient quantity and pressure other than the fire main loop if plant-specific features prevent extending the fire main supply inside containment. For BWR drywells, standpipe and hose stations should be placed outside the drywell with adequate lengths of hose, no longer than 30.5 m (100 ft.), to reach any location inside the drywell with an effective hose stream. The containment penetration of the standpipe system should meet the isolation requirements of GDC 56, "Primary Containment Isolation," of Appendix A to 10 CFR Part 50 and should be in seismic Category I and Quality Group B. Operation of the fire protection systems should not compromise the integrity of the containment or other systems important to safety. Fire protection activities in the containment areas should function in conjunction with total containment requirements such as ventilation and control of contaminated liquid and gaseous release. The licensee should place adequate self-contained breathing apparatuses near the containment entrances for firefighting and damage control personnel. These units should be independent of any breathing apparatuses or air supply systems provided for general plant activities and should be clearly marked as emergency equipment. For normally inerted containments, self-contained breathing apparatuses need be staged near the containment hatches only when the containment is not inerted, such as during maintenance outages.	Conform	Based on the FHA, the NPM containment design does not have any fire suppression. The containment will normally be under a low vacuum or flooded and combustible materials will be near zero.
6.1.1.3	**Containment Fire Detection** Fire detection systems should alarm and annunciate in the control room. In primary containment, fire detection systems should be provided for each fire hazard. For primary and secondary containment, the type of detection used and the location of the detectors should be the most suitable for the particular type of fire hazard identified by the fire hazards analysis. A general area fire detection capability should be provided in the primary containment as backup to the above-described hazard detection. To accomplish this, suitable smoke or heat detectors compatible with the radiation environment should be installed in the air recirculation system ahead of any filters.	Alternate Conformance	No fire detection has been provided inside containment as evaluated in the FHA of Appendix 9A.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.1.2	**Control Room Complex** The control room complex (including galleys and office spaces) should be protected against disabling fire damage and should be separated from other areas of the plant by floors, walls, and roof having minimum fire-resistance ratings of 3 hours. Peripheral rooms in the control room complex should have automatic water suppression and should be separated from the control room by noncombustible construction with a fire-resistance rating of 1 hour. Ventilation system openings between the control room and peripheral rooms should have automatic smoke dampers that close upon operation of the fire detection or suppression system. If a gas extinguishing system is used for fire suppression, these dampers should be strong enough to support the pressure rise accompanying the agent discharge and seal tightly against infiltration of the agent into the control room. CO2 total flooding systems are not acceptable for these areas. Breathing apparatuses for control room operators should be readily available. All cables that enter the control room should terminate in the control room. That is, no cabling should be routed through the control room from one area to another. Cables in underfloor and ceiling spaces should be rated and meet the separation criteria necessary for fire protection. Equipment that is important to safety should be mounted on pedestals, or the control room should have curbs and drains to direct water away from such equipment. Such drains should be provided with a means for closing to maintain integrity of the control room in the event of other accidents requiring control room isolation. The control room should not be carpeted. Where carpeting has been installed (e.g., for sound abatement or other human factors), it should be tested to standards such as ASTM D2859, "Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials", to establish the flammability characteristics of the material. The fire hazards analysis should address these characteristics.	Conform	Human Factors Engineering considerations will determine if carpet is indicated for the main control room.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.1.2.1	**Control Room Fire Suppression** Manual firefighting capability should be provided for both of the following: a) fire originating within a cabinet, console, or connecting cables, and b) exposure fires involving combustibles in the general room area. c) Portable Class A and Class C fire extinguishers should be located in the control room. A hose station should be installed inside or immediately outside the control room. d) Nozzles that are compatible with the hazards and equipment in the control room should be provided for the manual hose station. The nozzles chosen should meet actual firefighting needs, satisfy electrical safety, and minimize physical damage to electrical equipment from hose stream impingement. e) Fully enclosed electrical raceways located in underfloor and ceiling spaces, if over 0.09 m2 (1 ft2) in cross-sectional area, should have automatic fire suppression inside. Area automatic fire suppression should be provided for underfloor and ceiling spaces if these spaces are used for cable runs, unless all cable is run in 10-centimeter (4-in.) or smaller steel conduit or the cables are in fully enclosed raceways internally protected by automatic fire suppression.	Conform	Manual fire suppression capability is provided in the control room to address fire hazards. Fire hazards in the control room include ordinary combustibles such as paper, plastics and cable insulation, and electrical hazards such as control consoles, electrical cabinets and energized cables. Portable Class A and C fire extinguishers of the appropriate size and quantity are provided in the control room. At least one hose station is provided inside or immediately outside the control room. Automatic fire suppression for ceiling and underfloor areas is addressed by the as-built FHA based on the final installed configuration of cable runs.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.1.2.2	**Control Room Fire Detection** Smoke detectors should be provided in the control room, cabinets, and consoles. If redundant safe-shutdown equipment is located in the same control room cabinet or console, additional fire protection measures should be provided. Alarm and local indication should be provided in the control room. The outside air intake(s) for the control room ventilation system should be provided with smoke detection capability to alarm in the control room to enable manual isolation of the control room ventilation system and, thus, prevent smoke from entering the control room.	Conform	Automatic fire detection is provided in the control room, cabinets and consoles. Redundant safe shutdown equipment located in the same cabinet or console is protected with additional fire protection measures. Outside air intakes for control room ventilation is provided with smoke detection that alarms in the control room and isolates the control room ventilation system to prevent smoke from entering the control room.
6.1.2.3	**Control Room Ventilation** Venting of smoke produced by fire in the control room by means of the normal ventilation system is acceptable; however, provision should be made to permit isolation of the recirculating portion of the normal ventilation system. Manually operated venting of the control room should be available to the operators. Air-handling functions should be ducted separately from cable runs in ceiling and floor spaces. If cables are routed in underfloor or ceiling spaces, these spaces should not be used as air plenums for ventilation of the control room.	Conform	Means are provided to ventilate smoke from the control room. Smoke purge exhaust is drawn from the ceiling plenum of the fire zone being purged into a smoke purge duct that is routed up through each floor of the building within a fire rated shaft. Smoke purge air is discharged to the outside through a protected exhaust

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.1.3	**Cable Spreading Room** A separate cable spreading room should be provided for each redundant division. Cable spreading rooms should not be shared between reactors. Each cable spreading room should be separated from the others and from other areas of the plant by barriers with a minimum fire rating of 3 hours. If this is not possible, an alternative or dedicated shutdown capability should be provided.	Alternate Conformance	The plant design does not use a cable spreading room. Divisional separation is maintained in all areas except the shared main control room, the top of each module, and inside each containment. A shared remote shutdown station is provided. The basic design of the plant (shared reactor building and shared control room) for up to 12 modules in a compact footprint, results in single fire areas with Division I cables for multiple NPMs or Division II cables for multiple NPMs. This arrangement maintains safe shutdown capability for all NPMs affected by a fire in any single fire area.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.1.4	**Plant Computer Rooms** Computer rooms for computers performing functions important to safety that are not part of the control room complex should be separated from other areas of the plant by barriers having a minimum fire-resistance rating of 3 hours and should be protected by automatic detection and fixed automatic suppression. Computers that are part of the control room complex but are not located in the control room should be separated and protected as described in Regulatory Position 6.1.2 for peripheral rooms. Computer cabinets located in the control room should be protected as other control room equipment and cable runs therein. Nonsafety-related computers outside the control room complex should be separated from plant areas important to safety by fire barriers with a minimum rating of 3 hours and should be protected as needed to prevent fire and smoke damage to equipment important to safety. Manual hose stations and portable extinguishers should be located in areas containing equipment important to safety. NFPA 75, "Standard for the Protection of Information Technology Equipment", provides additional guidance. New reactor designs with individual digital control system servers located throughout the plant should include 3-hour fire barrier protection between redundant servers performing functions that are important to safety; however, nonsafety-related servers outside the control room complex do not need to be separated by fire barriers from plant areas important to safety, and servers that are important to safety do not need to be protected by detection and suppression unless required by the fire hazards analysis.	Conform	Building architectural drawings in Section 1.2 show fire barriers as described in Appendix 9A for separating the the module protection system (MPS) divisional equipment.
6.1.5	**Switchgear Rooms** Switchgear rooms containing equipment important to safety should be separated from the remainder of the plant by barriers with a minimum fire rating of 3 hours. Redundant switchgear safety divisions should be separated from each other by barriers with a 3-hour fire rating. Automatic fire detectors should alarm and annunciate in the control room and alarm locally. Cables entering the switchgear room that do not terminate or perform a function should be kept at a minimum to minimize the fire hazard. These rooms should not be used for any other purpose. Automatic fire suppression should be provided consistent with other safety considerations. Fire hose stations and portable fire extinguishers should be readily available outside the area. Some high-voltage electrical equipment (e.g., switchgear and transformers) have the potential for an energetic electrical fault that can damage SSC important to safety. The fire hazards analysis should consider the potential for this type of fault. Equipment should be located to facilitate access for manual firefighting. Drains (see Regulatory Position 4.1.5 of this guide) should be provided to prevent water accumulation from damaging equipment important to safety. Remote, manually actuated ventilation should be considered for venting smoke when manual fire suppression effort is needed. (See Regulatory Position 4.1.4 of this guide.)	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.1.6	**Alternative and Dedicated Shutdown Panels** Barriers having a minimum fire rating of 3 hours should separate panels providing alternative and dedicated shutdown capability from the control room complex. Panels providing alternative and dedicated shutdown capability should be electrically isolated from the control room complex so that a fire in either area will not affect shutdown capability from the other area. The general area housing remote panels important to safety should be provided with automatic fire detectors that alarm locally and alarm and annunciate in the control room. Combustible materials should be controlled and limited to those required for operation. Portable extinguishers and manual hose stations should be readily available in the general area. Locations containing alternative/dedicated shutdown panels must be habitable under fire and postfire conditions that require their use. Habitability should also be addressed for alternative and dedicated shutdown panels protected by or adjacent to areas with gaseous fire suppression systems.	Conform	
6.1.7	**Station Battery Rooms** Battery rooms important to safety should be protected against fires and explosions. Battery rooms should be separated from each other and from other areas of the plant by barriers having a minimum fire rating of 3 hours inclusive of all penetrations and openings. These battery rooms should not house dc switchgear and inverters. Automatic fire detection should alarm and annunciate in the control room and alarm locally. Battery room ventilation systems should be capable of maintaining the hydrogen concentration well below 2 percent. Loss of ventilation should be alarmed in the control room. Standpipes, hose stations, and portable extinguishers should be readily available outside the room.	Conform	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.1.8	**Diesel Generator Rooms** Diesel generators important to safety should be separated from each other and from other areas of the plant by fire barriers that have a fire-resistance rating of at least 3 hours. Diesel generators that are not important to safety should be separated from plant areas containing equipment and circuits important to safety by fire barriers that have a fire-resistance rating of at least 3 hours. Automatic fire suppression should be installed to suppress or control any diesel generator or lubricating oil fires. Such systems should be designed to operate without affecting the diesel when it is running. Automatic fire detection should alarm and annunciate in the control room and alarm locally. Hose stations and portable extinguishers should be readily available outside the area. Drainage for firefighting water should be provided and a means for local manual venting of smoke should be considered. Day tanks with a total capacity of up to 4,164 L (1,100 gal) may be located in rooms with diesel generators important to safety under the following conditions: a) The day tank is located in a separate enclosure with a fire-resistance rating of at least 3 hours, including doors or penetrations. These enclosures should be capable of containing the entire contents of the day tanks and should be protected by an automatic fire suppression system. b) The day tank is located inside the diesel generator room in a diked enclosure that has sufficient capacity to hold 110 percent of the contents of the day tank or is drained to a safe location.	Conform	
6.1.9	**Pump Rooms** Pump houses and rooms housing redundant pump trains important to safety should be separated from each other and from other areas of the plant by fire barriers having at least 3-hour ratings. These rooms should be protected by automatic fire detection and suppression unless a fire hazards analysis can demonstrate that a fire will not endanger other equipment required for safe plant shutdown. Fire detection should alarm and annunciate in the control room and alarm locally. Hose stations and portable extinguishers should be readily accessible. Equipment pedestals, curbs, and floor drains should be provided to prevent water accumulation from damaging equipment important to safety. (See Regulatory Position 4.1.5 of this guide.) Provisions should be made for manual control of the ventilation system to facilitate smoke removal if required for manual firefighting operation. (See Regulatory Position 4.1.4 of this guide.)	Conform	
6.2	**Other Areas** Other areas within the plant may contain hazards or equipment that warrant special consideration related to fire protection, including areas containing significant quantities of radioactive materials, yard areas containing water supplies or systems important to safety, and the plant cooling tower.	Information Statement	

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.2.1	**New Fuel Areas** Portable hand extinguishers should be located near this area. Also, hose stations should be located outside but within hose reach of this area. Automatic fire detection should alarm and annunciate in the control room and alarm locally. Combustibles should be kept to a minimum in the new fuel area. The storage area should be provided with a drainage system to prevent accumulation of water. The storage configuration of new fuel should always be maintained to preclude criticality for any water density that might occur during fire-water application.	Alternate Conformance	When new fuel is received on site it is brought into the reactor building and moved into the reactor pool. Areas through which the fuel moves are protected by sprinklers in addition to availability of fire hoses.
6.2.2	**Spent Fuel Areas** Local hose stations and portable extinguishers should provide protection for the spent fuel pool. Automatic fire detection should alarm and annunciate in the control room and alarm locally. Regulatory Guide 1.191 provides additional guidelines for fire protection of spent fuel areas for permanently shutdown reactors where removal of the spent fuel to an independently licensed storage facility is incomplete.	Conform	COL Applicant (licensee will address fire protection for a permanently shutdown facility)
6.2.3	**Radwaste Building, Radwaste Storage Areas and Decontamination Areas** Radioactive waste buildings, storage areas, and decontamination areas should be separated from other areas of the plant by fire barriers having at least 3-hour ratings. Automatic sprinklers should be used in all areas where combustible materials are located. Alternatively, manual hose stations and portable extinguishers (handheld and large-wheeled units sized according to the hazards) are acceptable. Automatic fire detection should annunciate and alarm in the control room and alarm locally. Ventilation systems in these areas should be capable of being isolated to prevent the release of radioactive materials to other areas or the environment. Water from firefighting activities should drain to liquid radwaste collection systems. Materials that collect and contain radioactivity, such as spent ion exchange resins, charcoal filters, and HEPA filters, should be stored in closed metal tanks or containers that are located in areas free from ignition sources or combustibles. These materials should be protected from exposure to fires in adjacent areas as well. Requirements for removal of decay heat from entrained radioactive materials should be considered.	Conform	COL Applicant (to address decontamination areas of Annex Building)
6.2.4	**Independent Spent Fuel Storage Areas** The requirements of 10 CFR 72.122(c) address fire protection of dry cask storage and other independent spent fuel storage facilities. The fire protection provided for these facilities should be commensurate with the potential fire hazards and with the potential for an unacceptable release of radiation during and following a fire. In addition to the requirements of 10 CFR Part 72, fire protection for independent spent fuel storage installations should ensure that fires involving such installations will not impact plant operations and plant areas important to safety.	Conform	COL Applicant (licensee will address fire protection for independent spent fuel storage installations)

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
6.2.5	**Water Tanks Important to Safety** Storage tanks that supply water for safe shutdown should be protected from the effects of an exposure fire. Combustible materials should not be stored next to outdoor tanks.	Conform	Water storage tanks are not required for safe shutdown.
6.2.6	**Cooling Towers** Cooling towers should be constructed of noncombustible materials or be located and protected in such a way that a fire will not adversely affect any systems or equipment important to safety. Cooling towers should be of noncombustible construction when the basins are used for the ultimate heat sink or for the fire protection water supply. For the latter, provisions should be made to ensure a continuous supply of fire protection water whenever the cooling tower basin is drained for cleaning or other maintenance.	Conform	Cooling towers are remote from plant structures and do not provide water for fire protection or UHS.
7.	**Protection of Special Fire Hazards Exposing Areas Important to Safety**		
7.1	**Reactor Coolant Pump Oil Collection** External RCPs with oil lubrication systems should be equipped with an oil collection system if the containment is not inerted during normal operation. The oil collection system should be designed, engineered, and installed to ensure that failure will not lead to fire during normal or design-basis accident conditions and that the system will withstand the safe-shutdown earthquake.	N/A	The design does not use reactor coolant pumps.
7.2	**Turbine Generator Building** The turbine building should be separated from adjacent structures containing equipment important to safety by a fire barrier with a rating of at least 3 hours. The fire barriers should be designed to maintain structural integrity even in the event of a complete collapse of the turbine structure. Openings and penetrations in the fire barrier should be minimized and should not be located where the turbine oil system or generator hydrogen cooling system creates a direct fire exposure hazard to the barrier. Considering the severity of the fire hazards, defense in depth may dictate additional protection to ensure barrier integrity, and the potential effect of a major turbine building fire on the ability to maintain operator control of the plant and safely shut down should be evaluated.	Conform	Turbine Building is a separate structure separated by 3-hour barriers (FHA, Rev B, Table 9-4)
7.2.1	**Oil Systems** Turbine buildings contain large sources of combustible liquids, including reservoirs and piping for lube oil, seal oil, and electrohydraulic systems. These systems should be separated from systems important to safety by 3-hour rated barriers. Additional protection should be provided on the basis of the hazard or where fire barriers are not provided. (See Regulatory Position 2.1.3 of this guide.)	Conform	Important to safety equipment is not located in the Turbine Building.
7.2.2	**Hydrogen System** Turbine generators may use hydrogen for cooling. Hydrogen storage and distribution systems should meet the guidelines in Regulatory Position 7.5 of this guide.	N/A	No hydrogen for cooling planned in the Turbine Building.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
7.2.3	**Smoke Control** Smoke control should be provided in the turbine building to mitigate potential heavy smoke conditions associated with combustible liquid and cable fires. Regulatory Position 4.1.4 provides specific guidance.	Conform	
7.3	**Station Transformers** Transformers installed inside fire areas containing systems important to safety should be of the dry type or insulated and cooled with noncombustible liquid. Transformers filled with combustible fluid that are located indoors should be enclosed in a transformer vault. NFPA 70 offers additional guidance. Outdoor oil-filled transformers should have oil spill confinement features or drainage away from the buildings. Such transformers should be located at least 15.2 m (50 ft.) distant from the building, or building walls within 15.2 m (50 ft.) of oil-filled transformers should be without openings and have a fire-resistance rating of at least 3 hours.	Conform	Station transformers are in the yard.
7.4	**Diesel Fuel Oil Storage Areas** Diesel fuel oil tanks with a capacity greater than 4,164 L (1,100 gal) should not be located inside buildings containing equipment important to safety. If aboveground tanks are used, they should be located at least 15.2 m (50 ft.) from any building containing equipment important to safety, or if located within 15.2 m (50 ft.), they should be housed in a separate building constructed with materials having a minimum fire-resistance rating of 3 hours. Potential oil spills should be confined or directed away from buildings containing equipment important to safety. Totally buried tanks are acceptable outside or under buildings. (See NFPA 30 for additional guidance.) An automatic fire suppression system should protect aboveground oil storage, including those tanks located in a separate building.	Conform	Outside storage planned.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
7.5	**Flammable Gas Storage and Distribution** Bulk gas storage (either compressed or cryogenic) should not be permitted inside structures housing equipment important to safety. Storage of flammable gas such as hydrogen should be located outdoors or in separate, detached buildings so that a fire or explosion will not adversely affect any systems or equipment important to safety. Care should be taken to locate high-pressure gas storage containers with the long axis parallel to building walls. This will minimize the possibility of wall penetration in the event of a container failure. Acetylene-oxygen gas cylinder storage locations should not be in areas that contain or expose equipment important to safety or the fire protection systems that serve those equipment areas. NFPA 55 provides additional guidance. Risks to equipment important to safety from hydrogen supply systems can be minimized by designing hydrogen lines in plant areas important to safety to seismic Category I requirements, sleeving the piping such that the pipe is directly vented to the outside. Risks can also be minimized through the use of restricting orifices or excess flow valves to limit the maximum flow rate from the storage facility to the areas of concern so that, in case of a line break, the hydrogen concentration in the affected areas will not exceed 2 percent. This approach includes preoperational testing and subsequent retesting of excess flow valves and measures to prevent buildup of unacceptable amounts of trapped hydrogen and inadvertent operation with the safety features bypassed. A somewhat less cost-effective alternative involves use of a normally isolated supply with intermittent manual makeup. EPRI NP-5283-SR-A, "Guidelines for Permanent BWR Hydrogen Water Chemistry Installations", provides additional guidelines and criteria for the design, installation, and operation of flammable cryogenic and compressed gas systems.	Conform	In service Hydrogen on the 50 foot level of the reactor building for the CVCS exists in the design. Storage will be in a detached building.
7.6	**Nearby Facilities** The FPP should address plant support facilities (e.g., offices, maintenance shops, warehouses, temporary structures, equipment storage yards), collocated power generating units (e.g., nuclear, coal, natural gas), and nearby industrial facilities (e.g., chemical plants, refineries, manufacturing facilities) to the extent that fires and or explosions in these facilities may affect equipment important to safety. Fire protection systems and features should be adequate to protect against potential exposure fires and explosions from nearby facilities.	Conform	All plant support facilities will be designed using current fire protection codes and standards and will be separated by at least 50 feet

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
8.	**Fire Protection for New Reactors**		
8.1	**General** Many of the current fire protection requirements and guidelines for operating reactors were issued after Commission approval of construction permits and/or operating licenses. The backfit of these requirements and guidelines to existing plant designs created the need for considerable flexibility in the application of the regulations on a plant-by-plant basis. New reactor designs should integrate fire protection requirements, including the protection of safe-shutdown capability and the prevention of radiological release, into the planning and design phase for the plant. In addition, new reactor designs should minimize or eliminate the use of alternative or dedicated shutdown systems and should rely on such systems only when it is not feasible to provide the required protection for redundant safe-shutdown systems, such as in the main control room. Similarly, when practical, reliance on operator manual actions should be avoided. Unless specifically noted otherwise, the guidance in this regulatory guide applies to the FPP for new reactor plants. Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)", provides guidance regarding the scope and content of the COL application for new reactors.	Conform	
8.2	**Enhanced Fire Protection Criteria**_New reactor designs should ensure that safe shutdown can be achieved by assuming that all equipment in any one fire area will be rendered inoperable by fire and that reentry into the fire area for repairs and operator actions is not possible. Because of its physical configuration, the control room is excluded from this approach, provided that the design includes an independent alternative shutdown capability that is physically and electrically independent of the control room. The control room should be evaluated to ensure that the effects of fire do not adversely affect the ability to achieve and maintain safe shutdown. New reactors should provide fire protection for redundant shutdown systems in the reactor containment building that will ensure, to the extent practicable, that one shutdown division will be free of fire damage. Additionally, new reactor designs should ensure that smoke, hot gases, or the fire suppressant will not migrate into other fire areas to the extent that they could adversely affect safe-shutdown capabilities, including operator actions.	Conform	Core basis of new plant fire protection design criteria. The regulatory guidance provided regarding a reactor containment building is applied to the inside of containment and to the fire area immediately outside containment enclosed by the bioshields.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
8.3	**Passive Plant Safe-Shutdown Condition** As discussed in SECY-94-084, the definitions of safe shutdown contained in the Commission's regulations and guidelines do not address the inherent limitations of passive RHR systems. In GDC 34, "Residual Heat Removal," of Appendix A to 10 CFR Part 50, the NRC regulations require that the design include an RHR system to remove residual heat from the reactor core so that specified acceptable fuel design limits are not exceeded. GDC 34 further requires suitable redundancy of the components and features of the RHR system to ensure that the system safety functions can be accomplished, assuming a loss of offsite power or onsite power, coincident with a single failure. Passive reactor designs are limited by the inherent ability of the passive heat removal processes and cannot reduce the temperature of the reactor coolant system below the boiling point of water for heat transfer to occur between the reactor coolant and the heat sink. The plant designs include cooling systems to bring the reactor to cold shutdown or refueling condition; however, these systems are not safety grade. These nonsafety-grade systems (i.e., makeup water to the heat sink and cooldown capability) are necessary to maintain long-term cooling (i.e., beyond 72 hours) and must be capable of accomplishing their respective functions without damage to the fuel as demonstrated by design and analysis. Based on the discussion and recommendations of SECY-94-084, the passive decay heat removal systems should be capable of achieving and maintaining a temperature of 215.6 degrees C (420 degrees F) or below for non-LOCA events. This safe-shutdown condition is predicated on demonstration of acceptable passive safety system performance.	Conform	The NuScale design supports an exemption from the power provisions of GDC 34. As described in Section 3.1.4, the design complies with a NuScale-specific principal design criterion in lieu of GDC 34. The design utilizes the passive decay heat removal system for safe- shutdown below 420 degrees F and does not rely on nonsafety grade systems beyond 72 hours.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position (1)	Conformance (2)	Comment
8.4	**Applicable Industry Codes and Standards** In general, the FPP for new LWR designs should comply with the provisions specified in NFPA 804, "Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants", as they relate to the protection of postfire safe-shutdown capability and the mitigation of a radiological release resulting from a fire. However, the NRC has not formally endorsed NFPA 804, and some of the guidance in the NFPA standard may conflict with regulatory requirements. When conflicts occur, the applicable regulatory requirements and guidance, including the guidance in this regulatory guide, will govern. The standards of record related to the design and installation of fire protection systems and features required to satisfy NRC requirements in all new reactor designs are those NFPA codes and standards in effect 180 days before the submittal of the application under 10 CFR Part 50 or 10 CFR Part 52. For COL applications that reference a certified design, the standards of record will be those approved for the certified design, except for FPP features that are not included in the certified design, such as unique site-specific fire protection systems or equipment. FPP features that are not addressed in the certified design, including the programmatic aspects of the FPP, should be in accordance with those NFPA codes and standards in effect 180 days before the submittal of the COL application.	Conform	
8.5	**Other New Reactor Designs** FPPs for proposed new non-light-water reactor designs should meet the overall fire protection objectives and guidance in the applicable regulations and this regulatory guide as they relate to safe shutdown and radiological release, as well as the specific fire protection requirements that apply. Fire hazards should be identified and evaluated, and an appropriate level of protection provided to meet these objectives. Design reviews and testing programs should confirm the safe-shutdown capability. SSCs important to safe shutdown should be protected in accordance with the enhanced criteria described above for light-water reactors.	N/A	The design utilizes light-water reactor technology..
8.6	**Fire Protection Program Implementation Schedule** SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," dated October 8, 2005, identifies fire protection as an "operation program." However, only those elements of the FPP that will not be implemented fully until the completion of the plant should be addressed as an operational program. These may include, but are not limited to, the fire brigade, combustible and ignition source control program, procedures and prefire plans, and portable extinguishing equipment. The COL application should identify the operational program aspects of the FPP and the implementation schedule for each. In lieu of the implementation schedule, the applicant may propose inspections, tests, analyses, and acceptance criteria for these aspects of the program.	Conform	COL Applicant as described in the introduction to Section 9.5.1.

Table 9.5.1-2: Compliance Table versus RG 1.189 (Continued)

RG Position Number	Regulatory Guide 1.189, Rev. 2, Regulatory Position [1]	Conformance [2]	Comment
8.7	**Fire Protection for Nonpower Operation** The guidance for fire prevention in Regulatory Position 2 of this guide applies to all modes of plant operation, including shutdown. License applications for new reactors should also address any special provisions to ensure that, in the event of a fire during a nonpower mode of operation, the plant can be maintained in safe shutdown.	Conform	COL Applicant (programmatic administrative controls)
9.	**Fire Protection for License Renewal** Licensees may apply for a license renewal to permit continued plant operation beyond the original operating license period of operation, in accordance with the provisions of 10 CFR Part 54. The fire protection licensing and design basis under license renewal should not differ significantly from that in effect before renewal, with the exception that fire protection SSCs must be included in an aging management program as appropriate.	Conform	COL Applicant (future option)

1. The restatement of the Regulatory Positions presented in this table may be abbreviated for brevity.
2. The design conforms to the regulatory positions delineated in RG 1.189 "Fire Protection for Nuclear Power Plants" as indicated by the following terms:
   - COL Applicant - The COL Applicant/Licensee will (also) address the subject regulatory Position
   - Conforms - The design conforms, or supports conformance, with the subject regulatory position.
   - N/A - (Not Applicable): The subject regulatory position is not applicable to the design
   - Alternate Conformance - The design conforms to the subject regulatory position by alternate means or methods.
   - Non-Conformance - The design does not conform with the subject regulatory position or intent of the subject regulatory position. The justification for the position is provided in the "Comments" column.
3. RG 1.189 numbering changed based on NRC memorandum entitled, "Periodic Review of Regulatory Guide 1.189," dated November 27, 2017. (ML17321A047 and ML17321A048)

Figure 9.5.1-1: Fire Protection System Water Supplies and Fire Pumps

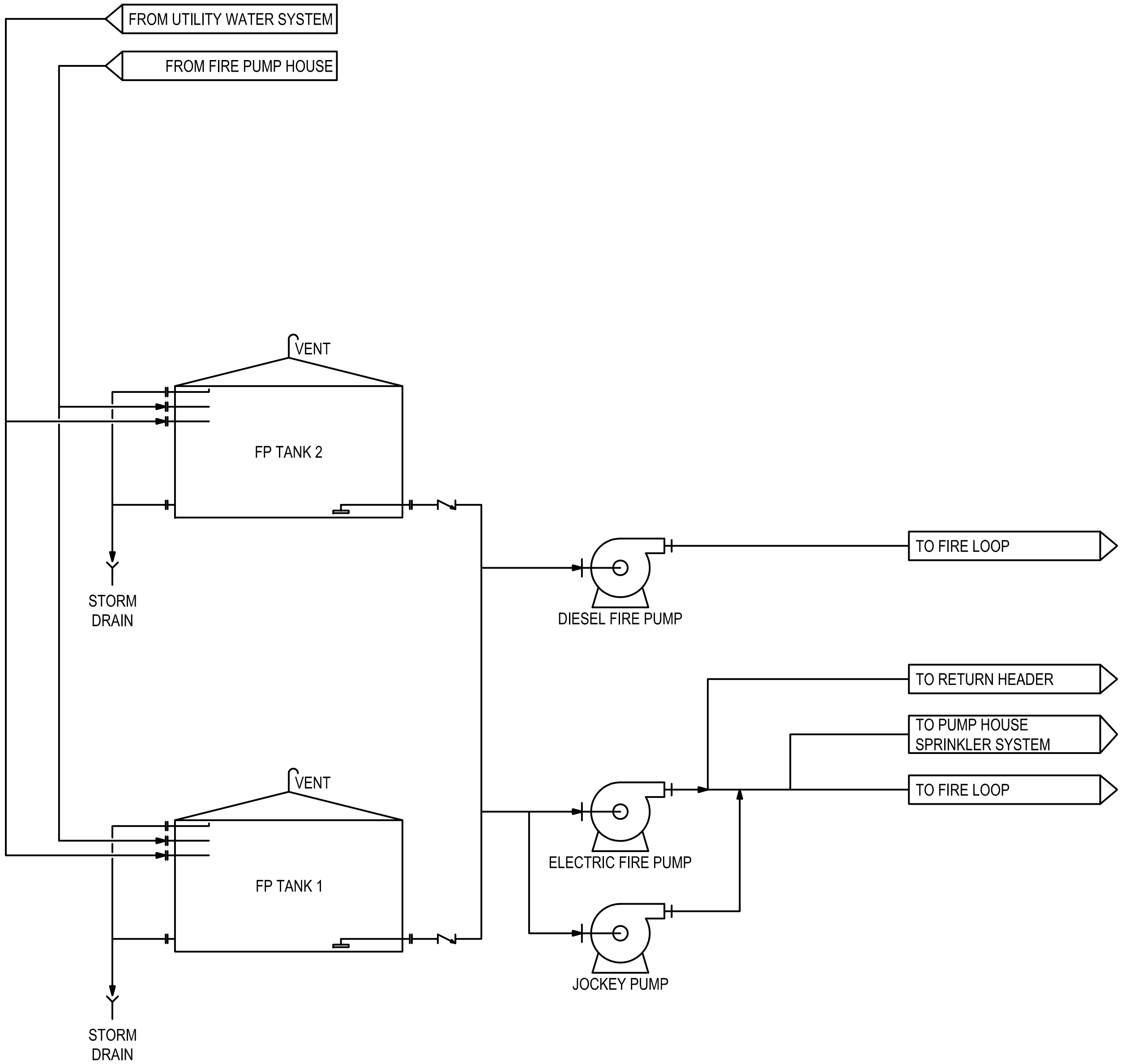
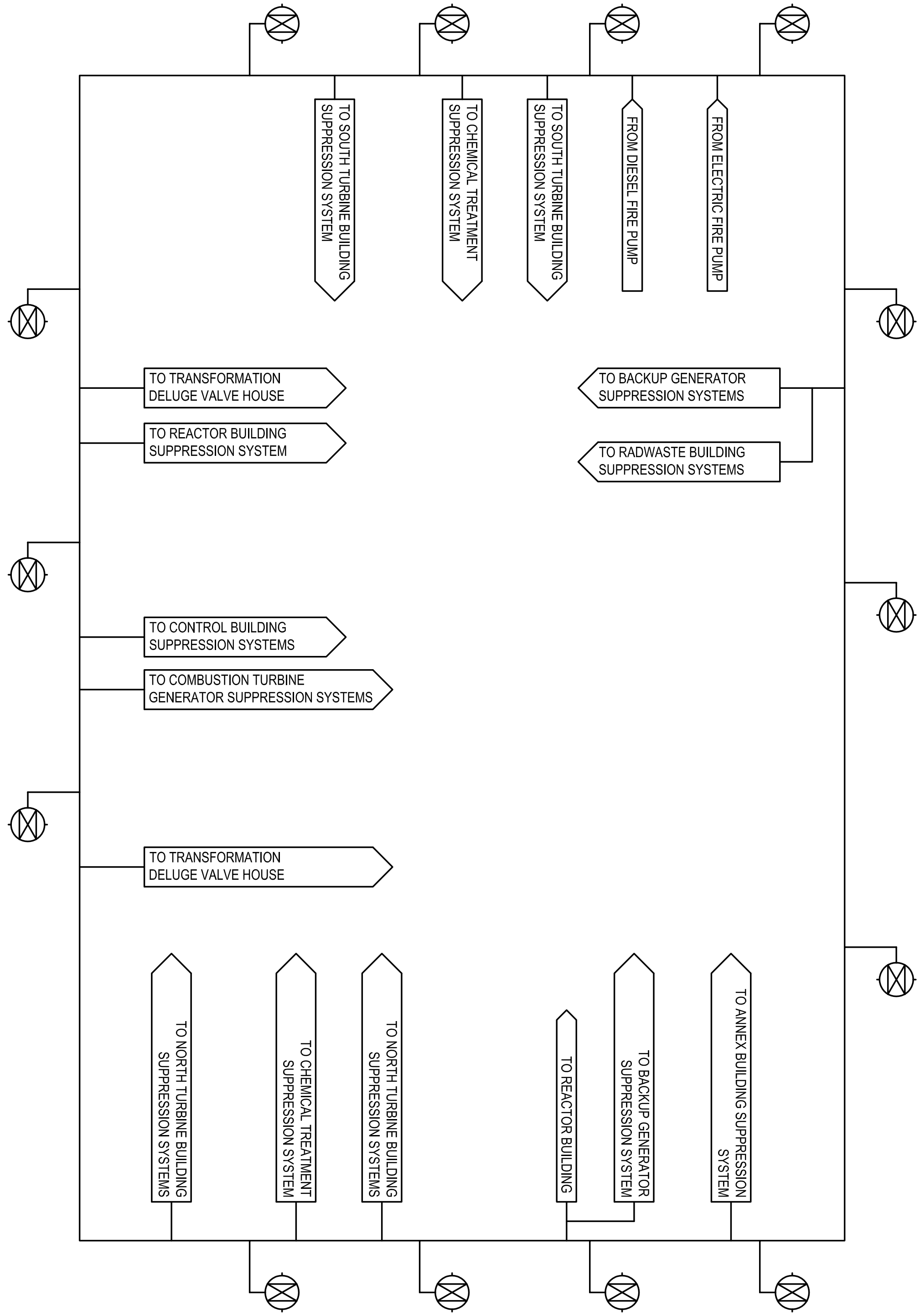


Figure 9.5.1-2: Fire Protection System Yard Fire Main Loop



9.5.2 Communication System

The communication system (COMS) includes components for intra-plant and plant-to-offsite communications. The COMS is designed to provide effective communications between plant personnel in vital areas during normal operations as well as during the full spectrum of accident or incident conditions under maximum potential noise levels.

The COMS is comprised of the following systems:

- private branch exchange
- plant radio
- public address and general alarm
- sound-powered telephone
- distributed antenna
- security communications

9.5.2.1 Design Bases

This section identifies the COMS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure that the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The COMS serves no safety-related functions, is not credited for mitigation of design basis accidents, and has no safe shutdown functions. Each of the COMS systems are independent of one another, therefore, a failure in one system will not disable another system.

General Design Criteria (GDC) 1, 2, 3, 4, and 19 were considered in the design of the COMS.

Consistent with GDC 1, communication equipment and related support equipment are designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

Consistent with GDC 2, the COMS is not relied upon to function during or after a natural phenomena event.

Consistent with GDC 3, communication equipment and related support equipment are designed and located to minimize, consistent with other safety requirements, the probability and effect of fires, smoke effects from fires, and explosions.

Consistent with GDC 4, the COMS is not required to function during or after events that result in the generation of missiles, pipe whipping, or discharging fluids.

Consistent with PDC 19, COMS equipment at locations outside the main control room (MCR) is provided with the capability to support onsite and offsite communications during all normal and emergency operating conditions.

Consistent with Appendix E to 10 CFR Part 50, Part IV.E(9), provisions for communications are made for emergency facilities and equipment, including one onsite and one offsite communications system; each system having a backup power source.

The COMS telephone private branch exchange system provides onsite communication with an offsite interface to the public switched telephone network for offsite communications. The COMS receives AC electrical power from the EDNS power system which has a battery-backed uninterruptible power supply. Security related COMS systems are powered by the security power system as discussed in the physical security technical report (Reference 9.5.2-2). In addition, fixed and portable satellite communications are provided to meet the 10 CFR 50 Appendix E requirement. Portable satellite communications devices, batteries, and battery chargers are designated for this purpose.

COL Item 9.5-1: A COL applicant that references the NuScale Power Plant design certification will provide a description of the offsite communication system, how that system interfaces with the onsite communications system, as well as how continuous communications capability is maintained to ensure effective command and control with onsite and offsite resources during both normal and emergency situations.

The requirements of 10 CFR 50.34(f)(2)(xxv), regarding Three Mile Island Action Plan Item III A.1.2 requires that details of the onsite technical support center (TSC), and onsite operational support center (OSC) be provided. Design details pertaining to the TSC are provided in Section 13.3. Details of the design pertaining to the OSC are site-specific, as stated in Section 13.3.

Consistent with the requirements of 10 CFR 50.47(b)(6) and 10 CFR 50.47(b)(8) adequate provisions for communications are provided and maintained in the emergency facilities and control room to support the emergency response, including the ability to provide prompt communication among principal response organizations, emergency personnel and to the public.

Consistent with the requirements of 10 CFR 50.55a, SSC related to the COMS are designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the importance of the safety function to be performed.

Consistent with the requirements of 10 CFR 73.45(e)(2)(iii),10 CFR 73.45(g)(4)(i), and 10 CFR 73.45(g)(4)(ii) as related to the COMS, provisions for communications systems and procedures are made and described that support site physical protection including the ability to transmit rapid and accurate security information among onsite forces for routine security operations, assessment of a contingency, response to a contingency, and detection and assessment information to offsite assistance forces.

Consistent with the requirements of 10 CFR 73.46(f), as related to the COMS, communications systems exist whereby each security officer, watchman, or armed response individual on duty is capable of maintaining continuous communication with an individual in each continuously manned alarm station required by paragraph 10 CFR 73.46(e)(5) who shall be capable of calling for assistance from other security officers, watchmen, and armed response personnel and from law enforcement authorities.

COL Item 9.5-2: A COL applicant that references the NuScale Power Plant design certification will determine the location for the security power equipment within a vital area in accordance with 10 CFR 73.55(e)(9)(vi)(B).

Consistent with the requirements of 10 CFR 73.55(j), adequate provisions for communications are made and described that support site security including the capability to establish and maintain continuous communication with onsite and offsite resources to ensure effective command and control during normal and emergency situations.

9.5.2.2 System Description

9.5.2.2.1 General Description

The COMS provides voice communications among site locations and between site and offsite locations. Communication methods include the private branch exchange, a public address and general alarm system, sound-powered telephones, distributed antenna, and radios for point-to-point communication between plant personnel in vital areas of the plant under expected conditions.

Descriptions of the COMS systems are provided in the following.

Private Branch Exchange

The private branch exchange is an intra-plant wireline telephone service. As a COMS system the private branch exchange provides onsite communication with an offsite interface to the public switched telephone network. Telephone terminals are located throughout the plant. Access to the site public address system is afforded using the private branch exchange. Conference calling capability is included in the private branch exchange design. The private branch exchange network is designed with the necessary bandwidth to support peak traffic for normal and emergency plant operations modes.

The private branch exchange design allows for security communications between local law enforcement authorities and the central alarm station and secondary alarm station. The wired telephone private branch exchange access network is internetworked on a fiber optic ring within the protected area boundary. The network between the MCR and the central alarm station and secondary alarm station does not have any terminations outside the protected area boundary.

Plant Radio System

The plant radio system is a digital trunked radio with the capability to provide talk groups to fixed and portable users. This system has the capability to encrypt designated talk groups and provide preemptive priority of use for emergencies.

The plant radio system is designed to provide a talk group exclusively for operations and maintenance personnel. As part of the plant radio system design, this talk group features the ability to override or preempt other calls or channel usage during normal or emergency plant operations. This system is designed to provide additional channels for normal and emergency plant operations modes.

The design of this system accommodates an interface with the public address and general alarm system for paging via the plant radio consoles and portable radios. The plant radio system has a telephone line interface for access to the private branch exchange and the external commercial telecommunications network.

Consistent with the requirements of Regulatory Guide 1.189 Position 4.1.7, the COMS is designed to provide effective communication between plant personnel in vital areas during fire conditions under maximum potential noise levels. Two-way voice communications are necessary for safe shutdown and emergency response in the event of fire. The portable radio communications system used by the fire brigade and other operations personnel in support of safe shutdown operations is designed not to interfere with the communications capabilities of the plant security force. Fixed repeaters, installed to permit use of portable radio communication units, are designed to be protected from fire damage.

Distributed Antenna System

A distributed antenna system (DAS) is provided to distribute multiple frequencies in support of the plant radio system. The DAS incorporates a hybrid fiber optic and coax cable system with broadband amplifiers and antenna to provide access to multiple radio frequencies within buildings and as needed outdoors across the site.

The DAS provides plant radio portable handset signal distribution and coverage throughout the plant site. The DAS design adheres to electromagnetic interference (EMI) / radio frequency interference (RFI) levels based on criteria set in Regulatory Guide 1.180.

Public Address and General Alarm System

The COMS public address and general alarm system is designed with voice capability for plant-wide paging of personnel. The paging system is designed to reach all areas of the plant without any dead areas. Sound intensity levels meet voice intelligibility requirements. Furthermore light strobes actuate in areas where paging notification is actuated. The public address and general alarm system is used to communicate information to plant personnel via the intra-plant wired private branch exchange.

Sound Powered Telephone System

The sound-powered telephone system provides voice service to key locations throughout the plant. This system uses portable sound-power telephones that can plug into local terminal jacks. The system allows uninterrupted communications. The system does not rely on external power supply for operation.

Security Communication

Security utilizes the common site private branch exchange, public address, and sound power phone circuits to facilitate a portion of their communications needs.

Security has a dedicated radio system providing continuous communications between each onsite security officer, watchman, or armed response individual and an individual in each continuously manned alarm station. An additional dedicated radio system provides continuous communications between the two alarm stations and the local law enforcement agency. These radio systems are powered by the security power system (SPS), which is described in the physical security technical report.

9.5.2.2.2 Component Descriptions

The following components comprise the COMS.

Cables

The COMS systems use cabling infrastructure including but not limited to fiber optic, coaxial, data/voice copper cables, and power cabling.

Patch Panels

The COMS systems use fiber optic and data/voice copper cables for cable to electronic equipment interfaces.

Switches

The COMS private branch exchange system utilizes access switches to connect telephone sets. The COMS private branch exchange system utilizes an applications specific voice-over-internet-protocol switch.

Servers

The COMS private branch exchange system use an applications specific unified communications server for system databases and applications.

Radio Transceivers

A central base station transceiver and multiple portable and mobile transceivers are integral to the COMS plant radio design. The COMS fixed and portable satellite communications systems utilize transceivers.

Antennas

Application specific antennas are employed in the COMS plant radio design. The DAS system uses broadband antennas for distributing multiple frequency channels. The COMS fixed and portable satellite communications systems use application specific antennas.

Public Address and General Alarm System Audio Amplifiers and Loud Speakers

The COMS public address and general alarm system uses audio amplifiers to distribute voice and alarm audio to loud speakers. Application audio loud speakers are used to broadcast voice and alarm audio.

Equipment Cabinets

Electronic equipment cabinets are used to house equipment such as amplifiers, transceivers, routers, switches, and patch panels.

9.5.2.2.3 System Operation

Normal Operation

The functionality of the COMS systems operation is checked as part of normal daily usage.

Voice and data communications systems and equipment are provided to support all phases of plant operations and maintenance, including emergency operations.

Portable, wireless communication capability is provided using equipment supported by base stations, antennas, amplifiers, and repeaters. This is the primary, dedicated means of communication among control room operators, equipment operators, radiation protection, and maintenance technicians for routine and emergency operations, including surveillance tests, startup and shutdown operations, refueling, job coverage, and emergency or accident conditions. Portable communication equipment used with respiratory protection gear are designed and selected in accordance with EPRI-6559 (Reference 9.5.2-1).

The COMS provides channel capacity to support peak traffic during all operational conditions. Communication channels are provided and accommodate the expected message load including task requirements in critical or emergency situations, plus allowing margin for expansion and contingency. The system provides the capability for open channel, or "party line" communication to support up to five different stations with continuous communication on an open line (e.g., a fire brigade or other emergency response team).

The COMS functions in all ambient noise level environments. The equipment allows communication from high-noise areas consistent with performing other tasks in those areas. Adequate means are provided to alert personnel to the use of communication equipment. For example, the COMS includes visual or vibra-tactile alerting as well as audible signals for hand-held communication devices, as needed.

The COMS does not adversely impact other plant systems with EMI and RFI. The system is designed in consideration of Regulatory Guide 1.180, which identifies electromagnetic environment operating envelopes, design, installation, and test practices for addressing the effects of EMI, RFI, and power surges on instrumentation and controls systems and components.

COMS equipment is designed to operate reliably within the environment in which it is installed including environmental conditions such as temperature, humidity, radiation, and noise. Furthermore the COMS is designed to operate taking into account placement of barriers such as shield walls. COMS equipment is accessible to personnel for operation, inspection, maintenance, and testing.

Human factors engineering principles including function and task analyses are applied relative to the design of the COMS.

Human-system interface evaluations of the design of individual communication devices and stations are performed to verify adequacy of equipment controls, labeling, and operating procedures. These evaluations take into account noise, and the use of protective masks or clothing in order to ensure the ability to communicate with personnel onsite and offsite.

The results of this evaluation include:

- development of a communication frequency allocation plan which defines the frequencies used by wireless transmission systems, thereby ensuring that there is no interference with other transmission and communication systems on or offsite, and
- ensuring compatibility with EMI/RFI qualification and protection measures employed in the design of electronic and computer systems.

Off-Normal Operation

The COMS will fail in a predictable manner with failure alarms alerting users to failed or degraded COMS status. The COMS are checked for functionality as part of daily usage; therefore COMS degradation is self-revealing.

System Shutdown

COMS systems do not require that a specific sequence of shutdown actions be performed. Each COMS system is independent of the other and a failure in one system will not degrade the performance of the other systems.

9.5.2.3 Safety Evaluation

The COMS serves no safety-related or risk-significant functions. It is not credited for mitigation of design basis accidents and has no safe-shutdown functions.

Consistent with GDC 1 and 10 CFR 50.55a, COMS structures, systems, and components are designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Recognized codes and standards are identified and evaluated to determine their applicability, adequacy, and sufficiency and supplemented or modified as necessary to assure a quality product in keeping with the required safety function. The COMS is classified as a non-Class 1E system which serves no safety-related function.

Consistent with GDC 2, portions of the COMS whose structural failure could adversely affect the function of Seismic Category I SSC are designed to Seismic Category II requirements in accordance with Section 3.2.1.2.

Consistent with GDC 3, the COMS systems are designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Section 9.5.1 evaluates the fire protection features. Table 3.2-1 classifies the COMS as nonsafety-related. The COMS provides two-way voice communications to support safe shutdown and emergency response in the event of fire. The plant radio system complies with Regulatory Guide 1.189, Regulatory Position 4.1.7, in that the communications system design provides effective communications between plant personnel in all vital areas during fire conditions under maximum potential noise levels.

Consistent with GDC 4, the COMS is not required to function during or after events that result in the generation of missiles, pipe whipping, or discharging fluids. The COMS is a nonsafety-related and nonrisk-significant system and does not interface with any safety-related or risk-significant SSC.

The three COMS subsystems (public address and general alarm system, private branch exchange, and plant radio systems) are physically independent. These systems serve as a backup to one another in the event of system failure as a result of natural phenomena, environmental or dynamic effects, and fires. The three independent voice communications systems are designed and installed to provide assurance that any single event does not cause a complete loss of intra-plant communication.

GDC 5 was considered in the design of the COMS. The COMS is designed to provide effective communications between plant personnel in vital areas during normal operations as well as during the full spectrum of accident or incident conditions under maximum potential noise levels. A failure in a COMS subsystem will not significantly impair the ability of the other COMS subsystems to perform, including in the event of an accident in one NuScale Power Module and an orderly shutdown and cooldown of the remaining NuScale Power Modules.

PDC 19 requires that an MCR be provided from which actions can be taken to operate the plant safely under normal conditions and to maintain it in a safe condition under accident conditions. PDC 19 is not directly applicable to the communications systems. The NuScale Power Plant design allows for safe shutdown without operator action. Therefore, the communications systems need not be credited in evaluating compliance with PDC 19. However the various independent and diverse communications systems located in the MCR significantly increase the overall command and control the reactor operators have over the plant by providing the ability to communicate and direct activities with operations, maintenance, health physics, firefighters, security, and rescue teams. The NuScale Power Plant has an independent plant radio system for security purposes. Other communications systems such as the public address and general alarm system and private branch exchange are available as alternate means, if necessary.

Consistent with the requirements of 10 CFR Part 50, Appendix E, IV.E(9), provisions are made for emergency facilities and equipment, which includes at least one onsite and one offsite communications system, with a backup power source. The public address and general alarm system, private branch exchange, sound-powered telephone system, and the plant radio system provide onsite communications capability. The private branch exchange and plant radio system are capable of providing offsite communications. These systems are powered by diverse nonsafety-related EDNS power supplies.

The failure of any communications system does not adversely affect safe shutdown capability. It is not necessary for plant personnel in safety-related areas of the plant to communicate with the MCR in order to achieve safe shutdown of the plant. There are four independent voice communications systems for support onsite and the failure of any or all of their components do not affect any safety-related equipment. There are two COMS systems that provide offsite communications. Since there are at least one onsite and offsite communications systems with backup power sources the COMS design complies with the requirements of 10 CFR Part 50 Appendix E.IV.E(9).

Consistent with the requirements of 10 CFR 50.34(f)(2)(xxv), regarding Three Mile Island Action Plan Item III A.1.2, and the requirements of 10 CFR 50.47(b)(6) and 10 CFR 50.47(b)(8) adequate provisions for communications are provided and maintained in the emergency facilities and control room to support the emergency response, including prompt communication among principal response organizations to emergency personnel and to the public. As stated in Section 13.3, the design of the TSC is compliant with the requirements of NUREG-0696 "Functional Criteria for Emergency Response Facilities." The central alarm station and secondary alarm station maintain the ability to provide continuous communications with onsite and offsite resources. The TSC and OSC are equipped with voice communications such as private branch exchange, public address and general alarm system, plant radio, and sound-powered telephone systems, which provide communications between the TSC and OSC and plant, local, and offsite emergency response facilities, the Nuclear Regulatory Commission, and local and state operations centers. Details of the OSC design are site-specific, as stated in Section 13.3.

10 CFR 73.45(e)(2)(iii) requires that communications systems and procedures provide for notification of an attempted unauthorized or unconfirmed removal of strategic special nuclear material. The design of the COMS employs a completely independent plant radio system for security communications purposes. Other communications systems such as the public address and general alarm system, private branch exchange, and plant radio are available as alternate means, if necessary. The application of these communications systems for security purposes is described in the physical security technical report under conformance to 10 CFR 73.55.

10 CFR 73.45(g)(4)(i) requires rapid and accurate transmission of security information among onsite forces for routine security operation, assessment of a contingency, and response to a contingency. Communications networks are provided to transmit rapid and accurate security information among onsite forces for routine security operation, assessment of a contingency, and response to a contingency. The design of the COMS employs a completely independent plant radio system for security communications purposes. The public address and general alarm system, private branch exchange, and

plant radio systems are physically independent systems which can serve as backup in the event of failure of the security communication (radio) system. The application of these communications systems for security purposes is described in the physical security technical report under conformance to 10 CFR 73.55.

10 CFR 73.45(g)(4)(ii) requires the transmission of rapid and accurate detection and assessment information to offsite forces. The COMS private branch exchange system provides onsite communication with an offsite interface to the PSTN for offsite communications. Furthermore, the plant radio system is capable of providing offsite communications. These systems are powered by diverse nonsafety-related EDNS power supplies. The private branch exchange, and plant radio system are physically independent systems which can serve as backup to each other in the event of a failure of an offsite communication system. In addition the design of the COMS employs a completely independent plant radio system for security communications purposes. The application of these communications systems for security purposes is described in the physical security technical report under conformance to 10 CFR 73.55.

Consistent with the requirements of 10 CFR 73.46(f), communications systems allow security officers and watchmen on duty to maintain continuous communications with personnel in manned alarm stations, and offsite and onsite resources as required by 10 CFR 73.55. This is accomplished by either the private branch exchange or wireless communications systems backed by the public address and general alarm system. The public address and general alarm system, private branch exchange, and plant radio system are physically independent systems powered from the EDNS. These three independent voice communications systems are designed and installed to provide assurance that any single event does not cause a complete loss of intra-plant communication. The application of these communications systems for security purposes is described in the physical security technical report under conformance to 10 CFR 73.55.

Consistent with the requirements of 10 CFR 73.55(j), provisions for communications are made and described that support site security including the capability to establish and maintain continuous communication with onsite and offsite resources to ensure effective command and control during normal and emergency situations.

The COMS has a completely independent plant radio system for security purposes that is capable of maintaining continuous communication capability with onsite and offsite resources to ensure effective command and control during both normal and emergency situations. The plant radio security system is powered by the security power system which is site-specific, as presented in the physical security technical report. The public address and general alarm system, private branch exchange, and plant radio systems are physically independent systems and can serve as backup to the plant radio security system in the event of a failure. The public address and general alarm system, private branch exchange, and plant radio systems are powered from the EDNS. The plant sound-powered telephone is a diverse system that does not require external power. These systems serve as a backup to one another in the event of system failure. These four independent voice communications systems are designed and installed to provide assurance that any single event does not cause a complete loss of intra-plant communication. The combination of the plant radio security system with the public address and general alarm system, private branch exchange, plant radio and sound-powered systems ensures that the capability to maintain continuous communication with onsite and offsite resources and effective command and control during normal and emergency situations exists in compliance with 10 CFR 73.55(j).

9.5.2.4 Inspection and Testing

The COMS is subject to preoperational and startup testing in accordance with the requirements of Section 14.2. Inspection and inservice testing of security system SSC is performed in accordance with Section 14.3.

The methodology associated with the development of Inspections, Tests, Analyses, and Acceptance Criteria is presented in Section 14.3.

9.5.2.5 References

9.5.2-1 Electric Power Research Institute, "Voice Communication Systems Compatible with Respiratory Protection," NP-6559, EPRI, November 1989.

9.5.2-2 NuScale Power, LLC, “NuScale Design of Physical Security Systems,” TR-0416-48929, Revision 1.

9.5.3 Lighting Systems

The plant lighting system (PLS) provides artificial illumination for buildings, rooms, spaces, and outdoor areas of the plant. The PLS includes the following lighting functions:

- normal plant lighting
- emergency plant lighting
- normal and emergency main control room (MCR) lighting

The physical security system within the nuclear island and structures (Reactor Building and Control Building) will rely on normal plant lighting and emergency plant lighting to support the successful implementation of security functions. The physical security technical report (Reference 9.5.3-1) provides additional discussion on lighting.

9.5.3.1 Design Bases

This section identifies the PLS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

The PLS is non-Class 1E. Normal plant lighting and emergency lighting do not perform safety-related functions during or after a design basis accident. Failure of the PLS does not compromise automatic actuation of nuclear safety-related systems, nor does it prevent safe shutdown of the reactor.

The plant illumination levels provided by the PLS are in accordance with the applicable lighting levels specified in NUREG-0700.

Lighting fixtures or switches that contain mercury are not used in nuclear fuel handling areas. The design of the lighting system for areas containing rotating equipment includes provisions to eliminate the risk of stroboscopic effects caused by flicker. Normal and emergency lighting circuits are fed from their respective lighting panels.

Plant lighting system cables meet the flame propagation criteria of IEEE Standard 1202, as specified in RG 1.189, and use zero halogen, low-smoke insulation, jacket and filler material. Plant lighting system cables inside buildings do not use polyvinyl chloride or neoprene insulation or jacket material.

Lighting fixtures in the MCR, remote shutdown station, and in areas containing safety-related structures, systems, and components are mounted to meet Seismic Category II requirements to ensure that their failure does not reduce the functional reliability of safety-related equipment, result in incapacitating injury to control room occupants, or render the control room uninhabitable.

9.5.3.2 System Description

Normal Plant Lighting

Normal plant lighting provides artificial illumination for outdoor areas on the plant site and for plant buildings, including:

- Reactor Building
- Control Building
- Turbine Generator Buildings
- Fire Water Building
- Radioactive Waste Building
- Diesel Generator Building
- Security Buildings
- Administration and Training Building
- Annex Building
- Central Utilities Building

Normal plant lighting also provides power to the cathodic protection system and other miscellaneous nonsafety-related loads.

Normal plant lighting provides an independent electrical distribution system that is powered by the low voltage AC electrical distribution system (ELVS) described in Section 8.3.1. Two nonsafety-related divisions of ELVS supply 480V AC power to the PLS lighting transformers, which supply 208/120V AC three-phase power or 120V single-phase power to the PLS lighting panelboards and miscellaneous connected plant loads. Major components of the PLS include:

- lighting transformers
- lighting panelboards
- normal lighting fixtures
- emergency lighting fixtures
- PLS cables

The PLS is designed such that power to lighting buses from the ELVS is maintained during normal operation and maintenance outages, unless the maintenance outage requires de-energizing the specific PLS circuits. Circuits to individual lighting fixtures are staggered, to the extent possible, from separate electrical circuits to ensure some lighting is maintained in the event of a circuit failure.

In the event of loss of AC power to the normal PLS, plant lighting is provided by emergency lighting.

Adequate lighting in important areas is ensured by lighting calculations that consider tasks performed in the area and other lighting factors (e.g, reflectance, illumination levels) when calculating required illumination levels. Task area coatings and equipment are also taken into consideration in the lighting calculations. The plant lighting system is capable of delivering at least 100 foot-candles of illumination to the main control room and remote shutdown station seated operator stations and 50 foot-candles of illumination to the panels in the primary operating areas and to the auxiliary panels in the main control room and the remote shutdown station. Lower illumination levels may be used within these areas to ensure more favorable visual conditions, or for areas where critical tasks are not performed.

Emergency Plant Lighting

Emergency lighting outside the control room provides illumination upon loss of normal lighting in plant areas where emergency operations are performed, including the:

- technical support center
- remote shutdown station
- battery rooms
- electrical distribution control panels
- backup diesel generators and their controls
- Fire Water Building

Emergency lighting is sufficient to support required activities, such as fire suppression and safe shutdown, and to illuminate access and egress pathways to safe shutdown areas during a fire.

Emergency lighting located outside of the MCR consists of self-contained, battery-powered fixtures. Lighting calculations confirm the illumination levels are in accordance with the National Electric Code (Reference 9.5.3-3) and the Life Safety Code of the National Fire Protection Association (Reference 9.5.3-4). The types of emergency lighting provided are:

- Life Safety Code 101 emergency lighting with a 1.5 hour battery backup for egress or exiting the area.
- Eight (8) hour emergency lighting that provides illumination for the access and egress routes of alternative safe shutdown equipment. This lighting has an 8 hour battery backup for the path and locations outside the control room to perform necessary actions for equipment necessary to implement the alternative shutdown capability in the event of loss of AC power. As stated in Section 8.4.1, no credit is taken for manual operator actions in the station blackout analysis.
- Eight (8) hour emergency lighting that provides illumination for post-fire safe shutdown activities in areas outside the MCR and RSS needed for operation of safe-shutdown equipment and for access and egress routes to these areas. This lighting provides at least one foot-candle of illumination in these areas in accordance with NFPA 804 (Reference 9.5.3-5). Although Table 14.2-60 includes a component level test for this lighting, no post-fire safe shutdown activities have been identified which would require operation of safe-shutdown equipment.

- Main Control Room MCR emergency lighting. In the event of a loss of AC power, MCR emergency lighting is supplied by 125V DC (battery) power from the common-plant portion of the highly reliable DC power system (EDSS-C) for a minimum of 72 hours.

Circuit breakers supplying power to the self-contained, battery-powered emergency lighting fixtures are locked in the "energized" position to reduce inadvertent operation. Following restoration of AC power, self-contained, battery-powered light units turn off after a time delay to provide adequate time for normal lighting to restart.

Normal and Emergency Main Control Room Lighting

Normal and emergency MCR lighting provides artificial illumination under all operating, maintenance, testing, and emergency conditions. Emergency lighting in the MCR provides the minimum illumination levels consistent with NUREG-0700. Plant illumination levels are summarized in Table 9.5.3-1.

The MCR lighting fixtures are designed to operate on either 120V AC power or 125V DC power, which allows MCR lighting to auto transfer from the normal AC power source to the emergency DC power source in the event of a failure of normal AC power. Normal and emergency lighting circuits are fed from their respective lighting panels, which are physically separated from each other. The MCR lighting circuits that auto transfer from normal to emergency power are transferred to the normal power supply after restoration of power.

The MCR lighting is supported by two divisions of nonsafety-related normal AC power and two divisions of nonsafety-related emergency DC power. Both normal and emergency power circuits to individual lighting fixtures are staggered, to the extent possible, to ensure both MCR normal and emergency lighting is maintained following loss of a circuit.

Normal (AC) MCR lighting power is supplied by the PLS which is powered by the ELVS described in Section 8.3.1. Two nonsafety-related divisions of ELVS (Division 1 and Division 2) supply 480V AC power to the PLS lighting transformers, which supply 120V single-phase power to the MCR lighting panelboards. The ELVS and PLS are nonsafety-related and not risk-significant.

Emergency (DC) MCR lighting power is supplied by the nonsafety-related highly reliable DC power system-common (EDSS-C) described in Section 8.3.2. Two divisions of EDSS-C (Division I and Division II) supply 125V DC power to MCR lighting. The EDSS-C batteries in either division are capable of maintaining MCR emergency lighting at a minimum illumination level of 10 foot-candles at work stations in the main operating area for a minimum of 72 hours following a design basis event.

Semi-indirect, low-glare lighting fixtures are used in the MCR in accordance with human factors engineering requirements.

9.5.3.3 Safety Evaluation

Normal and emergency plant lighting are not required to function in response to a design basis accident. The PLS is not essential for reactor shutdown, containment isolation, or containment and reactor heat removal. The PLS is not essential in preventing significant release of radioactive material to the environment. Failure of normal and emergency lighting does not compromise automatic actuation of nuclear safety-related systems, nor does it prevent safe shutdown of the reactor. Therefore, normal and emergency plant lighting are nonsafety-related, not risk-significant, and not Class 1E. Emergency lighting does provide illumination for operations during emergencies and anticipated operational occurrences.

Lighting units located in the MCR, remote shutdown station, or in the proximity of safety-related components include Seismic Category II supports, which ensure their failure will not reduce the functional reliability of safety-related equipment to unacceptable safety levels, result in incapacitating injury to control room occupants, or render the control room uninhabitable.

9.5.3.4 Inspection and Testing

Preoperational testing of the PLS verifies that the normal lighting system provides illumination under normal plant operating, maintenance, and testing conditions, and that the emergency lighting system provides illumination throughout the station, including areas where emergency operations are performed. Preoperational testing is described in Section 14.2.

Proper operation of the normal PLS is continuously verified during normal plant operations. Functionality of the emergency plant lighting units is periodically verified. The PLS emergency lighting can be tested while the plant is in normal operation without affecting plant operation.

9.5.3.5 Instrumentation Requirements

No special instrumentation is required for the PLS. The MCR emergency lighting and the self-contained, battery-powered plant emergency lighting automatically actuate on the loss of normal plant and MCR lighting.

9.5.3.6 References

9.5.3-1 NuScale Power, LLC, “NuScale Design of Physical Security Systems,” TR-0416-48929, Revision 1.

9.5.3-2 Not used.

9.5.3-3 National Fire Protection Association, “National Electrical Code (NEC),” NFPA 70, 2014 Edition, Quincy, MA.

9.5.3-4 National Fire Protection Association, “Life Safety Code,” NFPA 101, 2015 Edition, Quincy, MA.

9.5.3-5 National Fire Protection Association, "Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants," NFPA 804, 2015 Edition, Quincy, MA.

Table 9.5.3-1: Plant Illumination Levels

Area	Illumination (foot-candles)
Panels, primary operating area, MCR and RSS	50
Auxiliary panels, MCR and RSS	50
Seated Operator Workstations, MCR and RSS	100
Emergency operating lighting, MCR and RSS	10

Appendix 9A Fire Hazards Analysis

9A.1 General Information

9A.1.1 Purpose

This appendix provides a fire hazards analysis and a fire safe shutdown plan (Section 9A.6) that demonstrate the design conforms to GDC 3.

The fire hazards analysis (FHA) demonstrates how fire areas meet the following objectives relative to fire protection:

- prevent fires from starting
- promptly detect, rapidly control, and extinguish fires that occur
- provide protection for structures, systems, and components (SSC) required for safe shutdown so that a fire that is not promptly extinguished by fire suppression activities does not prevent the safe shutdown of the plant

The FHA demonstrates that the plant maintains the ability to perform safe shutdown functions and minimize radioactive material releases to the environment in the event of a fire. The FHA has the following objectives:

- to consider in situ and transient fire hazards
- to determine the effects of a fire in any location in the plant on the ability to safely shut down the reactor or to minimize and control the release of radioactivity to the environment
- to specify measures for fire prevention, detection, suppression, and containment for each fire area containing safety-related and risk-significant SSC, in accordance with NRC guidance and regulations

9A.1.2 Scope

In accordance with NFPA 804 (Reference 9A-1) and Regulatory Guide (RG) 1.189, Revision 2, the FHA considers the following items:

- physical construction and layout of the buildings and equipment, including fire areas and the fire ratings of area boundaries
- inventory of the principal combustibles within each fire subdivision
- description of the fire protection equipment, including detection and alarm systems, and manual and automatic extinguishing systems
- analysis of the postulated fire in each fire area, including its effect on safe shutdown equipment, assuming automatic and manual fire protection equipment does not function
- analysis of the potential effects of a fire on life safety, release of contamination, impairment of operations, and property loss, assuming the operation of installed fire-extinguishing equipment

- analysis of the potential effects of other hazards, such as earthquakes, storms, and floods, on fire protection
- analysis of the potential effects of an uncontained fire that may cause other problems not related to safe shutdown, such as a release of contamination or impairment of operations
- analysis of the post-fire recovery potential
- analysis of the protection of nuclear safety-related systems and components from the inadvertent actuation of or breaks in a fire protection system
- analysis of the smoke control system and the impact smoke can have on nuclear safety and plant operation within each fire area
- analysis of the emergency planning and coordination requirements necessary for effective loss control, including necessary measures to compensate for the failure or inoperability of an active or passive fire protection system or feature

9A.2 Fire Hazards Analysis Methodology

The FHA consists of an assessment of the fire hazards in the following plant structures: Reactor Building (RXB), Control Building (CRB), Radioactive Waste Building (RWB).

No other structures in the plant contain equipment necessary for safe shutdown or have the potential for a radiological release.

In accordance with RG 1.189 and Reference 9A-1, the FHA includes the elements and attributes listed in Table 9A-1. The limitations of this evaluation as they pertain to these features are identified.

9A.3 Fire Hazards Analysis Description

9A.3.1 Nuclear Regulatory Commission Fire Protection Requirements

Fire protection programs for new reactor licensees that submit applications in accordance with 10 CFR 52 are subject to 10 CFR 50.48(a) and the criteria for enhanced fire protection, in accordance with SECY-90-016, SECY-93-087, and SECY-94-084.

SECY-90-016 established enhanced fire protection criteria for evolutionary light water reactors. SECY-93-087 recommended that the enhanced criteria be extended to include passive reactor designs. The Commission approved SECY-90-016 and SECY-93-087 in staff requirements memoranda. SECY-94-084, in part, established criteria defining safe shutdown conditions for passive light water reactor designs. These SECYs are met through compliance with RG 1.189.

9A.3.2 In Situ and Transient Combustibles and Ignition Sources

9A.3.2.1 In Situ Combustibles and Ignition Sources

The FHA is provided to identify in situ hazards and address fire protection features of the facility including fire separation used to protect against the in situ hazards.

The plant, to the extent practicable, is built of non-combustible or limited-combustible materials.

The types of combustibles and ignition sources expected to be located in specific areas throughout the plant are identified in Table 9A-2 and Table 9A-3 respectively. Those listed are intended to be representative of the hazards and not a comprehensive list.

Self-ignition of electrical cables that are qualified in accordance with a nationally recognized standard fire test methodology, such as IEEE 1202 (Reference 9A-6), is not considered credible as long as protective devices (fuses or circut breakers) are provided and analyzed to be properly sized and cables are appropriately derated for ampacity. Therefore, no self-ignited cable fires are postulated as in situ ignition source.

9A.3.2.2 Transient Combustibles

Transient combustibles are those fire hazards that are not commonly found in a space, room, or other location, but may be present in various quantities due to movement of materials, temporary storage, testing, maintenance, or other conditions of normal operation, such as refueling, maintenance, or plant modifications. Fire areas are rated based on a low, medium or high level of transient combustibles based on anticipated activities. Transient combustibles are controlled by fire protection program procedures. (See COL Items in Section 9.5.1.) Typical transient combustibles are listed in Table 9A-4.

Construction materials may involve assorted materials related to construction or installation of system(s) for additional modules. This construction may occur while one or more modules are operating. Dedicated operating areas may contain construction materials but only prior to operation of that area. For example, a module protection system (MPS) room could contain construction materials before the MPS equipment in that room goes into operation, but one the MPS equipment is operating (controlling a reactor), construction materials are not expected to be present. Some areas that contain shared equipment is backed up by redundant safe shutdown equipment in a different area. System construction or installation includes connections, terminations, and importation of relatively small equipment since the walls, floors, and ceilings will be in place, preventing the importation of large equipment skids and tanks. Note that NuScale Power Module (NPM) passage is accommodated by the building design. Construction materials are typically indistinguishable from transient combustibles associated with repair and maintenance of plant systems.

9A.3.2.3 Transient Ignition Sources

Transient ignition sources may be the result of maintenance, repair, or renovation work in the area that results in a temporary source that is brought in to the fire area. A list of transient ignition sources considered in the fire hazards analysis are listed in Table 9A-5.

Self-ignition of electrical cables that are qualified in accordance with a nationally recognized standard fire test methodology is not considered credible as long as protective devices (fuses or circuit breakers) are provided and analyzed to be properly sized, and cables are appropriately de-rated for ampacity. In light of this, self-ignited cable fires are not postulated.

9A.3.3 External Exposure Hazards

In general, external exposure hazards are site-specific and have not been considered in this analysis. Buildings are protected from the effects of external fires in accordance with NFPA 80A (Reference 9A-2).

Exposure hazards may be plant-specific depending on the final location of the plant and arrangement of the nearby structures and support buildings. Intervening combustibles are maintained with a 50-foot spatial separation in accordance with NFPA 804, Sections 8.1 and 8.9, and RG 1.189, Sections C.7.3 and C.7.4.

Programmatic requirements regarding flammable and combustible liquid or gas storage are addressed in Section 9.5.1.

9A.3.4 Fire Detection and Suppression

Fire detection and suppression requirements for fire areas within the plant are provided in Section 9A.5.

The systems are selected considering the following:

- type or Class of hazard
- effect of agent discharge on critical equipment such as thermal shock, continued operability, water damage, over-pressurization, or cleanup
- health hazards

Specific design details and capabilities of the fire detection and suppression system are described in Section 9.5.1.

Where automatic fire suppression systems are required, they are designed and installed in accordance with the guidance provided by RG 1.189 and the applicable NFPA standards. Significant deviations from the requirements of these standards, such as partial suppression system, are justified.

Hazard classifications designated in Section 9A.5 are listed in Table 9A-6 and are in alignment with Chapter 5 of NFPA 13 (Reference 9A-3) and Chapter 6 of NFPA 101 (Reference 9A-7).

9A.3.5 Safety-Related and Risk-Significant System, Structure, or Component Layout

Fire area layout is depicted in the architectural drawings of Section 1.2, and major equipment is discussed in Section 9A.5 for individual fire areas.

9A.3.6 Qualification of Fire Barriers

Fire barriers are qualified in accordance with RG 1.189.

The use of an electrical raceway fire barrier system is minimized, but those that are required are commercially available systems designed and tested based on applicable guidance in Regulatory Guide 1.189.

9A.3.7 Fire Area Construction

Fire areas are defined in RG 1.189 as the portion of a building or plant that is separated from other areas by rated fire barriers adequate for the hazard.

Consistent with Section 9A.3.6, fire area walls, floors, and ceiling are qualified in accordance with RG 1.189.

Architectural drawings in Chapter 1 show the fire barriers in the reactor building, control building, and radioactive waste building. The unique room codes on these drawings are used for fire area identification in the fire hazards analysis (Section 9A.5).

As noted in RG 1.189, new reactor designs should ensure that smoke, hot gases and fire suppressants do not migrate into other fire areas and adversely impact safe shutdown capability. The manner in which this is accomplished by the ventilation systems is described in Sections 9.4.1, 9.4.2, and 9.4.3.

9A.3.8 Manual Fire Suppression

Manual firefighting capability is provided throughout the plant to allow the fire brigade the ability to limit fire damage to SSC. Manual firefighting capability is provided by properly spaced standpipe connections, fire hoses and nozzles, exterior fire hydrants and hose houses, and portable fire extinguishers. Fire brigade training and organization is addressed in Section 9.5.1. The fire brigade is to have access to the appropriate equipment required for the site including large capacity fire nozzles, thermal imaging cameras, hose, and self-contained breathing apparatus.

Due to the inaccessibility and configuration of the fire areas under the bioshields, manual fire suppression capability is not necessary when the module is at power. Specific details regarding the configuration of these areas are discussed in Section 9A.5.

9A.3.9 Impact on Operations

The extent to which an area is expected to impact plant operations is identified in Section 9A.5. As final cable routing information is site-specific, the considerations are limited to the impact of the loss of equipment physically located in the areas.

Details regarding considerations given to the demonstration of safe shutdown following a fire in the plant are described in Section 9A.6.

9A.3.10 Fire Suppression Effects Analysis

The effect of fire suppression system operation, either in response to a fire or a spurious discharge, is minimized by providing suitable protection for equipment that may be compromised by the operation of the fire suppression system.

Areas containing only dry-type electrical equipment installed in 2-hour fire-rated enclosures where no combustible materials are permitted to be stored are not provided with sprinkler coverage in accordance with NFPA 13, Section 8.15.11.2. This minimizes the potential for equipment damage due to spurious fire suppression system actuation.

Facility design ensures that fire water discharge in one area does not impact safety-related equipment in adjacent areas. Internal flooding is addressed in Section 3.4.

Details regarding considerations given to the demonstration of safe shutdown following a fire in the plant are described in Section 9A.6.

9A.3.11 Explosion Prevention

Explosion prevention measures are described in Section 9.5.1.

9A.3.12 Availability of Oxygen

During normal operation, the inside of the containment vessel is maintained at approximately a 1 psia vacuum and a vacuum that cannot sustain a fire.

9A.3.13 Alternative Shutdown

Safe shutdown, including alternative shutdown considerations, following a fire is discussed in Section 9A.6.

9A.4 Conclusion

The FHA demonstrates that the effects of a fire in any location do not preclude safe shutdown of any reactor and that radiological releases are limited as described in Section 9.5.1 and Section 9A.6.

9A.5 Fire Hazards Analysis

9A.5.1 Reactor Building - Fire Area: 010-001, 010-101, 010-201, 010-401, 010-501

Reference Drawing 1.2-10 through 1.2-17

Room Name: Northwest Stair (Stair)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of shaft.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire/smoke in the stair will have limited impact on manual firefighting as there are other stairs that allow access to the level, manual hose stations are located on the floor, and hose stations are located in the stair at the upper levels.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.2 Reactor Building - Fire Area: 010-002, 010-102, 010-202, 010-402, 010-502

Reference Drawing 1.2-10 through 1.2-17

Room Name: Northeast Stair (Stair)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of shaft.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire/smoke in the stair will have limited impact on manual firefighting as there are other stairs that allow access to the level, manual hose stations are located on the floor, and hose stations are located in the stair at the upper levels.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.3 Reactor Building - Fire Area: 010-003, 010-103, 010-203, 010-403, 010-503

Reference Drawing 1.2-10 through 1.2-17

Room Name: Southeast Stair (Stair)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Appliances

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of shaft.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire/smoke in the stair will have limited impact on manual firefighting as there are other stairs that allow access to the level, manual hose stations are located on the floor, and hose stations are located in the stair at the upper levels.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.4 Reactor Building - Fire Area: 010-004, 010-104, 010-204, 010-404, 010-504

Reference Drawing 1.2-10 through 1.2-17

Room Name: Southwest Stair (Stair)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Appliances

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of shaft.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire/smoke in the stair will have limited impact on manual firefighting as there are other stairs that allow access to the level, manual hose stations are located on the floor, and hose stations are located in the stair at the upper levels.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.5 Reactor Building - Fire Area: 010-005

Reference Drawing 1.2-10

Room Name: Reactor Building Elevator (Elevator "A")

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Misc. Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Furniture, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

<u>Postulated Fire:</u>

The elevator hoist way contains a negligible amount of combustible material. In addition, there are no significant ignition sources or fire hazards in the area.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of the elevator for the reactor building.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.6 Reactor Building - Fire Area: 010-006

Reference Drawing 1.2-10

Room Name: 24' West Mechanical Room (Mechanical Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Electrical Cabinets, Lubricants, Oils, Misc. Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Air Compressor, Air Handling Units, Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinet), HVAC Equipment
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Electric Motors, Electric Switchgear, Hot work

Postulated Fire:

The postulated fire for this area would involve transient combustibles. Based on the installed fire detection/ suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room is not likely to have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of MCCs and equipment in the mechanical space.

Operations/ Post-Fire Recovery:

The impact of fire and smoke on post fire operations should be minimal as fire and smoke should be contained within the mechanical room due to the boundaries.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.7 Reactor Building - Fire Area: 010-007

Reference Drawing 1.2-10

Room Name: Pool Cleanup Filter B (Pool Cleanup Filter Rm "A")

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Appliances, Misc. Combustibles, Qualified Electrical Cable

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: Hot Work Fuel & Oxidizer

Transient Ignition: Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of the one of the cleanup filters.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal and should be contained to the area due to the fire barriers and detection alerting the control room of a fire.

9A.5.8 Reactor Building - Fire Area: 010-008

Reference Drawing 1.2-10

Room Name: Pool Cleanup Filter A (Pool Cleanup Filter Rm "B")

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances, Misc. Combustibles, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of the one of the cleanup filters.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal and should be contained to the area due to the fire barriers and detection alerting the control room of a fire.

9A.5.9 Reactor Building - Fire Area: 010-009

Reference Drawing 1.2-10

Room Name: Train B LRW Degasifier Equipment Room (Degasifier Room "B")

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Electrical Cabinets, Lubricants, Oils, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets
Transient Combustibles:	Construction Materials, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault, or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of the degasifier unit B.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations. The degasifier is provided with a redundant system, and fire and smoke should be contained to the room of origin.

Radiological Release:

Fire and smoke impact on radiological release is expected to be minimal, since the room is provided with barriers and fire suppression and detection.

9A.5.10 Reactor Building - Fire Area: 010-012

Reference Drawing 1.2-10

Room Name: Train A LRW Degasifier Equipment Room (Degasifier Room "A")

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Electrical Cabinets, Lubricants, Oils, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault, or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundary and automatic suppression.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of the degasifier unit A.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations. The degasifier is provided with a redundant system, and fire and smoke should be contained to the room of origin.

Radiological Release:

Fire and smoke impact on radiological release is expected to be minimal, since the room is provided with barriers and fire suppression and detection.

9A.5.11 Reactor Building - Fire Area: 010-014

Reference Drawing 1.2-10

Room Name: 24' Northwest Gallery Area (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Electrical Cabinets, Lubricants, Oils, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets,
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical wiring failure. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of sumps, MCCs and equipment in the gallery. The gallery is a large space with limited combustibles, and the combination of suppression, detection and fire barriers should limit damage to the point of origin in the gallery area.

Operations/ Post-Fire Recovery:

Post fire operations are not impaired as fire, smoke and hot gases should be contained to the area.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.12 Reactor Building - Fire Area: 010-015

Reference Drawing 1.2-10

Room Name: 24' North Telecommunication Room (Telecom Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	None

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.13 Reactor Building - Fire Area: 010-016

Reference Drawing 1.2-10

Room Name: 24' Northeast CVCS Ion Exchanger Gallery (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electrical Cabinets, Pump
Transient Combustibles:	Construction Materials, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is an electrical control cabinet. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Unmitigated fire may result in loss of electrical control equipment and wiring for the CVCS for up to six adjacent modules.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression. Damage in the area may initially limit access to the CVCS ion exchange rooms for six modules, but would have minimal effect on overall operation.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.14 Reactor Building - Fire Area: 010-017

Reference Drawing 1.2-10

Room Name: Boric Acid Storage Tank Room (Boric Acid Storage Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Lubricants, Oils, Misc. Combustibles, Misc. wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, Pump
Transient Combustibles:	Construction Materials, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Chemical Reactions, Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is a pump fire resulting from a mechanical failure, or an electrical control cabinet failure. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of the boric acid system.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room. If boric acid addition was rendered in-operable it could result in the controlled shutdown of all 12 reactors until repairs are made.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.15 Reactor Building - Fire Area: 010-018

Reference Drawing 1.2-10

Room Name: 24' Southeast CVCS Ion Exchanger Gallery (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable

In Situ Ignition Sources: Electrical Cabinets, Pump

Transient Combustibles: Construction Materials, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Temporary Electrical Cables

Transient Ignition: Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is an electrical control cabinet. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Unmitigated fire may result in loss of electrical control equipment and wiring for the CVCS for up to six adjacent modules.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression. Damage in the area may initially limit access to the CVCS ion exchange rooms for six modules, but would have minimal effect on overall operation.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.16 Reactor Building - Fire Area: 010-019

Reference Drawing 1.2-10

Room Name: 24' South Telecommunication Room (Telecom Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	None

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.17 Reactor Building - Fire Area: 010-020

Reference Drawing 1.2-10

Room Name: 24' South Gallery Area (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Electrical Cabinets, Lubricants, Oils, Misc. Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables, Vehicles
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is a pump fire resulting from a mechanical failure, or an electrical control cabinet failure. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of sumps, MCCs and equipment in the gallery. The gallery is a large space with limited combustibles, and the combination of suppression, detection and fire barriers should limit damage to the point of origin in the gallery area.

Operations/ Post-Fire Recovery:

Post fire operations are not impaired as fire, smoke and hot gases should be contained to the area, and the area does not contain post-fire shutdown equipment.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.18 Reactor Building - Fire Area: 010-022, 010-023, 010-024, 010-422, 010-423

Reference Drawing 1.2-10 through 1.2-17

Room Name: Reactor Pool Area, Spent Fuel Pool and Dry Dock Area (24' Level Submerged under water)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	Electric Motors
Transient Combustibles:	Construction Materials, Hot Work Fuel & Oxidizer
Transient Ignition:	Hot work

Postulated Fire:

The postulated fire for this area is an electrical fire, or transient fire within the crane. However, the fire would be limited to the crane due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

No significant impact on property loss expected.

Operations/ Post-Fire Recovery:

The area above the reactor pool area included the reactor pool area, spent fuel pool, and re-fueling area. The area extends to the bottom of the building roof at 177'. The reactor pool area is a large open area, and fire and smoke in this area should not impair operations and post fire recovery. Fire and smoke movement beyond the reactor pool area would be restricted by the barriers.

Radiological Release:

Fire and smoke impact on radiological release is expected to be minimal, since the room is provided with hardened fire barriers and fire detection, and the lack of transients and low combustibles.

9A.5.19 Reactor Building - Fire Area: 010-022-01

Reference Drawing 1.2-17

Room Name: Module 1 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Duct smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.20 Reactor Building - Fire Area: 010-022-02

Reference Drawing 1.2-17

Room Name: Module 2 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Duct smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.21 Reactor Building - Fire Area: 010-022-03

Reference Drawing 1.2-17

Room Name: Module 3 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Duct smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.22 Reactor Building - Fire Area: 010-022-04

Reference Drawing 1.2-17

Room Name: Module 4 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

<u>Postulated Fire:</u>

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

<u>Fire Protection Features:</u>

Suppression Systems: None

Detection Systems: Duct smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.

Fire Extinguishers: None

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.23 Reactor Building - Fire Area: 010-022-05

Reference Drawing 1.2-17

Room Name: Module 5 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Duct smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.24 Reactor Building - Fire Area: 010-022-06

Reference Drawing 1.2-17

Room Name: Module 6 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Duct smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.25 Reactor Building - Fire Area: 010-022-07

Reference Drawing 1.2-17

Room Name: Module 7 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Duct smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.26 Reactor Building - Fire Area: 010-022-08

Reference Drawing 1.2-17

Room Name: Module 8 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Duct smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.27 Reactor Building - Fire Area: 010-022-09

Reference Drawing 1.2-17

Room Name: Module 9 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Duct smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.28 Reactor Building - Fire Area: 010-022-10

Reference Drawing 1.2-17

Room Name: Module 10 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Duct smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.29 Reactor Building - Fire Area: 010-022-11

Reference Drawing 1.2-17

Room Name: Module 11 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Duct smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.30 Reactor Building - Fire Area: 010-022-12

Reference Drawing 1.2-17

Room Name: Module 12 Area Beneath Bioshield (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Based on the minimal combustibles (all conductors are of noncombustible construction or in suitable metal conduit, and the use of noncombustible hydraulic fluid) the only postulated fire during power operations would be located in an electrical junction box caused by a deficient connection. However, during an outage there is the potential for a more severe fire involving the introduction of transient combustibles.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Duct smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards. This area is inaccessible during normal operations.
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated. This area is inaccessible during normal operation.

Property Loss:

An unmitigated fire could challenge multiple redundant safety systems. Note: Based on the lack of combustibles under the bioshield a fire under the bioshield is not considered plausible.

Operations/ Post-Fire Recovery:

Unmitigated fire and smoke at the top of the module can potentially affect operation and shutdown of the module and post-fire operation of the module. The NuScale modules do not require the active systems, but may be passively cooled by the reactor pool. The plant systems and operations outside the individual module damaged by the fire should not be affected and allow for post-fire operations for other areas, and allow for other actions to address the impacted module. This is due to a combination of separations, smoke detection to alert the control room and emergency responders, and fire barriers that will restrict fire and smoke

movement beyond the area. Post fire smoke purge is provided as well to aid in post-fire recovery.

Radiological Release:

There is minimal potential for fire or smoke to damage any equipment in the area. The radiological sources in this area will be contained within piping which is not susceptible to fire damage.

9A.5.31 Reactor Building - Fire Area: 010-026

Reference Drawing 1.2-11

Room Name: Module 1 CVCS Recirculation Pump room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

<u>Postulated Fire:</u>

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.32 Reactor Building - Fire Area: 010-027

Reference Drawing 1.2-11

Room Name: Module 2 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, (Instrumentation), Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.33 Reactor Building - Fire Area: 010-028

Reference Drawing 1.2-11

Room Name: Module 3 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.34 Reactor Building - Fire Area: 010-029

Reference Drawing 1.2-11

Room Name: Module 4 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.35 Reactor Building - Fire Area: 010-030

Reference Drawing 1.2-11

Room Name: Module 5 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

<u>Postulated Fire:</u>

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.36 Reactor Building - Fire Area: 010-031

Reference Drawing 1.2-11

Room Name: Module 6 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.37 Reactor Building - Fire Area: 010-032

Reference Drawing 1.2-11

Room Name: Module 12 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, HVAC Equipment, Hydrogen, Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.38 Reactor Building - Fire Area: 010-033

Reference Drawing 1.2-11

Room Name: Module 11 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.39 Reactor Building - Fire Area: 010-034

Reference Drawing 1.2-11

Room Name: Module 10 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

<u>Postulated Fire:</u>

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.40 Reactor Building - Fire Area: 010-035

Reference Drawing 1.2-11

Room Name: Module 9 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.41 Reactor Building - Fire Area: 010-036

Reference Drawing 1.2-11

Room Name: Module 8 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

<u>Postulated Fire:</u>

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.42 Reactor Building - Fire Area: 010-037

Reference Drawing 1.2-11

Room Name: Module 7 CVCS Recirculation Pump Room (Reactor Coolant Filter Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Flammable Gas, Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Hydrogen Fire, Pump
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Motors, Hot work

<u>Postulated Fire:</u>

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault or a lube oil fire resulting from a mechanical fault in a pump motor. Smoke and heat spread to adjacent areas and cabling is not likely due to boundaries and automatic suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of CVCS equipment for one module.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.43 Reactor Building - Fire Area: 010-040

Reference Drawing 1.2-10

Room Name: module 1 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

<u>Postulated Fire:</u>

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.44 Reactor Building - Fire Area: 010-041

Reference Drawing 1.2-10

Room Name: module 2 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Qualified Electrical Cable

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance

Transient Ignition: Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.45 Reactor Building - Fire Area: 010-042

Reference Drawing 1.2-10

Room Name: module 3 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.46 Reactor Building - Fire Area: 010-043

Reference Drawing 1.2-10

Room Name: module 4 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.47 Reactor Building - Fire Area: 010-044

Reference Drawing 1.2-10

Room Name: module 5 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

<u>Postulated Fire:</u>

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.48 Reactor Building - Fire Area: 010-045

Reference Drawing 1.2-10

Room Name: module 6 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.49 Reactor Building - Fire Area: 010-046

Reference Drawing 1.2-10

Room Name: module 12 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.50 Reactor Building - Fire Area: 010-047

Reference Drawing 1.2-10

Room Name: module 11 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.51 Reactor Building - Fire Area: 010-048

Reference Drawing 1.2-10

Room Name: module 10 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.52 Reactor Building - Fire Area: 010-049

Reference Drawing 1.2-10

Room Name: module 9 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.53 Reactor Building - Fire Area: 010-050

Reference Drawing 1.2-10

Room Name: module 8 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.54 Reactor Building - Fire Area: 010-051

Reference Drawing 1.2-10

Room Name: module 7 ion exchanger room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer, Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would potentially lead to the loss of the CVCS for one module. There are redundant systems separated by 3-hour fire rated barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations as fire or smoke should be contained to the area due to the fire barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the fire area boundaries containing any potential release.

9A.5.55 Reactor Building - Fire Area: 010-052

Reference Drawing 1.2-10

Room Name: Pool Cleanup Demineralizer Room 1

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer
Transient Ignition:	Hot work

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of the use of one demin water tank until repairs are completed.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, and suppression

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as contamination levels would be low and fire and smoke should be maintained within the room due to the boundaries, and manual and active suppression.

9A.5.56 Reactor Building - Fire Area: 010-053

Reference Drawing 1.2-10

Room Name: Pool Cleanup Demineralizer Room 3

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Hot Work Fuel & Oxidizer
Transient Ignition:	Hot work

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of the use of one demin water tank until repairs are completed.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, and suppression

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as contamination levels would be low and fire and smoke should be maintained within the room due to the boundaries, and manual and active suppression.

9A.5.57 Reactor Building - Fire Area: 010-054

Reference Drawing 1.2-10

Room Name: Pool Cleanup Demineralizer Room 2

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: Hot Work Fuel & Oxidizer

Transient Ignition: Hot work

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in the loss of the use of one demin water tank until repairs are completed.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, and suppression

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as contamination levels would be low and fire and smoke should be maintained within the room due to the boundaries, and manual and active suppression.

9A.5.58 Reactor Building - Fire Area: 010-106

Reference Drawing 1.2-12

Room Name: Spent Fuel Pool Heat Exchanger Gallery (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Lubricants, Oils, Misc. Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, Switchgear <480 V
Transient Combustibles:	Files, Books, Records, and other paper files, Furniture, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is a pump fire resulting from a mechanical failure, or an electrical control cabinet failure. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire may result in loss of cooling water pumps and heat exchangers for the reactor pool.

Operations/ Post-Fire Recovery:

An unmitigated fire may result in loss of reactor cooling water system and heat exchangers for the reactor pool.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.59 Reactor Building - Fire Area: 010-106-01

Reference Drawing 1.2-12

Room Name: Spent Fuel Pool Heat Exchanger Gallery Pipe Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: Hot work

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: None

Detection Systems: None

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.60 Reactor Building - Fire Area: 010-107, 010-138

Reference Drawing 1.2-12

Room Name: Utilities Area (HVAC AHUs on mezzanine room 010-138)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Lubricants, Oils, Misc. Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, Switchgear <480 V
Transient Combustibles:	Files, Books, Records, and other paper files, Furniture, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is a fan motor fire resulting from a mechanical failure, or an electrical control cabinet failure. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire may result in loss of HVAC AHUs, the loss of one division of CVCS demin water make up supply, and could result in loss of one division of safety-related demin water isolation valves for multiple NPMs. Redundant valves will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

Fire and smoke will have minimal effect on post fire operations as fire and smoke will be contained to the area due to the fire barriers and automatic sprinkler system. The HVAC AHUs are physically separated to reduce the likelihood of losing multiple AHUs. Loss of one division of safety-related demin water isolation valves may impact multiple units on the North side of the plant. The impact could require normal reactor shutdown of affected units.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.61 Reactor Building - Fire Area: 010-112

Reference Drawing 1.2-12

Room Name: 50' North Telecommunications Room (Telecom Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	None

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.62 Reactor Building - Fire Area: 010-114, 010-115, 010-116, 010-117, 010-118, 010-119, 010-120, 010-139

Reference Drawing 1.2-12

Room Name: 50' Northeast CVCS Makeup Pump Gallery (Utilities Area, Heat Exchanger Areas, HVAC AHUs on mezzanine)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Lubricants, Oils, Misc. Combustibles, Misc. wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable, in service CVCS Hydrogen bottles
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, Pump
Transient Combustibles:	Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is an electrical control cabinet failure, pump failure, or transient introduced during repair or maintenance of the equipment. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Unmitigated fire may result in loss of the CVCS for up to six adjacent modules (North side). Unmitigated fire in North Utilities area could result in loss of one division of safety-related demin water isolation valves for up to 6 NPMs. The fire area is separated by 3-hr fire rated barriers so the redundant division of safety-related valves will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression. Damage in the area may limit operation of the CVCS for six modules. Loss of safety-related demin water isolation valves may impact multiple units on the North side of the plant. The impact could require normal reactor shutdown of affected units.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.63 Reactor Building - Fire Area: 010-121, 010-123

Reference Drawing 1.2-12

Room Name: Hot Lab & Chemistry Count Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** EH-1

In Situ Combustibles:	Appliances, Chemicals (Health Hazards), Clothing - Rubber/plastic, Clothing - Textile, Combustible/ Flammable Liquids, Electrical Cabinets, Furniture, Lubricants, Oils, Misc. Combustibles, Misc. Wire & Plastic Components, Oxidizers, Paints, solvents, Paper & Cardboard (Files), Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Heaters, Switchgear <480 V
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Furniture, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Chemical Reactions, Electric Heaters, Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is from an electrical cable failure, or transient fire. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this area would result in the loss of the hot lab.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations as the room does not contain systems required for operation.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.64 Reactor Building - Fire Area: 010-122

Reference Drawing 1.2-12

Room Name: Hot Lab Corridor (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets, Switchgear <480 V
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is an electrical control cabinet failure, or transient fire. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Unmitigated fire could result in loss of one division of safety-related equipment for up to 12 NPMs. The fire area is separated by 3-hr fire rated barriers so the redundant division of safety-related equipment will be unaffected by a fire in this area. Additionally unmitigated fire in this area may result in the loss of multiple motor control centers and elements of the primary sampling system.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room may lead to a loss of a one division of cable going to the CR for all 12 NPMs. Redundant systems will be unaffected by a fire in this area allowing normal shut if required. Normal reactor shutdown may be required until damage is assessed which will impact plant operations.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.65 Reactor Building - Fire Area: 010-125, 010-126, 010-127, 010-128, 010-129, 010-130, 010-131, 010-140

Reference Drawing 1.2-12

Room Name: 50' Southeast CVCS Makeup Pump Gallery (Utilities Area, Heat Exchanger Areas, HVAC AHUs on mezzanine)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Lubricants, Oils, Misc. Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable, in service CVCS Hydrogen bottles
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, Pump
Transient Combustibles:	Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is an electrical control cabinet failure, pump failure, or transient introduced during repair or maintenance of the equipment. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Unmitigated fire may result in loss of CVCS equipment for up to six adjacent modules (South side) including one division of demin water valves. Unmitigated fire in this fire area could result in loss of one division of safety-related demin water isolation valves for 6 NPMs. The fire area is separated by 3-hr fire rated barriers so redundant safety-related valves will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression. Damage in the area may limit operation of the South NPMs, but normal shutdown should be available. Loss of one division of safety-related demin water isolation valves may impact multiple units on the North side of the plant. The impact could require normal reactor shutdown of affected units.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.66 Reactor Building - Fire Area: 010-133

Reference Drawing 1.2-12

Room Name: 50' South Telecommunications Room (Telecom Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable

In Situ Ignition Sources: Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables

Transient Ignition: None

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.67 Reactor Building - Fire Area: 010-134, 010-137

Reference Drawing 1.2-12

Room Name: Reactor Pool Heat Exchanger Gallery (Utilities Area, HVAC AHUs on mezzanine room 010-137)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Furniture, Lubricants, Oils, Misc. Wire & Plastic Components, Paints, solvents, Paper & Cardboard (Files), Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, Switchgear <480 V
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is a pump fire resulting from a mechanical failure, or an electrical control cabinet failure. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire may result in loss of cooling water pumps and heat exchangers for the reactor pool, HVAC AHUs, CVCS demin water make up supply and could result in loss of one division of safety-related demin water isolation valves for multiple NPMs. Redundant valves will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

An unmitigated fire may result in loss of reactor cooling water system and heat exchanges for the reactor pool, which would impact the reactor pool operation. The HVAC AHUs are physically separated to reduce the likelihood of losing multiple AHUs. Loss of safety-related demin water isolation valves may impact multiple units on the South side of the plant. The impact could require normal reactor shutdown of affected units.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.68 Reactor Building - Fire Area: 010-139-01

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 1 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	None
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.69 Reactor Building - Fire Area: 010-139-02

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 2 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	None
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.70 Reactor Building - Fire Area: 010-139-03

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 3 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	None
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.71 Reactor Building - Fire Area: 010-139-04

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 4 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.72 Reactor Building - Fire Area: 010-139-05

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 5 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.73 Reactor Building - Fire Area: 010-139-06

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 6 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.74 Reactor Building - Fire Area: 010-140-07

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 7 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.75 Reactor Building - Fire Area: 010-140-08

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 8 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.76 Reactor Building - Fire Area: 010-140-09

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 9 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.77 Reactor Building - Fire Area: 010-140-10

Reference

Room Name: Vertical Pipe Chase Module 10 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.78 Reactor Building - Fire Area: 010-140-11

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 11 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	None
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.79 Reactor Building - Fire Area: 010-140-12

Reference Drawing 1.2-13

Room Name: Vertical Pipe Chase Module 12 (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and separation from adjacent areas.

Property Loss:

There is minimal chance for fire-induced damage to piping systems.

Operations/ Post-Fire Recovery:

There is minimal impact on post fire operations.

Radiological Release:

Fire and smoke would not have an impact on release of radiation as fire and smoke should be maintained within the chase.

9A.5.80 Reactor Building - Fire Area: 010-206

Reference Drawing 1.2-14

Room Name: Remote Shutdown Station Corridor (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables, Wood, such as pallets, or temporary structures
Transient Ignition:	Electric Motors

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling for the remote shutdown room, or equipment failure. Due to the small quantity of the combustibles and qualified cabling, automatic detection and automatic with manual suppression, the fire is likely to be limited to the immediate area.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

There is minimal equipment shown in this area.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.81 Reactor Building - Fire Area: 010-207

Reference Drawing 1.2-14

Room Name: Remote Shutdown Station (Remote Shutdown Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Furniture, Paper & Cardboard (Files), Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. Due to the small quantity of the combustibles, qualified cabling, and three hour fire barriers the fire is limited to the immediate area.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area., In-cabinet fire detection is provided for control cabinets.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in loss of the remote shutdown room and monitoring equipment in the room.

Operations/ Post-Fire Recovery:

Fire could damage safety-related control room manual isolation switches, if located in RSS. This may require plant shutdown if repairs are not made in the defined time period.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.82 Reactor Building - Fire Area: 010-208, 010-242, 010-275

Reference Drawing 1.2-14

Room Name: 75' Electrical Gallery (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets, Switchgear <480 V
Transient Combustibles:	Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Electric Motors

Postulated Fire:

The postulated fire for this area is a fire resulting from an electrical control cabinet failure. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Unmitigated fire could result in loss of one division of safety-related equipment for 12 NPMs. Additionally Unmitigated fire may result in the loss of multiple motor control centers and accordingly impact the operations of systems that they control. The fire area is separated by 3-hr fire rated barriers so redundant safety-related equipment will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression. Damage in the area may limit operation of the multiple systems controlled by the motor control centers in the area. Loss of one division of safety-related equipment may impact multiple units in the plant. The impacted units could require normal reactor shutdown for assessment.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.83 Reactor Building - Fire Area: 010-209

Reference Drawing 1.2-14

Room Name: Module 1 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.84 Reactor Building - Fire Area: 010-210

Reference Drawing 1.2-14

Room Name: Module 1 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.85 Reactor Building - Fire Area: 010-211

Reference Drawing 1.2-14

Room Name: Module 1 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.86 Reactor Building - Fire Area: 010-211-01

Reference Drawing 1.2-14

Room Name: Module 1 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.87 Reactor Building - Fire Area: 010-212

Reference Drawing 1.2-14

Room Name: Module 1 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets

In Situ Ignition Sources: Batteries, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.88 Reactor Building - Fire Area: 010-213

Reference Drawing 1.2-14

Room Name: Module 1 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.89 Reactor Building - Fire Area: 010-214

Reference Drawing 1.2-14

Room Name: Module 2 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.90 Reactor Building - Fire Area: 010-215

Reference Drawing 1.2-14

Room Name: Module 2 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets

In Situ Ignition Sources: Batteries, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.91 Reactor Building - Fire Area: 010-216

Reference Drawing 1.2-14

Room Name: Module 2 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.92 Reactor Building - Fire Area: 010-216-01

Reference Drawing 1.2-14

Room Name: Module 2 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.93 Reactor Building - Fire Area: 010-217

Reference Drawing 1.2-14

Room Name: Module 2 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.94 Reactor Building - Fire Area: 010-218

Reference Drawing 1.2-14

Room Name: Module 2 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.95 Reactor Building - Fire Area: 010-219

Reference Drawing 1.2-14

Room Name: 75' North Telecommunications Room (Telecom Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.96 Reactor Building - Fire Area: 010-220

Reference Drawing 1.2-14

Room Name: Module 3 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.97 Reactor Building - Fire Area: 010-221

Reference Drawing 1.2-14

Room Name: Module 3 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.98 Reactor Building - Fire Area: 010-222

Reference Drawing 1.2-14

Room Name: Module 3 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.99 Reactor Building - Fire Area: 010-222-01

Reference Drawing 1.2-14

Room Name: Module 3 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.100 Reactor Building - Fire Area: 010-223

Reference Drawing 1.2-14

Room Name: Module 3 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.101 Reactor Building - Fire Area: 010-224

Reference Drawing 1.2-14

Room Name: Module 3 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.102 Reactor Building - Fire Area: 010-225

Reference Drawing 1.2-14

Room Name: Module 4 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.103 Reactor Building - Fire Area: 010-226

Reference Drawing 1.2-14

Room Name: Module 4 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.104 Reactor Building - Fire Area: 010-227

Reference Drawing 1.2-14

Room Name: Module 4 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.105 Reactor Building - Fire Area: 010-227-01

Reference Drawing 1.2-14

Room Name: Module 4 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.106 Reactor Building - Fire Area: 010-228

Reference Drawing 1.2-14

Room Name: Module 4 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.107 Reactor Building - Fire Area: 010-229

Reference Drawing 1.2-14

Room Name: Module 4 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets

In Situ Ignition Sources: Batteries, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.108 Reactor Building - Fire Area: 010-230

Reference Drawing 1.2-14

Room Name: Module 5 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher will be located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.109 Reactor Building - Fire Area: 010-231

Reference Drawing 1.2-14

Room Name: Module 5 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.110 Reactor Building - Fire Area: 010-232

Reference Drawing 1.2-14

Room Name: Module 5 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.111 Reactor Building - Fire Area: 010-232-01

Reference Drawing 1.2-14

Room Name: Module 5 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.112 Reactor Building - Fire Area: 010-233

Reference Drawing 1.2-14

Room Name: Module 5 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.113 Reactor Building - Fire Area: 010-234

Reference Drawing 1.2-14

Room Name: Module 5 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.114 Reactor Building - Fire Area: 010-235

Reference Drawing 1.2-14

Room Name: Module 6 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets

In Situ Ignition Sources: Batteries, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.115 Reactor Building - Fire Area: 010-236

Reference Drawing 1.2-14

Room Name: Module 6 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.116 Reactor Building - Fire Area: 010-237

Reference Drawing 1.2-14

Room Name: Module 6 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.117 Reactor Building - Fire Area: 010-237-01

Reference Drawing 1.2-14

Room Name: Module 6 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.118 Reactor Building - Fire Area: 010-238

Reference Drawing 1.2-14

Room Name: Module 6 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.119 Reactor Building - Fire Area: 010-239

Reference Drawing 1.2-14

Room Name: Module 6 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.120 Reactor Building - Fire Area: 010-244

Reference Drawing 1.2-14

Room Name: Module 7 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.121 Reactor Building - Fire Area: 010-245

Reference Drawing 1.2-14

Room Name: Module 7 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.122 Reactor Building - Fire Area: 010-246

Reference Drawing 1.2-14

Room Name: Module 7 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.123 Reactor Building - Fire Area: 010-246-01

Reference Drawing 1.2-14

Room Name: Module 7 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.124 Reactor Building - Fire Area: 010-247

Reference Drawing 1.2-14

Room Name: Module 7 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.125 Reactor Building - Fire Area: 010-248

Reference Drawing 1.2-14

Room Name: Module 7 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.126 Reactor Building - Fire Area: 010-249

Reference Drawing 1.2-14

Room Name: Module 8 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.127 Reactor Building - Fire Area: 010-250

Reference Drawing 1.2-14

Room Name: Module 8 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.128 Reactor Building - Fire Area: 010-251

Reference Drawing 1.2-14

Room Name: Module 8 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Electrical Cabinets

In Situ Ignition Sources: Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.129 Reactor Building - Fire Area: 010-251-01

Reference Drawing 1.2-14

Room Name: Module 8 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.130 Reactor Building - Fire Area: 010-252

Reference Drawing 1.2-14

Room Name: Module 8 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets

In Situ Ignition Sources: Batteries, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.131 Reactor Building - Fire Area: 010-253

Reference Drawing 1.2-14

Room Name: Module 8 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.132 Reactor Building - Fire Area: 010-254

Reference Drawing 1.2-14

Room Name: Module 9 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.133 Reactor Building - Fire Area: 010-255

Reference Drawing 1.2-14

Room Name: Module 9 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.134 Reactor Building - Fire Area: 010-256

Reference Drawing 1.2-14

Room Name: Module 9 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.135 Reactor Building - Fire Area: 010-256-01

Reference Drawing 1.2-14

Room Name: Module 9 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.136 Reactor Building - Fire Area: 010-257

Reference Drawing 1.2-14

Room Name: Module 9 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.137 Reactor Building - Fire Area: 010-258

Reference Drawing 1.2-14

Room Name: Module 9 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets

In Situ Ignition Sources: Batteries, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.138 Reactor Building - Fire Area: 010-259

Reference Drawing 1.2-14

Room Name: Module 10 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.139 Reactor Building - Fire Area: 010-260

Reference Drawing 1.2-14

Room Name: Module 10 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets

In Situ Ignition Sources: Batteries, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.140 Reactor Building - Fire Area: 010-261

Reference Drawing 1.2-14

Room Name: Module 10 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.141 Reactor Building - Fire Area: 010-261-01

Reference Drawing 1.2-14

Room Name: Module 10 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.142 Reactor Building - Fire Area: 010-262

Reference Drawing 1.2-14

Room Name: Module 10 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.143 Reactor Building - Fire Area: 010-263

Reference Drawing 1.2-14

Room Name: Module 10 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.144 Reactor Building - Fire Area: 010-264

Reference Drawing 1.2-14

Room Name: 75' South Telecommunications Room (Telecom Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable

In Situ Ignition Sources: Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables

Transient Ignition: Cabling - Low Voltage, Cabling- Instrumentation

<u>Postulated Fire:</u>

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

<u>Fire Protection Features:</u>

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.145 Reactor Building - Fire Area: 010-265

Reference Drawing 1.2-14

Room Name: Module 11 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.146 Reactor Building - Fire Area: 010-266

Reference Drawing 1.2-14

Room Name: Module 11 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.147 Reactor Building - Fire Area: 010-267

Reference Drawing 1.2-14

Room Name: Module 11 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.148 Reactor Building - Fire Area: 010-267-01

Reference Drawing 1.2-14

Room Name: Module 11 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.149 Reactor Building - Fire Area: 010-268

Reference Drawing 1.2-14

Room Name: Module 11 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.150 Reactor Building - Fire Area: 010-269

Reference Drawing 1.2-14

Room Name: Module 11 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.151 Reactor Building - Fire Area: 010-270

Reference Drawing 1.2-14

Room Name: Module 12 EDSS-MS Battery Room C (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.152 Reactor Building - Fire Area: 010-271

Reference Drawing 1.2-14

Room Name: Module 12 EDSS-MS Battery Room A (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.153 Reactor Building - Fire Area: 010-272

Reference Drawing 1.2-14

Room Name: Module 12 MPS Division I Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division I equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.154 Reactor Building - Fire Area: 010-272-01

Reference Drawing 1.2-14

Room Name: Module 12 Division I Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.155 Reactor Building - Fire Area: 010-273

Reference Drawing 1.2-14

Room Name: Module 12 EDSS-MS Battery Room B (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.156 Reactor Building - Fire Area: 010-274

Reference Drawing 1.2-14

Room Name: Module 12 EDSS-MS Battery Room D (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.157 Reactor Building - Fire Area: 010-280

Reference Drawing 1.2-15

Room Name: Module 1 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separates from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.158 Reactor Building - Fire Area: 010-281

Reference Drawing 1.2-15

Room Name: Module 1 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separates from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.159 Reactor Building - Fire Area: 010-282

Reference Drawing 1.2-15

Room Name: Module 1 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.160 Reactor Building - Fire Area: 010-282-02

Reference Drawing 1.2-15

Room Name: Module 1 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.161 Reactor Building - Fire Area: 010-283

Reference Drawing 1.2-15

Room Name: Module 1 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separates from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.162 Reactor Building - Fire Area: 010-284

Reference Drawing 1.2-15

Room Name: Module 1 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Battery Chargers, Electrical Cabinets

In Situ Ignition Sources: Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separates from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.163 Reactor Building - Fire Area: 010-285

Reference Drawing 1.2-15

Room Name: Module 2 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separates from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.164 Reactor Building - Fire Area: 010-286

Reference Drawing 1.2-15

Room Name: Module 2 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separates from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.165 Reactor Building - Fire Area: 010-287

Reference Drawing 1.2-15

Room Name: Module 2 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.166 Reactor Building - Fire Area: 010-287-02

Reference Drawing 1.2-15

Room Name: Module 2 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.167 Reactor Building - Fire Area: 010-288

Reference Drawing 1.2-15

Room Name: Module 2 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separates from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.168 Reactor Building - Fire Area: 010-289

Reference Drawing 1.2-157

Room Name: Module 2 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Battery Chargers, Electrical Cabinets

In Situ Ignition Sources: Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separates from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.169 Reactor Building - Fire Area: 010-290

Reference Drawing 1.2-15

Room Name: North Storage Room (Storage Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Storage (Misc.)
Transient Ignition:	None

Postulated Fire:

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in minimal loss due to the lack of significant equipment, smoke detection, and fire barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.170 Reactor Building - Fire Area: 010-291

Reference Drawing 1.2-15

Room Name: Module 3 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separates from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.171 Reactor Building - Fire Area: 010-292

Reference Drawing 1.2-15

Room Name: Module 3 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.172 Reactor Building - Fire Area: 010-293

Reference Drawing 1.2-15

Room Name: Module 3 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.173 Reactor Building - Fire Area: 010-293-02

Reference Drawing 1.2-15

Room Name: Module 3 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.174 Reactor Building - Fire Area: 010-295

Reference Drawing 1.2-15

Room Name: Module 3 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.175 Reactor Building - Fire Area: 010-296

Reference Drawing 1.2-15

Room Name: Module 3 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.176 Reactor Building - Fire Area: 010-297

Reference Drawing 1.2-15

Room Name: Module 4 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Battery Chargers, Electrical Cabinets

In Situ Ignition Sources: Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.177 Reactor Building - Fire Area: 010-298

Reference Drawing 1.2-15

Room Name: Module 4 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.178 Reactor Building - Fire Area: 010-299

Reference Drawing 1.2-15

Room Name: Module 4 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection will be provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.179 Reactor Building - Fire Area: 010-299-02

Reference Drawing 1.2-157

Room Name: Module 4 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.180 Reactor Building - Fire Area: 010-300

Reference Drawing 1.2-15

Room Name: Module 4 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.181 Reactor Building - Fire Area: 010-301

Reference Drawing 1.2-15

Room Name: Module 4 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Battery Chargers, Electrical Cabinets

In Situ Ignition Sources: Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.182 Reactor Building - Fire Area: 010-302

Reference Drawing 1.2-15

Room Name: Module 5 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.183 Reactor Building - Fire Area: 010-303

Reference Drawing 1.2-15

Room Name: Module 5 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.184 Reactor Building - Fire Area: 010-304

Reference Drawing 1.2-15

Room Name: Module 5 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.185 Reactor Building - Fire Area: 010-304-02

Reference Drawing 1.2-15

Room Name: Module 5 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.186 Reactor Building - Fire Area: 010-305

Reference Drawing 1.2-15

Room Name: Module 5 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.187 Reactor Building - Fire Area: 010-306

Reference Drawing 1.2-15

Room Name: Module 5 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.188 Reactor Building - Fire Area: 010-307

Reference Drawing 1.2-15

Room Name: Module 6 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.189 Reactor Building - Fire Area: 010-308

Reference Drawing 1.2-15

Room Name: Module 6 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.190 Reactor Building - Fire Area: 010-309

Reference Drawing 1.2-15

Room Name: Module 6 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.191 Reactor Building - Fire Area: 010-309-02

Reference Drawing 1.2-15

Room Name: Module 6 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.192 Reactor Building - Fire Area: 010-310

Reference Drawing 1.2-15

Room Name: Module 6 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.193 Reactor Building - Fire Area: 010-311

Reference Drawing 1.2-15

Room Name: Module 6 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.194 Reactor Building - Fire Area: 010-312

Reference Drawing 1.2-15

Room Name: Module 7 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.195 Reactor Building - Fire Area: 010-313

Reference Drawing 1.2-15

Room Name: Module 7 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.196 Reactor Building - Fire Area: 010-314

Reference Drawing 1.2-15

Room Name: Module 7 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.197 Reactor Building - Fire Area: 010-314-02

Reference Drawing 1.2-15

Room Name: Module 7 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

<u>Fire Protection Features:</u>

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.198 Reactor Building - Fire Area: 010-315

Reference Drawing 1.2-15

Room Name: Module 7 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.199 Reactor Building - Fire Area: 010-316

Reference Drawing 1.2-15

Room Name: Module 7 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Battery Chargers, Electrical Cabinets

In Situ Ignition Sources: Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.200 Reactor Building - Fire Area: 010-317

Reference Drawing 1.2-15

Room Name: Module 8 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.201 Reactor Building - Fire Area: 010-318

Reference Drawing 1.2-15

Room Name: Module 8 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.202 Reactor Building - Fire Area: 010-319

Reference Drawing 1.2-15

Room Name: Module 8 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.203 Reactor Building - Fire Area: 010-319-02

Reference Drawing 1.2-15

Room Name: Module 8 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.204 Reactor Building - Fire Area: 010-320

Reference Drawing 1.2-15

Room Name: Module 8 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.205 Reactor Building - Fire Area: 010-321

Reference Drawing 1.2-15

Room Name: Module 8 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.206 Reactor Building - Fire Area: 010-322

Reference Drawing 1.2-15

Room Name: Module 9 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.207 Reactor Building - Fire Area: 010-323

Reference Drawing 1.2-15

Room Name: Module 9 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.208 Reactor Building - Fire Area: 010-324

Reference Drawing 1.2-15

Room Name: Module 9 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.209 Reactor Building - Fire Area: 010-324-02

Reference Drawing 1.2-15

Room Name: Module 9 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.210 Reactor Building - Fire Area: 010-325

Reference Drawing 1.2-15

Room Name: Module 9 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.211 Reactor Building - Fire Area: 010-326

Reference Drawing 1.2-15

Room Name: Module 9 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Battery Chargers, Electrical Cabinets

In Situ Ignition Sources: Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.212 Reactor Building - Fire Area: 010-327

Reference Drawing 1.2-15

Room Name: Module 10 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.213 Reactor Building - Fire Area: 010-328

Reference Drawing 1.2-15

Room Name: Module 10 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.214 Reactor Building - Fire Area: 010-329

Reference Drawing 1.2-15

Room Name: Module 10 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.215 Reactor Building - Fire Area: 010-329-02

Reference Drawing 1.2-15

Room Name: Module 10 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.216 Reactor Building - Fire Area: 010-330

Reference Drawing 1.2-15

Room Name: Module 10 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.217 Reactor Building - Fire Area: 010-331

Reference Drawing 1.2-15

Room Name: Module 10 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.218 Reactor Building - Fire Area: 010-332

Reference Drawing 1.2-15

Room Name: South Storage Room (Storage Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Storage (Misc.)
Transient Ignition:	None

<u>Postulated Fire:</u>

The room contains a negligible amount of combustibles. In addition, there are no significant ignition sources in the area.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in minimal loss due to the lack of significant equipment, smoke detection, and fire barriers.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.219 Reactor Building - Fire Area: 010-333

Reference Drawing 1.2-15

Room Name: Module 11 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.220 Reactor Building - Fire Area: 010-334

Reference Drawing 1.2-15

Room Name: Module 11 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.221 Reactor Building - Fire Area: 010-335

Reference Drawing 1.2-15

Room Name: Module 11 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.222 Reactor Building - Fire Area: 010-335-02

Reference Drawing 1.2-15

Room Name: Module 11 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Qualified Electrical Cable
In Situ Ignition Sources:	None
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of chase.
Manual Suppression:	None
Fire Extinguishers:	None

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.223 Reactor Building - Fire Area: 010-336

Reference Drawing 1.2-15

Room Name: Module 11 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.224 Reactor Building - Fire Area: 010-337

Reference Drawing 1.2-15

Room Name: Module 11 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.225 Reactor Building - Fire Area: 010-338

Reference Drawing 1.2-15

Room Name: Module 12 EDSS-MS Switchgear Room C (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.226 Reactor Building - Fire Area: 010-339

Reference Drawing 1.2-15

Room Name: Module 12 EDSS-MS Switchgear Room A (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.227 Reactor Building - Fire Area: 010-340

Reference Drawing 1.2-15

Room Name: Module 12 MPS Division II Equipment Room (I/O Cabinet Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	High sensitivity air aspirating smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of the Division II equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.228 Reactor Building - Fire Area: 010-340-02

Reference Drawing 1.2-15

Room Name: Module 12 Division II Electrical Chase (Not Labeled On Drawings)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Qualified Electrical Cable

In Situ Ignition Sources: None

Transient Combustibles: None

Transient Ignition: None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling. The chase 3-hr separations, chase smoke detection and auto suppression should allow for early notification and containment of a fire. The limited combustibles, suppression and barriers would limit smoke and fire spread to adjacent areas.

<u>Fire Protection Features:</u>

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: None

Fire Extinguishers: None

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke in the area would not be expected to have a significant impact on manual firefighting due to automatic detection and suppression along with separation from adjacent areas.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for one NPM. The cable chase is separated by 3-hr fire rated barriers to mitigate damage to adjacent systems. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

The fire may result in the loss of one division of equipment credited for safe-shutdown for the respective module, but a redundant division will remain free of fire damage.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.229 Reactor Building - Fire Area: 010-341

Reference Drawing 1.2-15

Room Name: Module 12 EDSS-MS Switchgear Room B (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.230 Reactor Building - Fire Area: 010-342

Reference Drawing 1.2-15

Room Name: Module 12 EDSS-MS Switchgear Room D (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.231 Reactor Building - Fire Area: 010-405

Reference Drawing 1.2-16

Room Name: Southwest Stair Vestibule (Vestibule)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.232 Reactor Building - Fire Area: 010-406

Reference Drawing 1.2-16

Room Name: Northwest Stair Vestibule (Vestibule)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.233 Reactor Building - Fire Area: 010-407

Reference Drawing 1.2-16

Room Name: Northeast Stair Vestibule (Vestibule)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Appliances

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.234 Reactor Building - Fire Area: 010-408

Reference Drawing 1.2-16

Room Name: Southeast Stair Vestibule (Vestibule)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.235 Reactor Building - Fire Area: 010-409

Reference Drawing 1.2-16

Room Name: 100' Northwest Reactor Component Cooling Water Pump Gallery (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Charcoal Filters, Electrical Cabinets, Lubricants, Oils, Misc. Combustibles, Misc. Wire & Plastic Components, Paper & Cardboard (Files), Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Air Handling Units, Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, HVAC Equipment
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Furniture, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation, Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is a pump fire resulting from a mechanical failure, or an electrical control cabinet failure. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Smoke and fire could result in total loss of reactor component cooling water pumps.

Operations/ Post-Fire Recovery:

Loss of reactor component cooling water system would challenge plant operations. System would need to be repaired before normal operations could resume.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.236 Reactor Building - Fire Area: 010-410

Reference Drawing 1.2-16

Room Name: 100' North Telecommunications Room (Telecom)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.237 Reactor Building - Fire Area: 010-411

Reference Drawing 1.2-16

Room Name: 100' Northeast Containment Evacuation Pump Gallery (Hydraulic Control Stations)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Pipe Insulation, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, Pump
Transient Combustibles:	Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation, Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, or equipment failure. Due to the small quantity of combustibles, qualified cabling, automatic detection and automatic and manual suppression plus 3 hour rate barriers, the fire is limited to the immediate area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in loss of one or more containment evacuation systems. The CES systems are provided with redundant pumps. Additionally, one division of hydraulic control units that control safety-related valves could be lost.

Operations/ Post-Fire Recovery:

The modules are designed to work independently. A fire could result in loss of the containment evacuation system for a single unit. A large unmitigated fire in the room could result in loss of the systems for the six adjacent modules. Systems are to be designed to fail safe. Safety-related equipment in the area is separated from redundant systems by 3-hour fire rated barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.238 Reactor Building - Fire Area: 010-412

Reference Drawing 1.2-16

Room Name: East Gallery Area (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Hot work

Postulated Fire:

The postulated fire for this area is an electrical appliance or transient fire. However, the fire would be limited to the immediate area due to actuation of the automatic suppression system, fire rated boundary construction, and the lack of combustibles in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this area may result in loss of a subset of fire protection equipment and systems passing through the area.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression. Damage in the area may limit operation of the multiple systems controlled by the motor control centers in the area.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.239 Reactor Building - Fire Area: 010-414

Reference Drawing 1.2-16

Room Name: Power Channel A EDN Switchgear Area (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.240 Reactor Building - Fire Area: 010-415

Reference Drawing 1.2-16

Room Name: Power Channel A EDN Battery Area (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.241 Reactor Building - Fire Area: 010-416

Reference Drawing 1.2-16

Room Name: Power Channel B EDN Battery Area (Battery Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.242 Reactor Building - Fire Area: 010-417

Reference Drawing 1.2-16

Room Name: Power Channel B EDN Switchgear Area (Charger Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.243 Reactor Building - Fire Area: 010-418

Reference Drawing 1.2-16

Room Name: 100' Southeast Containment Evacuation Pump Gallery (Hydraulic Control Stations)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Pipe Insulation, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, Pump
Transient Combustibles:	Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation, Electric Motors, Hot work

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, or equipment failure. Due to the small quantity of combustibles, qualified cabling, automatic detection and automatic and manual suppression plus 3 hour rate barriers, the fire is limited to the immediate area.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in loss of one or more containment evacuation systems. The CES systems are provided with redundant pumps. Additionally, one division of hydraulic control units that control safety-related valves could be lost.

Operations/ Post-Fire Recovery:

The modules are designed to work independently. A fire could result in loss of the containment evacuation system for a single unit. A large unmitigated fire in the room could result in loss of the systems for the six adjacent modules. Systems are to be designed to fail safe. Safety-related equipment in the area is separated from redundant systems by 3-hour fire rated barriers.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.244 Reactor Building - Fire Area: 010-419

Reference Drawing 1.2-16

Room Name: 100' South Telecommunications Room (Telecom)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.245 Reactor Building - Fire Area: 010-420

Reference Drawing 1.2-16

Room Name: 100' Southwest Reactor Component Cooling Water Pump Gallery (Utilities Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Charcoal Filters, Electrical Cabinets, Lubricants, Oils, Misc. Combustibles, Misc. Wire & Plastic Components, Paper & Cardboard (Files), Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Air Handling Units, Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, HVAC Equipment, Pump
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Furniture, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation, Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is a pump fire resulting from a mechanical failure, or an electrical control cabinet failure. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Smoke and fire could result in total loss of reactor component cooling water pumps.

Operations/ Post-Fire Recovery:

Loss of reactor component cooling water system would challenge plant operations. System would need to be repaired before normal operations could resume.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.246 Reactor Building - Fire Area: 010-506

Reference Drawing 1.2-17

Room Name: 125' North Telecommunications Room (Telecom)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Battery Chargers, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.247 Reactor Building - Fire Area: 010-507, 010-601

Reference Drawing 1.2-17

Room Name: 125' North CRDS Gallery (Mechanical Equipment Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Misc. Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Air Handling Units, Electric Appliances (lighting, controls), Electrical Cabinets, HVAC Equipment
Transient Combustibles:	Files, Books, Records, and other paper files, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation, Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, or equipment failure. Due to the small quantity of combustibles, qualified cabling, automatic detection and automatic and manual suppression plus 3 hour rate barriers, the fire is limited to the immediate area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in loss of one or more control rod drive systems. Additionally, one division of hydraulic control units that control safety-related valves could be lost.

Operations/ Post-Fire Recovery:

The modules are designed to work independently. A fire could result in loss of the control rod drive system for a single unit. A large unmitigated fire in the room could result in loss of the systems for six adjacent modules and also compromise the reactor building HVAC system. Systems are designed to fail safe which in the case of the control rod drives would produce unplanned control rod insertions in the affected NPMs. Safety-related hydraulic controllers in the area are separated from their redundant controllers by 3-hour fire rated barriers assuring safe shutdown. Damage to the hydraulic units or control rod drive systems would likely require complete repair before reactors could be restarted.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.248 Reactor Building - Fire Area: 010-508

Reference Drawing 1.2-17

Room Name: 125' East Reactor Pool Air Recirculation AHU Area (Mechanical Equipment Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Air Handling Units, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Electric Motors

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault, fire in an HVAC unit, or transient fire. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this area could lead to loss of AHU units in this area that serve the pool area.

Operations/ Post-Fire Recovery:

Fire or smoke in this area would impact the reactor pool ventilation system.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.249 Reactor Building - Fire Area: 010-509, 010-602

Reference Drawing 1.2-17

Room Name: 125' South CRDS Gallery (Mechanical Equipment Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Air Handling Units, Electric Appliances (lighting, controls), Electrical Cabinets, HVAC Equipment
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, or equipment failure. Due to the small quantity of combustibles, qualified cabling, automatic detection and automatic and manual suppression plus 3 hour rate barriers, the fire is limited to the immediate area.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire could result in loss of one or more control rod drive systems. Additionally, one division of

hydraulic control units that control safety-related valves could be lost.

Operations/ Post-Fire Recovery:

The modules are designed to work independently. A fire could result in loss of the control rod drive system for a single unit. A large unmitigated fire in the room could result in loss of the systems for six adjacent modules and also compromise the reactor building HVAC system. Systems are designed to fail safe which in the case of the control rod drives would produce unplanned control rod insertions in the affected NPMs. Safety-related hydraulic controllers in the area are separated from their redundant controllers by 3-hour fire rated barriers assuring safe shutdown.

Damage to the hydraulic units or control rod drive systems would likely require complete repair before reactors could be restarted.

Radiological Release:

Fire and smoke would not have a significant impact on release of radiation as fire and smoke should be maintained within the room due to the boundaries, detection, and manual and active suppression.

9A.5.250 Reactor Building - Fire Area: 010-510

Reference Drawing 1.2-17

Room Name: 125' South Telecommunications Room (Telecom)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Battery Chargers, Electrical Cabinets, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.251 Reactor Building - Fire Area: 010-600

Reference Drawing 1.2-18

Room Name: Elevator Machine Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Lubricants, Oils, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors
Transient Combustibles:	Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The postulated fire for this area is an electrical appliance, or transient fire. However, the fire would be limited to the immediate area due to actuation of the automatic suppression system, fire rated boundary construction, and the lack of combustibles in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	SSE fire hose installation conforming to NFPA 14 is located within 100 ft. of hazards.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of the elevator.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.252 Radioactive Waste Building - Fire Area: 030-001, 030-100

Reference Drawing 1.2-28 and 1.2-30

Room Name: North Stair (Stair)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of shaft.
Manual Suppression:	Standpipe with Fire Hose Connection located is located in the area or room.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire/smoke in the stair will have limited impact on manual firefighting as there are other stairs that allow access to the level, manual hose stations are located on the floor, and hose stations are located in the stair at the upper levels.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.253 Radioactive Waste Building - Fire Area: 030-002

Reference Drawing 1.2-28

Room Name: North Electrical Room (Electrical Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets, Switchgear 480 V
Transient Combustibles:	Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection will be provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the electrical in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.254 Radioactive Waste Building - Fire Area: 030-003, 030-010, 030-032

Reference Drawing 1.2-28

Room Name: Service Area (Service Area, Storage)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Clothing - Rubber/plastic, Misc. Combustibles

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: Lubricants, Grease, Hydraulic Fluids, Packing materials, Paints, Solvents and Cleaning Chemicals, Pallets, Plastic and Rubber materials

Transient Ignition: Chemical Reactions, Hot work

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: Standpipe with Fire Hose Connection located is located in the area or room.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of a common space on the RWB lower elevation providing access to the various rooms. The connecting rooms are separated. The combustible loading of the compartment will be mitigated by the installed suppression system. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.255 Radioactive Waste Building - Fire Area: 030-004, 030-005

Reference Drawing 1.2-28

Room Name: Charcoal Decay Bed Rooms (Tank Rooms)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Charcoal Filters
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Reactive Chemicals
Transient Combustibles:	Materials for Testing & Maintenance
Transient Ignition:	Hot work

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. The charcoal decay beds are welded steel or welded stainless steel with dedicated fire suppression systems and therefore would not contribute to the fire load of the area. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of multiple tank rooms in the lower elevation of the RWB. The connecting rooms are separated by FRR construction. The combustible loading of the compartment will be mitigated by the installed suppression system. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles, auto and manual suppression, and manual use of the building ventilation system.

9A.5.256 Radioactive Waste Building - Fire Area: 030-006

Reference Drawing 1.2-28

Room Name: Gas Cooler Room (Tank Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Charcoal Filters, Clothing - Rubber/plastic, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Heaters, Electrical Cabinets, Reactive Chemicals
Transient Combustibles:	Materials for Testing & Maintenance
Transient Ignition:	Electric Heaters

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of a tank room in the lower elevation of the RWB. The connecting rooms are separated by FRR construction. The combustible loading of the compartment will be mitigated by the installed suppression system. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.257 Radioactive Waste Building - Fire Area: 030-007

Reference Drawing 1.2-28

Room Name: Waste Drum Room (Tank Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Clothing - Rubber/plastic, Lubricants, Oils
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Pump
Transient Combustibles:	Materials for Testing & Maintenance, Pallets
Transient Ignition:	Electric Motors

<u>Postulated Fire:</u>

The worst case fire postulated would involve in situ combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

This fire area consists of a waste storage room in the lower elevation of the RWB. The combustible loading of the compartment will be mitigated by the installed suppression system. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste storage and mixed waste storage.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste storage and mixed waste storage required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles, auto and manual suppression, and manual use of the building ventilation system.

9A.5.258 Radioactive Waste Building - Fire Area: 030-009, 030-104

Reference Drawing 1.2-28 and 1.2-30

Room Name: South Stair (Stair)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Appliances

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of shaft.
Manual Suppression:	Standpipe with Fire Hose Connection located is located in the area or room.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire/smoke in the stair will have limited impact on manual firefighting as there are other stairs that allow access to the level, manual hose stations are located on the floor, and hose stations are located in the stair at the upper levels.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.259 Radioactive Waste Building - Fire Area: 030-010-01

Reference Drawing 1.2-28

Room Name: Vertical Material Lift

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: None

In Situ Ignition Sources: Electric Motors

Transient Combustibles: Lubricants, Grease, Hydraulic Fluids, Packing materials, Paints, Solvents and Cleaning Chemicals, Pallets, Plastic and Rubber materials

Transient Ignition: Electric Motors

Postulated Fire:

The worst case fire postulated would involve wiring in the lift motor. Based on the robust fire barrier envelop, a fire would be contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems: None

Detection Systems: Smoke detection is provided at top of chase.

Manual Suppression: Fire Hose valve is located in adjacent room or area.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of a vertical material lift in the lower elevation of the RWB connecting with the upper grade level. The vertical material lift is separated. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of material lift functionality which would limit the movement large equipment and supplies to and from the lower level of the RWB until repaired.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room could lead to the loss of material lift functionality which repaired promptly would not affect operations.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.260 Radioactive Waste Building - Fire Area: 030-012, 030-013, 030-015, 030-016, 030-018, 030-019, 030-020, 030-021, 030-024, 030-025, 030-026, 030-027

Reference Drawing 1.2-28 and 1.2-29

Room Name: Rad Waste Tank Rooms (Tank Rooms)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Clothing - Rubber/plastic, None
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Materials for Testing & Maintenance
Transient Ignition:	None

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of multiple tank rooms in the lower elevation of the RWB. The connecting rooms are separated by FRR construction. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.261 Radioactive Waste Building - Fire Area: 030-017, 030-014, 030-011

Reference Drawing 1.2-28

Room Name: South Rad Waste Pumps Rooms (Pump Rooms)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Clothing - Rubber/plastic, Lubricants, Oils
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets, Pump
Transient Combustibles:	Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance
Transient Ignition:	Electric Motors

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of a pump room in the lower elevation of the RWB. The connecting rooms are separated. The combustible loading of the compartment will be mitigated by the installed suppression system. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.262 Radioactive Waste Building - Fire Area: 030-022, 030-023, 030-028

Reference Drawing 1.2-28

Room Name: North Rad Waste Pumps Rooms (Pump Rooms)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Clothing - Rubber/plastic, Lubricants, Oils
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets, Pump
Transient Combustibles:	Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance
Transient Ignition:	Electric Motors

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of a pump room in the lower elevation of the RWB. The connecting rooms are separated. The combustible loading of the compartment will be mitigated by the installed suppression system. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.263 Radioactive Waste Building - Fire Area: 030-029

Reference Drawing 1.2-28

Room Name: Telecom Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Electrical Cabinets, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Materials for Testing & Maintenance, Plastic and Rubber materials
Transient Ignition:	None

Postulated Fire:

The worst case fire postulated would involve wiring in the control cabinets. Based on the installed smoke detection and robust fire barrier envelop, a fire would be immediately detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of a telecom room in the lower elevation of the RWB. The connecting rooms are separated. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.264 Radioactive Waste Building - Fire Area: 030-030

Reference Drawing 1.2-28

Room Name: Battery Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets

In Situ Ignition Sources: Batteries, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

<u>Postulated Fire:</u>

The worst case fire postulated would involve the malfunction of a battery. Based on the installed smoke detection and robust fire barrier envelop, a fire would be immediately detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

<u>Fire Protection Features:</u>

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: Fire Hose valve is located in adjacent room or area.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

This fire area consists of a battery room in the lower elevation of the RWB. The connecting rooms are separated by FRR construction. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.265 Radioactive Waste Building - Fire Area: 030-031

Reference Drawing 1.2-28

Room Name: Charger Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment including battery chargers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.266 Radioactive Waste Building - Fire Area: 030-033

Reference Drawing 1.2-28

Room Name: HIC Filling Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-2

In Situ Combustibles:	Plastic, Rubber Materials, Ion Exchange Resin, Carbon Absorption Media
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Clothing rubber/plastic, Clothing Textile
Transient Ignition:	Chemical Reactions

Postulated Fire:

The postulated fire for this area is an electrical fault in electrical cabinet, or exothermic reaction that spreads to HICs. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this space.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of waste segregation equipment in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by fire suppression and use of the building ventilation system.

9A.5.267 Radioactive Waste Building - Fire Area: 030-034

Reference Drawing 1.2-28

Room Name: Class A/B/C HIC Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-2

In Situ Combustibles:	Plastic, Rubber Materials, Ion Exchange Resin, Carbon Absorbtion Media
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Clothing rubber/plastic, Clothing Textile
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in electrical cabinet, or other electrical type that spreads to HICs. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this space.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the bulk waste storage containers in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by fire suppression and use of the building ventilation system.

9A.5.268 Radioactive Waste Building - Fire Area: 030-101

Reference Drawing 1.2-30

Room Name: Mechanical Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Clothing - Rubber/plastic, Electrical Cabinets, Lubricants, Oils, Misc Combustibles, Qualified Electrical Cable
In Situ Ignition Sources:	Air Handling Units, Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, HVAC Equipment
Transient Combustibles:	Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Storage (Misc.)
Transient Ignition:	Electric Motors

Postulated Fire:

The worst case fire postulated would involve an HVAC fan motor. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Standpipe with Fire Hose Connection located is located in the area or room.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of a mechanical HVAC room at the grade elevation of the RWB. The connecting rooms are separated. The combustible loading of the compartment will be mitigated by the installed suppression system. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components along with the radioactive waste building ventilation system.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.269 Radioactive Waste Building - Fire Area: 030-102, 030-103, 030-105, 030-106, 030-107, 030-108, , 030-111, 030-112, 030-113

Reference Drawing 1.2-30

Room Name: 100' Rad Waste Building General Area (Trolley Bay, Truck Bay, Drum Dryer Rooms, LRW Processing Area, Class "A" Storage, Low Level Solid Waste Sorting, Flex Space, Warehouse)

NFPA 101 Hazard Classification: High **NFPA 13 Hazard Classification:** EH-1

In Situ Combustibles:	Clothing - Rubber/plastic, Electrical Cabinets, Misc Combustibles, Qualified Electrical Cable, Vehicles
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets
Transient Combustibles:	, Packing materials, Paints, Solvents and Cleaning Chemicals, Pallets, Plastic and Rubber materials, Resin, Temporary Electrical Cables, Vehicles
Transient Ignition:	Chemical Reactions, Electric Motors

Postulated Fire:

The worst case fire postulated would involve a motor vehicle. This fire hazard has the potential to place the RWB and the RXB at risk of damage. Based on the installed specialized fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this space. This space also has the potential of moderate quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Deluge Sprinkler suppression system is provided.
Detection Systems:	IR/UV flame detection is provided in the area.
Manual Suppression:	Fire Hose or fire hose valve is located within 100 ft of hose and 30 ft of water spray.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of multiple truck bays at the grade elevation of the RWB. The connecting rooms are separated. The combustible loading of the compartment will be mitigated by the installed suppression system. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of radioactive waste processing components required for power production.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles and manual use of the building ventilation system.

9A.5.270 Control Building - Fire Area: 030-114

Reference Drawing 1.2-30

Room Name: Exhaust Monitoring Equipment Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Qualified Electrical Cable
In Situ Ignition Sources:	Electrical Cabinets
Transient Combustibles:	Materials for Testing & Maintenance
Transient Ignition:	Electric Motors

Postulated Fire:

The worst case fire postulated would involve wiring in the control cabinets. Based on the installed smoke detection and robust fire barrier envelop, a fire would be immediately detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of an exhaust sampling room in the ground level of the RWB. The combustible loading of the compartment will be mitigated by the installed suppression system. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of effluent sampling components required for power production.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.271 Radioactive Waste Building - Fire Area: 030-115

Reference Drawing 1.2-30

Room Name: Waste Management Control Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Furniture
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Files, Books, Records and other paper files
Transient Ignition:	None

Postulated Fire:

The worst case fire postulated would involve an office type electrical appliance. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	None.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area consists of an office equipped room at the grade elevation of the RWB. The connecting rooms are separated. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room could lead to the loss of the office space and normal monitoring of radioactive waste processing systems and components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would not affect components required for power production as controlof equipment in the building can be regained from other control stations outside of the fire area.

Radiological Release:

A potential radiological release due to a fire in this area would be mitigated by the limited combustibles, lack of radiological material, and use of the building ventilation system.

9A.5.272 Control Building - Fire Area: 170-001

Reference Drawing 1.2-21

Room Name: North Air Bottle Room (Air Bottle Room)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	None

<u>Postulated Fire:</u>

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to loss of bottle equipment skids.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room may lead to a loss of a portion of the control room habitability system, but would have a minimal impact on plant operations.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location would not involve a radiological release.

9A.5.273 Control Building - Fire Area: 170-002

Reference Drawing 1.2-21

Room Name: Central Air Bottle Room (Air Bottle Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Qualified Electrical Cable

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables

Transient Ignition: None

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems: Automatic wet pipe sprinkler suppression is provided.

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: Fire Hose valve is located in adjacent room or area.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for 12 NPMs and loss of bottle equipment skids. The fire area is separated by 3-hr fire rated barriers to mitigate damage to adjacent areas. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room may lead to a loss of a one division of cable going to the CR for all 12 NPMs and may lead to a loss of a portion of the control room habitability system. Redundant systems will be unaffected by a fire in this area allowing normal shut if required. Normal reactor shutdown may be required until damage is assessed which will impact plant operations.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location would not involve a radiological release.

9A.5.274 Control Building - Fire Area: 170-003

Reference Drawing 1.2-21

Room Name: South Air Bottle Room (Air Bottle Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Qualified Electrical Cable

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables

Transient Ignition: None

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for 12 NPMs and loss of bottle equipment skids. The fire area is separated by 3-hr fire rated barriers to mitigate damage to adjacent areas. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room may lead to a loss of a one division of cable going to the CR for all 12 NPMs and may lead to a loss of a portion of the control room habitability system. Redundant systems will be unaffected by a fire in this area allowing normal shut if required. Normal reactor shutdown may be required until damage is assessed which will impact plant operations.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location would not involve a radiological release.

9A.5.275 Control Building - Fire Area: 170-004

Reference Drawing 1.2-21

Room Name: Tunnel (Utility Access)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Temporary Electrical Cables
Transient Ignition:	None

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for 12 NPMs and loss of bottle equipment skids. The fire area is separated by 3-hr fire rated barriers to mitigate damage to adjacent areas. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room may lead to a loss of a one division of cable going to the CR for all 12 NPMs. Redundant systems will be unaffected by a fire in this area allowing normal shut if required. Normal reactor shutdown may be required until damage is assessed which will impact plant operations.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location would not involve a radiological release.

9A.5.276 Control Building - Fire Area: 170-005

Reference Drawing 1.2-21

Room Name: Tunnel (Utility Access)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Temporary Electrical Cables
Transient Ignition:	None

Postulated Fire:

The worst case fire postulated would involve transient combustibles. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated

Property Loss:

An unmitigated fire would result in loss of one division of safety-related equipment for 12 NPMs and loss of bottle equipment skids. The fire area is separated by 3-hr fire rated barriers to mitigate damage to adjacent areas. Redundant systems will be unaffected by a fire in this area.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room may lead to a loss of a one division of cable going to the CR for all 12 NPMs. Redundant systems will be unaffected by a fire in this area allowing normal shut if required. Normal reactor shutdown may be required until damage is assessed which will impact plant operations.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location would not involve a radiological release.

9A.5.277 Control Building - Fire Area: 170-006, 170-113, 170-213, 170-301

Reference Drawing 1.2-21, 1.2-23, 1.2-24 and 1.2-25

Room Name: Southeast Stair (Stair)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles: Appliances

In Situ Ignition Sources: Electric Appliances (lighting, controls)

Transient Combustibles: None

Transient Ignition: None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of shaft.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire/smoke in the stair will have limited impact on manual firefighting as there are other stairs that allow access to the level, manual hose stations are located on the floor, and hose stations are located in the stair at the upper levels.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.278 Control Building - Fire Area: 170-007

Reference Drawing 1.2-21

Room Name: South Battery Room (Battery Rm)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.279 Control Building - Fire Area: 170-008

Reference Drawing 1.2-21

Room Name: South Switchgear Room (Charger Rm)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets, Switchgear ≤480 V
Transient Combustibles:	Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.280 Control Building - Fire Area: 170-009

Reference Drawing 1.2-21

Room Name: Central Battery Room (Battery Rm)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles: Appliances, Batteries, Electrical Cabinets

In Situ Ignition Sources: Batteries, Electric Appliances (lighting, controls), Electrical Cabinets

Transient Combustibles: None

Transient Ignition: None

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems: None

Detection Systems: Area-wide smoke detection is provided in the area.

Manual Suppression: Fire Hose valve is located in adjacent room or area.

Fire Extinguishers: A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.281 Control Building - Fire Area: 170-010

Reference Drawing 1.2-21

Room Name: Central Switchgear Room (Charger Rm)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets, Switchgear ≤480 V
Transient Combustibles:	Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.282 Control Building - Fire Area: 170-011

Reference Drawing 1.2-21

Room Name: North Switchgear Room (Charger Rm)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Battery Chargers, Electrical Cabinets, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets, Switchgear ≤480 V
Transient Combustibles:	Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation

<u>Postulated Fire:</u>

The postulated fire for this area is an electrical fault in cabling, and electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection allow for early notification and containment of a fire to allow for manual suppression.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger rooms.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.283 Control Building - Fire Area: 170-012

Reference Drawing 1.2-21

Room Name: North Battery Room (Battery Rm)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, battery, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment and batteries in the room. The room is separated from adjacent areas by 3-hr fire rated barriers to mitigate damage to adjacent systems. The battery rooms are separated from the battery charger room. Redundant battery rooms are provided in adjacent areas.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.284 Control Building - Fire Area: 170-013

Reference Drawing 1.2-21

Room Name: 50' North Airlock (Airlock)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Transformers - Dry
In Situ Ignition Sources:	Batteries, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage

<u>Postulated Fire:</u>

The worst case fire postulated would involve wiring in the control cabinets. Based on the installed smoke detection and robust fire barrier envelop, a fire would be immediately detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

This fire area is protected with a fire detection system designed to alert the fire brigade of a fire at its incipient stage. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to loss of multiple power panels and a MCC.

Operations/ Post-Fire Recovery:

An unmitigated fire in the room would lead to the loss of MCC-B functionality associated with the back-up power supply system equipment.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location could not involve a radiological release.

9A.5.285 Control Building - Fire Area: 170-014, 170-121, 170-122, 170-304

Reference Drawing 1.2-21, 1.2-23, 1.2-24 and 1.2-25

Room Name: Northeast Stair (Stair)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

Electrical fire in the stair from electrical appliances (lighting) or electrical junction boxes located within the stair.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Smoke detection is provided at top of shaft.
Manual Suppression:	Standpipe with Fire Hose Connection located is located in the area or room.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire/smoke in the stair will have limited impact on manual firefighting as there are other stairs that allow access to the level, manual hose stations are located on the floor, and hose stations are located in the stair at the upper levels.

Property Loss:

No significant impact on property loss.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.286 Control Building - Fire Area: 170-015

Reference Drawing 1.2-21

Room Name: East I/O Cabinet Room (I/O Cabinets)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of a Division of equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.287 Control Building - Fire Area: 170-016

Reference Drawing 1.2-21

Room Name: West I/O Cabinet Room (I/O Cabinets)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	None
Transient Ignition:	None

Postulated Fire:

The postulated fire for this area is an electrical fault in cabling, electrical cabinet, or other electrical type of fire. The room separations, and area smoke detection should allow for early notification and containment of a fire to allow for manual suppression.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire would result in loss of the equipment in the fire area. The fire area is divided by 3-hr fire rated barriers to mitigate damage to adjacent systems, but would result in loss of a Division of equipment cabinets.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations. There are redundant systems separated by 3-hour fire barriers.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.288 Control Building - Fire Area: 170-017

Reference Drawing 1.2-21

Room Name: 50' Corridor (Passage)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Misc Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets, Pump, Switchgear ≤480 V
Transient Combustibles:	Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation, Electric Motors

<u>Postulated Fire:</u>

Generally transient combustibles are attended while in the elevator. However, the fire would be limited to the immediate area due to the lack of intervening combustibles, and adequate boundary construction.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Unmitigated fire may result in the loss of multiple motor control centers and accordingly impact the operations of systems that they control.

Operations/ Post-Fire Recovery:

Fire or smoke should be contained to the area due to the fire barriers, smoke detection, and suppression. Damage in the area may limit operation of the multiple systems controlled by the motor control centers in the area.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.289 Control Building - Fire Area: 170-018

Reference Drawing 1.2-21

Room Name: Control Building Elevator (Elevator "A")

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Lubricants, Oils, Misc. Wire & Plastic Components, Plastic, Rubber materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Furniture, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The worst case fire postulated would involve transient combustibles. The elevator hoistway contains a negligible amount of combustible material. In addition, there are no significant ignition sources or fire hazards in the area. Generally transient combustibles are attended while in the elevator

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of the elevator for the reactor building.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.290 Control Building - Fire Area: 170-020

Reference Drawing 1.2-22

Room Name: Control Room Air Compressor Area (Utility Access)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Lubricants, Oils, Misc Combustibles, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Air Compressor, Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation, Electric Motors, Hot work

Postulated Fire:

The worst case fire postulated would involve a motor associated with the air compressor. A fire would be immediately detected through plant control monitoring and extinguished either via the installed suppression system or fire brigade intervention. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of the control room habitability air compressor.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location could not involve a radiological release.

9A.5.291 Control Building - Fire Area: 170-021

Reference Drawing 1.2-22

Room Name: Electrical Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Misc. Wire & Plastic Components, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets
Transient Combustibles:	Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation, Electric Motors

Postulated Fire:

Generally transient combustibles are attended while in the elevator This fire contains low combustible loading and would not challenge the surrounding 3 hr. fire resistant construction. In addition, there are no additional significant ignition sources in the area.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to loss of MCS and PCS components.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of functionality associated with the affected MCS and PCS system components.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location could not involve a radiological release.

9A.5.292 Control Building - Fire Area: 170-100, 170-102

Reference Drawing 1.2-23

Room Name: Main Control Room (Control Room, Break Area)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Furniture, Interior Finish - Carpet, Misc Combustibles, Paper & Cardboard (Files), Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets, Main Control Board
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	None

<u>Postulated Fire:</u>

The worst case fire postulated would involve wiring in the main control boards. However, due to constant staffing and early warning smoke detectors, a fire would be immediately detected alerting plant staff and the fire brigade. This room would not likely have significant quantities of transient combustibles.

<u>Fire Protection Features:</u>

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area., In-cabinet fire detection is provided for control cabinets.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

The Control Room complex is separated from the remainder of the control building by fire resistant construction. Fire and smoke propagation outside of the fire area boundary is unlikely. The fire area boundaries control fire spread reducing manual firefighting efforts.

Property Loss:

An unmitigated fire in this room would lead to the loss of numerous primary instrument monitoring and manual control switches.

Operations/ Post-Fire Recovery:

An unmitigated fire in this room would lead to the loss of functionality associated with numerous primary instrument and control systems. Post-fire safe shutdown for the main control room is discussed in Section 9A.6.4.1.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location could not involve a radiological release.

9A.5.293 Control Building - Fire Area: 170-101

Reference Drawing 1.2-23

Room Name: 76' Telecom Room (Telecom Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Misc Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Temporary Electrical Cables
Transient Ignition:	None

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.294 Control Building - Fire Area: 170-103, 170-104

Reference Drawing 1.2-23

Room Name: RXB Airlock and Access Tunnel (Airlock, Access Tunnel)

NFPA 101 Hazard Classification: Low **NFPA 13 Hazard Classification:** LH

In Situ Combustibles:	Appliances, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls)
Transient Combustibles:	Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation

Postulated Fire:

Electrical fire in the tunnel from electrical appliances (lighting) or electrical junction boxes located in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

Unmitigated fire could result in loss of one division of safety-related equipment for 12 NPMs. The fire area is separated by 3-hr fire rated barriers so redundant safety-related equipment will be unaffected by a fire in this area. Additionally an unmitigated fire in this room would lead to loss of the RXB access from the CRB.

Operations/ Post-Fire Recovery:

Fire barriers should contain the fire, smoke, and hot gases while the detection and suppression systems should limit fire and smoke to the room. Loss of one division of safety-related equipment may impact multiple units of the plant. The impact could require normal reactor shutdown of affected units.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location could not involve a radiological release.

9A.5.295 Control Building - Fire Area: 170-106, 170-107, 170-108, 170-109, 170-110, 170-111, 170-112, 170-114, 170-115, 170-116, 170-117, 170-118, 170-119, 170-120, 170-123, 170-124

Reference Drawing 1.2-23

Room Name: Control Room Office Support Area (Office Areas, Toilets, Emergency Equipment Room, Reference Files Room, Conference Rooms, STA Area, Airlock, Vestibule)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Furniture, Interior Finish - Carpet, Misc Combustibles, Misc. Wire & Plastic Components, Paper & Cardboard (Files), Plastic, Rubber Materials
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Furniture, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	None

<u>Postulated Fire:</u>

The worst case fire postulated would involve electrical components. Based on the installed fire detection/suppression system and 3-hour fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this fire area. This room would not likely have significant quantities of transient combustibles.

<u>Fire Protection Features:</u>

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

<u>Fire Area/Zone Fire/Smoke Impact on:</u>

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to alert the fire brigade and provide suppression to control a fire. The area is separated from adjacent areas by 3-hour barrier that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of accessory use space for the control room.

Operations/ Post-Fire Recovery:

There is potential loss of plant equipment in this fire area that would impact operations. Damaged equipment would need to be repaired or replace then tested which could impact operation.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location could not involve a radiological release.

9A.5.296 Control Building - Fire Area: 170-200, 170-203, 170-205, 170-206, 170-207, 170-210, 170-211, 170-212, 170-214, 170-215, 170-216, 170-217, 170-218, 170-220, 170-221, 170-223, 170-224

Reference Drawing 1.2-24

Room Name: Technical Support Center and Surrounding Rooms (Technical Support Center, Records Storage, Offices, Toilet, Conference Rooms, Break Room, Corridor, Data Maintenance, Vestibule, Fire Riser Room

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Furniture, Interior Finish - Carpet, Misc Combustibles, Misc. Wire & Plastic Components, Paper & Cardboard (Files), Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Furniture, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Temporary electrical installations

Postulated Fire:

The worst case fire postulated would involve electrical components. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of office space that supports the technical support center.

Operations/ Post-Fire Recovery:

There is no potential loss of plant equipment in this fire area that would impact plant operations.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location could not involve a radiological release.

9A.5.297 Control Building - Fire Area: 170-201

Reference Drawing 1.2-24

Room Name: Data Equipment Room (Data Equipment)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Misc Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	None

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke may affect technical support center capability along with other peripheral systems but would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection along with suppression should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.5.298 Control Building - Fire Area: 170-202

Reference Drawing 1.2-24

Room Name: 100' Telecom Room (Telecom Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Batteries, Electrical Cabinets, Misc Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Batteries, Battery Charger, Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Materials for Testing & Maintenance, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	None

Postulated Fire:

The postulated fire scenario for the area is an electrical equipment fire resulting from an electrical fault. The fire is not expected to spread beyond the boundaries of the room due to the lack of significant combustibles. Smoke or embers will not be recirculated from or to this area via the ventilation system, since the system is provided with fire dampers and smoke detectors to shutoff the supply fans in the event of a fire.

Fire Protection Features:

Suppression Systems:	None
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of network and communication equipment in the room.

Operations/ Post-Fire Recovery:

Fire and smoke would not have a major impact on post fire operations since the room barriers should contain the fire, smoke, and hot gases. The detection and suppression systems should limit fire and smoke to the room.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of radiological sources in the area.

9A.5.299 Control Building - Fire Area: 170-208

Reference Drawing 1.2-24

Room Name: Reserved ("Reserved")

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Misc Combustibles, Misc. Wire & Plastic Components, Qualified Electrical Cable
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electrical Cabinets
Transient Combustibles:	Files, Books, Records, and other paper files, Furniture, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	None

Postulated Fire:

The worst case fire postulated would involve electrical components. Based on the installed fire detection/suppression system and robust fire barrier envelop, a fire would be detected and contained to the area of fire origin and not propagate beyond this room. This room would not likely have significant quantities of transient combustibles. This analysis is based on an anticipated fire is an office-like environment. The details of the contents of this room are safeguards information and a future analysis will confirm the adequacy of this assessment.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area is protected with a fire detection and suppression (peripheral areas) system designed to either alert the fire brigade or where suppression is provided, control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of accessory use space for the control building.

Operations/ Post-Fire Recovery:

There is no potential loss of plant equipment in this fire area that would impact plant operations.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location could not involve a radiological release.

9A.5.300 Control Building - Fire Area: 170-300, 170-302, 170-303

Reference Drawing 1.2-25

Room Name: Mechanical Equipment Room (Mechanical Equipment Room, Airlocks)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Lubricants, Oils, Misc Combustibles, Pipe Insulation, Plastic, Rubber Materials, Qualified Electrical Cable
In Situ Ignition Sources:	Air Handling Units, Electric Appliances (lighting, controls), Electric Motors, Electrical Cabinets, HVAC Equipment
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Hot Work Fuel & Oxidizer, Lubricants, Grease, Hydraulic Fluids, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Cabling - Low Voltage, Cabling- Instrumentation, Electric Motors, Hot work

Postulated Fire:

The worst case fire postulated would involve a motor associated with one of the fans or AHU. A fire would be immediately detected through Plant control monitoring and extinguished either via the installed suppression system or fire brigade intervention. This room would not likely have significant quantities of transient combustibles.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose valve is located in adjacent room or area.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

This fire area is protected with a fire detection and suppression system designed to control a fire. The area is separated from adjacent spaces by fire resistant construction that will resist the propagation of fire and smoke. Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of various pieces of equipment associated with the control building ventilation system.

Operations/ Post-Fire Recovery:

There is no potential loss of plant equipment (both trains of CR HVAC) in this fire area that would impact plant operations.

Radiological Release:

This fire area is located outside the radiological controlled area; therefore, a fire in this location could not involve a radiological release.

9A.5.301 Control Building - Fire Area: 170-305

Reference Drawing 1.2-25

Room Name: Elevator Machine Room (Elevator Equip. Room)

NFPA 101 Hazard Classification: Ordinary **NFPA 13 Hazard Classification:** OH-1

In Situ Combustibles:	Appliances, Electrical Cabinets, Lubricants, Oils, Plastic, Rubber Materials, Qualified Electrical Cable, Transformers - Dry
In Situ Ignition Sources:	Electric Appliances (lighting, controls), Electric Motors
Transient Combustibles:	Construction Materials, Files, Books, Records, and other paper files, Furniture, Materials for Testing & Maintenance, Paints, Solvents and Cleaning Chemicals, Plastic and Rubber materials, Storage (Misc.), Temporary Electrical Cables
Transient Ignition:	Electric Motors, Hot work

Postulated Fire:

The elevator equipment room contains a negligible amount of combustible material. In addition, there are no significant ignition sources or fire hazards in the area.

Fire Protection Features:

Suppression Systems:	Automatic wet pipe sprinkler suppression is provided.
Detection Systems:	Area-wide smoke detection is provided in the area.
Manual Suppression:	Fire Hose or fire hose valve is located within 100 ft of hose and 30 ft of water spray.
Fire Extinguishers:	A portable fire extinguisher is located in the area or in an adjacent area.

Fire Area/Zone Fire/Smoke Impact on:

Emergency Response:

Fire and smoke impact on manual firefighting is minimal as the area is physically separated from the stairs where the standpipe and fire hose valve are located and manual response will be coordinated.

Property Loss:

An unmitigated fire in this room would lead to the loss of the elevator for the control building.

Operations/ Post-Fire Recovery:

Minimal impact on post-fire operations.

Radiological Release:

Radiological impact due to a fire in the area would be minimal based on the lack of significant radiological sources in the area.

9A.6 Fire Safe Shutdown Plan

9A.6.1 General Information

The purpose of this section is to identify the systems necessary for the safe shutdown of the plant following an internal fire event.

This section documents considerations given to the safe shutdown of the plant following an internal fire event in accordance with RG 1.189, NFPA 804 (Reference 9A-1), and NEI 00-01 (Reference 9A-4).

This section documents how a fire may challenge the safe shutdown of the plant and describes how the systems credited for safe shutdown following a fire can be affected by fire-induced failures. This includes assessing the impact of multiple spurious operations (MSOs).

9A.6.2 Fire Safe Shutdown Definition

RG 1.189, Regulatory Position 8.3, defines safe shutdown following a fire for plants with passive residual heat removal systems.

Consistent with this RG, safe shutdown is achieved following a fire event given the demonstration of the availability of the passive decay heat removal systems that are capable of achieving and maintaining a temperature less than 420 degrees F.

9A.6.3 Systems Required for Fire Safe Shutdown

Although systems credited for safe shutdown following a fire event are not required to be safety-related, safe shutdown is achieved using only safety-related equipment. Nonsafety-related equipment is credited for defense-in-depth, with specific examples provided in Section 9A.6.4.

Safe shutdown following a fire is ensured through the successful operation of one division of each of the systems listed in Table 9A-7. System functions have also been identified.

9A.6.3.1 Fire-Induced Failure of Safe Shutdown Systems

Enhanced Fire Protection Criteria

Consistent with RG 1.189, Position 8.2, redundant divisions of equipment required for safe shutdown are separated by three-hour fire barriers except in the areas discussed in Section 9A.6.4. In demonstrating that safe shutdown is achieved, specific consideration is given to the potential for MSOs as noted below.

Multiple Spurious Operations

Consistent with NEI 00-01 and RG 1.189, an expert panel process was utilized to identify multiple spurious actuations that could affect the safety shutdown success path SSC. The details of that meeting are included in Section 9A.7. The fire-induced failures, including multiple spurious operations, that were determined to be applicable to the design are listed in Table 9A-10.

9A.6.4 Special Cases

The specific cases discussed in this section provide a description of how safe shutdown is achieved following a fire in a single fire area where the placement of redundant equipment required for safe shutdown cannot be avoided. Regulatory Position 8.2 describes the control room and the reactor containment building as such areas.

Although the configuration of equipment is such that one division of equipment should remain free of fire damage in the unlikely event that a fire occurs in one of these areas, additional equipment which can be used to mitigate potential equipment failures has been identified that provides additional defense-in-depth, as appropriate.

9A.6.4.1 Fire in the Main Control Room

Redundant equipment necessary for safe shutdown is present in the main control room (MCR). Manual switches that are used to provide backup control of systems automatically controlled by the MPS are located in the MCR. The MPS is described in Section 7.0.4.

This configuration is acceptable considering the fact that a fire in the MCR is highly unlikely and a fire that does occur is promptly detected and extinguished by qualified personnel.

Additionally, in the unlikely event that a fire grew large enough to require an evacuation of the MCR, the controls in the MCR are isolated from affected equipment from outside the fire area. The main control room safety-related manual switches associated with MPS actuations (e.g., reactor trip and containment isolation) are isolated using switches located outside the MCR.

9A.6.4.2 Fire in the Containment

Unlike other PWR designs, the NPM containment is not a structural part of a building, but rather a movable metal vessel. A fire in the containment is virtually impossible as the containment evacuation system (Section 9.3.6) maintains the containment vessel at a vacuum which cannot sustain a fire. Electrical conductors within the containment vessel are of noncombustible construction or routed in conduit which results in no intervening combustible loading for an exposure fire impacting other cable or components in the containment. The vacuum is maintained until the containment is flooded with water, to facilitate decay heat removal during shut down and cool down for refueling. Although the vacuum is eliminated as a result of this process, flooding the containment vessel acts to again preclude the possibility of fire.

The containment is inaccessible during reactor operation which precludes introduction of transient combustibles at any time that the reactor is in operation. After reactor shutdown is completed and safe shutdown is achieved, access to containment is only allowed after the containment is separated from the reactor vessel. Once the containment is separated from the reactor vessel and placed in the dry-dock area transient combustibles could be introduced but at the same time manual fire suppression is available and the core cannot be affected as it has remained in the refueling area. Transient combustibles in the containment when accessible (during shutdown) are administratively controlled.

The fire safe shutdown equipment that is located in the containment vessel is the emergency core cooling system valves, the control rod drive mechanisms, and the pressurizer heaters.

9A.6.4.3 Fire at the Top of a Module

A fire in the area at the top of a module (under the bioshield) is virtually impossible as all of the cabling under the bioshield is routed in conduit or is three hour rated cable which results in no intervening combustible loading for an exposure fire impacting other cable or components in the area.

The top of the module area is inaccessible during reactor operation which precludes introduction of transient combustibles at any time that the reactor is operating. After reactor shutdown is complete, and safe shutdown and appropriate conditions are achieved, removal of the bioshield is permissible. Once the bioshield is removed transient combustibles could be introduced but at the same time manual fire suppression is available in the area of the top of the module. Administrative controls limit transient combustibles in the area of the top of the module when accessible (during shutdown).

Although not plausible, a fire at the top of the module has the potential to challenge multiple redundant systems required for safe shutdown. The potential for these failures to occur have been minimized through the following design considerations.

Minimal Combustible Loading

The cables routed throughout the area around the top of the module are routed through metal conduit or are three hour rated cable. The conduits are either rigid or flexible, corrugated hose conduits. Based on the use of metal conduit, the insulation of the conductors is sealed from the environment; therefore the contribution of conductor insulation fuel load within the conduits is considered negligible and cannot represent an exposure fire for other SSC.

The hydraulic fluid for the mechanical valves controlling the various reactor systems is supplied by piping penetrating through the reactor pool wall and terminating at the valve actuators. The hydraulic fluid is noncombustible.

Robust Component Design

The operation of the DHRS valves and containment isolation valves is independent of control equipment in the area. The energy required for valve operation is stored in a pressurized nitrogen bottle mounted on the valve body. During normal plant operation, the force from this bottle is counteracted by hydraulic force from a remotely located hydraulic system. On an actuation signal from the MPS, an operator action, or a loss of power, two redundant solenoid valves located on the remotely located hydraulic skid open, venting the hydraulic pressure from the valves. With the hydraulic pressure relieved, the nitrogen pressure drives the valve to its safe position.

Given this configuration, common fire-induced failure mechanisms for these components; such as hot shorts, ground faults, and open circuits in control circuits, are not failure modes of concern in this area. In order for a fire to challenge the operation of these components, the smoke or radiant heat of a fire would need to physically damage the mechanical valves themselves.

9A.7 Multiple Spurious Operations - Expert Panel

Consistent with RG 1.189, the methodology of NEI 00-01 Chapter 4 was used as guidance in performing the expert panel reviews. The expert panel reviewed the safe shutdown equipment list, plant drawings, and other plant-specific documents in order to develop a list of possible plant-specific MSOs. The pressurized water reactor Generic MSO List contained in Appendix G of NEI 00-01 was used as guidance, as well as the consideration of a potential MSO scenario encountered during the review of plant documents. Other possible scenarios identified by the facilitator or by NuScale participants were discussed and, if determined to be applicable, added to the MSO list. The MSOs determined to be relevant to the design are presented in Table 9A-10.

Explicit consideration was given to the potential for MSOs in establishing the initial plant fire safe shutdown analysis.

9A.7.1 Preparation for the Expert Panel Meeting

Consistent with NEI 00-01, the MSO Expert Panel included experts from fire protection, probabilistic risk assessment, electrical, instrumentation and controls, operations, and engineering disciplines.

Expert panel members were trained in

- Regulatory Guide 1.189
- examples of MSOs, including specific details from electrical drawings
- the Generic pressurized water reactor MSO List from NEI 00-01 Revision 3, as applicable for the NuScale design
- process for conducting the expert panel
- expectations for the expert panel members
- documentation of results

References

9A-1 National Fire Protection Association, "Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants," NFPA 804, 2015 Edition, Quincy, MA.

9A-2 National Fire Protection Association, "Recommended Practice for Protection of Buildings From Exterior Fire Exposures," NFPA 80A, 2012 Edition, Quincy, MA.

9A-3 National Fire Protection Association, "Standard for the Installation of Sprinkler Systems," NFPA 13, 2016 Edition, Quincy, MA.

9A-4 Nuclear Energy Institute, "Guidance for Post Fire Safe Shutdown Circuit Analysis," NEI 00-01, Revision 2, May 2009.

9A-5 Institute of Electrical and Electronics Engineers, "Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations," IEEE Standard 383-2003, Piscataway, NJ.

9A-6 Institute of Electrical and Electronics Engineers, "IEEE Standard for Flame-Propagation Testing of Wire & Cable" IEEE Standard 1202-2006, Piscataway, NJ.

9A-7 National Fire Protection Association, “Life Safety Code,” NFPA 101, 2015 Edition, Quincy, MA.

Table 9A-1: Fire Hazards Analysis Elements and Attributes

	FHA Elements and Attributes (Regulatory Position 1.2 of RG 1.189 and NFPA 804)	Limitation of this Evaluation
1	The applicability of NRC fire protection requirements and guidance should be evaluated	No specific limitation.
2	In situ and potential transient fire and explosion hazards, including amounts, types, configurations, and locations of flammable and combustible materials (e.g., electric cable insulation and jacketing material, lube oil, diesel fuel oil, flammable gases, chemicals, building materials and finishes) associated with operations, maintenance, and refueling activities should be identified. The continuity of combustible materials (e.g., exposed electrical cables that span the distance between redundant trains), the potential for fire spread, and sources of ignition should be identified and described in the analysis.	Typical transient combustibles are considered within this evaluation, but site-specific transient control programs have not been considered. (See Section 9.5.1).
3	External exposure hazards (e.g., flammable and combustible liquid or gas storage, auxiliary boiler units, adjacent industrial facilities or transportation systems, natural vegetation, and adjacent plant support facilities) that could potentially expose SSCs important to safety to damage from the effects (e.g., heat, flame, smoke) of fires should be identified. Wildfire hazards should be addressed if there is the potential for a wildfire to damage SSCs important to safety.	External hazards are site-specific and have not been specifically considered in this analysis.
4	The design, installation, operaton, testing, and maintenance of automatic fire detection and suppression capabilities should be addressed. The fire hazards analysis should describe the level of automatic protection (e.g., water spray density, gaseous agent concentration) provided relative to the specific fire hazards that have been identified. The effects of lightning strikes should be included in the design of fire detection systems.	This analysis evaluates the needed fire suppression capabilities for the fire protection system. System operation is described in Section 9.5.1.
5	The layout and configurations of SSCs important to safety should be depicted. The protection for safe-shutdown systems (see Regulatory Positions 5.3 and 5.4 of RG 1.189) within a fire area should be determined on the basis of the worst-case fire that is likely to occur and the resulting damage. The fire hazards analysis should explain and document the extent of such damage. The analysis should consider the degree of spatial separation between redundant shutdown systems, the presence of in situ and transient combustibles, the available fire protection systems and features, sources of ignition, and the susceptibility to fire damage of the cables, equipment, systems, and features in the area that are related to safe shutdown.	The detailed cable routing design will be evaluated as part of the as-built FHA. Fire area layout is depicted in the architectural drawings of Section 1.2 and major equipment is described in Section 9A.5 for individual fire areas.
6	Reliance on and qualifications of fire barriers, including fire test results, the quality of the materials and barrier system, and the quality of the barrier installation should be described. Regulatory Position 4.3 of RG 1.189 provides detailed guidelines for testing and qualifying electrical raceway fire barrier systems.	Selection and use of electrical raceway fire barrier systems is site specific and qualification and testing is described by the as-built FHA.
7	Fire area construction (walls, floor, and ceiling materials, including coatings and thicknesses; fireproofing of structural members; area dimensions and volume; normal ventilation and smoke removal capability; and level of congestion as it applies to access for manual firefighting activities) should be described. The fire hazards analysis should provide sufficient information to determine that fire areas have been properly selected based on the fire hazards present and the need for separation of SSCs important to safety. Regulatory Position 4.1.2 of RG 1.189 provides guidelines for fire areas and zones.	With only a few exceptions (electrical raceway fire barrier systems) fire barriers are structural reinforced concrete walls, floors and ceilings. Final determination of the adequacy of barrier construction is established by the as-built FHA.

Table 9A-1: Fire Hazards Analysis Elements and Attributes (Continued)

	FHA Elements and Attributes (Regulatory Position 1.2 of RG 1.189 and NFPA 804)	Limitation of this Evaluation
8	Manual fire suppression capability, including systems (e.g., hydrants, standpipes, and extinguishers), fire brigades, manual firefighting equipment, plans and procedures, training, drills, mutual aid, and accessibility of plant areas for manual firefighting should be identified. The fire hazards analysis should list the location and type of manual firefighting equipment and accessibility for manual firefighting.	No specific limitation, however elements specific to the fire protection program are addressed in Section 9.5.1.
9	Potential fire impacts on operations are to be identified, including the following: • fire in control rooms or other locations where safety-related operations are performed, • fire conditions that may necessitate evacuation from areas that are required to be attended for safe shutdown, and • lack of adequate access or smoke removal facilities that impede plant operations or fire extinguishment in safety-related plant areas	No specific limitation.
10	Potential disabling effects of fire suppression systems on safe-shutdown capability should be identified. The term “damage by fire” in Appendix R also includes damage to equipment from the normal or inadvertent operation of fire suppression systems. The fire hazards analysis should address the effects of firefighting activities. GDC 3 of Appendix A to 10 CFR Part 50 states that “Fire-fighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components.”	Safety-related and risk-significant SSC are protected from the effects of fire suppression system operation. This is described in Section 9.5.1 and not evaluated further in this analysis. 10 CFR 50 Appendix R is not applicable to this application.
11	Explosion-prevention measures in areas subject to potentially explosive environments from flammable gases or other potentially energetic sources (e.g., chemical treatment systems, ion exchange columns, high-voltage electrical equipment) should be listed.	No specific limitation.
12	The availability of oxygen (e.g., inerted containment) should be identified.	No specific limitation.
13	Alternative or dedicated shutdown capability for those fire areas where adequate separation of redundant safe-shutdown systems cannot be achieved should be identified.	Special cases are identified in Section 9A.6.4. Exceptions outside these cases are not expected, but are subject to evaluation of as-built cable runs.

Table 9A-2: In Situ Combustible Material Classification

Combustible Material Classification	Common Fire Sources
Appliances	Electrical appliances (lighting, fixtures, tools, etc.)
Batteries	Uninterruptible power supplies, battery rooms
Battery Chargers	Battery Chargers
Charcoal filters	Filters
Chemicals (health hazards)	Toxic, corrosive, irritants and other chemicals not flammable
Clothing - rubber and plastic	Rubber gloves, plastic hardhats and other personal protective equipment
Clothing - textile	Clothing of cotton, mixed fabrics etc.
Combustible or flammable liquids	Storage or use of flammable or combustible liquids
Electrical cabinets	Junction boxes, control panels, switchgear, distribution panels, motor control centers
Flammable gas	Hydrogen, welding gases
Fuel - propane	Propane tanks for heating or stored for vehicle fuel
Fuel - diesel	Diesel generators, diesel storage
Furniture	Wood and combustible furniture
Interior finish - carpet	Office and other similar environments, main control room, and corridors.
Lubricants, oils	Oils for gears and bearings, shafts, motor controlled valves
Miscellaneous combustibles	Fans, heating units,
Miscellaneous electrical cable	Non-IEEE 383 (Reference 9A-5) or equivalent cables
Miscellaneous wire and plastic components	Control cabling, internal component wiring (computers)
Oxidizers	Oxygen tanks
Paints, solvents	Paints, cleaning supplies
Paper and cardboard (files)	Paper and cardboard files, office areas, record storage/file rooms
Pipe insulation	Approved noncombustible or limited combustible pipe insulation compliant
Plastic, rubber materials	Tubing, plastic parts, storage
Qualified electrical cable	IEEE-383/IEEE-1202 (Reference 9A-6) and equivalent cables
Transformers - dry	Silicon type transformers
Transformers - oil filled	Oil filled transformers
Vehicles	Trucks, security vehicles, forklifts
Wood finishes	Wall and ceiling finishes

Table 9A-3: In Situ Ignition Sources

batteries
pump(s)
battery charger(s)
electric motors
electric switchgear
electrical cabinets
electrical heaters
electric cable(s)
electrical appliances
HVAC equipment
chemical reactions

Table 9A-4: Typical Transient Combustibles

Combustible Material Classification	Common Transient Sources
Vehicles	Fueling vehicles, forklifts for moving storage, security vehicles
Wood, such as pallets, or temporary structures, or wood veneers and finishes	Pallets for transporting materials, temporary structure such as work benches, ladders
Temporary electrical cables	Temporary lighting circuits (extension cabling), temporary power cables
Lubricants, grease, hydraulic fluids	Pumps for transferring liquids, temporary staging of materials for use
Hot work fuel and oxidizer	Welding, torch, plasma welders, etc.
Construction materials	Ladders, temporary structures, scaffolding, tools and equipment storage
Paints, solvents and cleaning chemicals	Materials for cleaning or maintenance on a temporary basis
Files, books, records, and other paper files	Temporary storage of materials in boxes
Plastic and rubber materials	Tools, parts, plastic carts used for transporting equipment
Fuel, diesel	Temporary equipment - generators, motors, and pumps
Fuel, propane	Propane cylinders for fuel
Furniture	Temporary furnishings, storage units, temporary work desks, seating
Materials for testing and maintenance	Test equipment
Resin	Material used in the water chemistry program
Small appliances	Small heating or air units, power tools; may contain plastics that could introduce electrical hazards
Storage (miscellaneous)	Staging of equipment and materials

Table 9A-5: Transient Ignition Sources

Batteries
Hot work - open welding, cutting, and grinding
Temporary electrical installations
Electric motors
Electric switchgear
Diesel engines
Electric heaters
Chemical reactions

Table 9A-6: Hazard Classifications

NFPA 13	
Term	**Definition**
Light hazard occupancies (LH)	Occupancies or portions of other occupancies where the quantity and or combustibility of contents is low and fires with relatively low rates of heat release are expected.
Ordinary hazard (Group 1) (OH-1)	Occupancies or portions of other occupancies where combustibility is low, quantity of combustibles is moderate, stockpiles of combustibles do not exceed 8 ft, and fires with moderate rates of heat release are expected.
Ordinary hazard (Group 2) (OH-2)	Occupancies or portions of other occupancies where the quantity and combustibility of contents are moderate to high, stockpiles of contents with moderate rates of heat release do not exceed 12 ft, and stockpiles of contents with high rates of heat release do not exceed 8 ft.
Extra hazard (Group 1) (EH-1)	Occupancies or portions of other occupancies where the quantity and combustibility of contents are very high and dust, lint, or other materials are present, introducing the probability of rapidly developing fires with high rates of heat release but with little or no combustible or flammable liquids.
Extra hazard (Group 2) (EH-2)	Occupancies or portions of other occupancies with moderate to substantial amounts of flammable or combustible liquids or occupancies where shielding of combustibles is extensive.
NFPA 101	
Term	**Definition**
Low hazard contents	Low hazard contents shall be classified as those of such low combustibility that no self-propagating fire therein can occur.
Ordinary hazard contents	Ordinary hazard contents shall be classified as those that are likely to burn with moderate rapidity or to give off a considerable volume of smoke.
High hazard contents	High hazard contents shall be classified as those that are likely to burn with extreme rapidity or from which explosions are likely.

Table 9A-7: Safe Shutdown Plant Functions

System	Safe Shutdown Plant Functions
Chemical and volume control system (demin water isolation valves)	Reactivity control (prevent inadvertent RCS dilution during safe shutdown)
Containment system	Remove fuel assembly heat, maintain containment integrity, maintain reactor coolant pressure boundary integrity, reactivity control
Control rod assembly	Reactivity control
Control rod drive system	Reactivity control
Decay heat removal system	Remove fuel assembly heat, maintain reactor coolant pressure boundary integrity, reactivity control, maintain containment integrity
Emergency core cooling system	Remove fuel assembly heat
Module protection system	Remove fuel assembly heat, maintain reactor coolant pressure boundary integrity, reactivity control, maintain containment integrity
Neutron monitoring system	Reactivity monitoring
Reactor coolant system	Remove fuel assembly heat, reactivity control, maintain containment integrity
Ultimate heat sink	Remove fuel assembly heat

Table 9A-8: Unlabeled Fire Areas

Building	Room Code	Description
RXB	010-022-01	Module 1 area beneath bioshield
RXB	010-022-02	Module 2 area beneath bioshield
RXB	010-022-03	Module 3 area beneath bioshield
RXB	010-022-04	Module 4 area beneath bioshield
RXB	010-022-05	Module 5 area beneath bioshield
RXB	010-022-06	Module 6 area beneath bioshield
RXB	010-022-07	Module 7 area beneath bioshield
RXB	010-022-08	Module 8 area beneath bioshield
RXB	010-022-09	Module 9 area beneath bioshield
RXB	010-022-10	Module 10 area beneath bioshield
RXB	010-022-11	Module 11 area beneath bioshield
RXB	010-022-12	Module 12 area beneath bioshield
RXB	010-106-01	Spent fuel pool heat exchanger gallery pipe chase
RXB	010-139-01	Vertical pipe chase module 1
RXB	010-139-02	Vertical pipe chase module 2
RXB	010-139-03	Vertical pipe chase module 3
RXB	010-139-04	Vertical pipe chase module 4
RXB	010-139-05	Vertical pipe chase module 5
RXB	010-139-06	Vertical pipe chase module 6
RXB	010-140-07	Vertical pipe chase module 7
RXB	010-140-08	Vertical pipe chase module 8
RXB	010-140-09	Vertical pipe chase module 9
RXB	010-140-10	Vertical pipe chase module 10
RXB	010-140-11	Vertical pipe chase module 11
RXB	010-140-12	Vertical pipe chase module 12
RXB	010-211-01	Module 1 division I electrical chase
RXB	010-216-01	Module 2 division I electrical chase
RXB	010-222-01	Module 3 division I electrical chase
RXB	010-227-01	Module 4 division I electrical chase
RXB	010-232-01	Module 5 division I electrical chase
RXB	010-237-01	Module 6 division I electrical chase
RXB	010-246-01	Module 7 division I electrical chase
RXB	010-251-01	Module 8 division I electrical chase
RXB	010-256-01	Module 9 division I electrical chase
RXB	010-261-01	Module 10 division I electrical chase
RXB	010-267-01	Module 11 division I electrical chase
RXB	010-272-01	Module 12 division I electrical chase
RXB	010-282-02	Module 1 division II electrical chase
RXB	010-287-02	Module 2 division II electrical chase
RXB	010-293-02	Module 3 division II electrical chase
RXB	010-299-02	Module 4 division II electrical chase
RXB	010-304-02	Module 5 division II electrical chase
RXB	010-309-02	Module 6 division II electrical chase
RXB	010-314-02	Module 7 division II electrical chase
RXB	010-319-02	Module 8 division II electrical chase
RXB	010-324-02	Module 9 division II electrical chase
RXB	010-329-02	Module 10 division II electrical chase
RXB	010-335-02	Module 11 division II electrical chase
RXB	010-340-02	Module 12 division II electrical chase

Table 9A-8: Unlabeled Fire Areas (Continued)

Building	Room Code	Description
RWB	030-010-01	Vertical material lift
CRB	170-018	Control Building elevator

Table 9A-9: Fire Areas

Building	Room Code(S)	Description
Reactor Building	010-001, 010-101, 010-201, 010-401, 010-501	Northwest stair (stair)
Reactor Building	010-002, 010-102, 010-202, 010-402, 010-502	Northeast stair (stair)
Reactor Building	010-003, 010-103, 010-203, 010-403, 010-503	Southeast stair (stair)
Reactor Building	010-004, 010-104, 010-204, 010-404, 010-504	Southwest stair (stair)
Reactor Building	010-005	Reactor building elevator (elevator “A”)
Reactor Building	010-006	24’ west mechanical room (mechanical room)
Reactor Building	010-007	Pool cleanup filter B (pool cleanup filter room “A”)
Reactor Building	010-008	Pool cleanup filter A (pool cleanup filter room “B”)
Reactor Building	010-009	Train B LRW degasifier equipment room (degasifier room “B”)
Reactor Building	010-012	Train A LRW degasifier equipment room (degasifier room “A”)
Reactor Building	010-014	24’ northwest gallery area (utilities area)
Reactor Building	010-015	24’ north telecommunication room (telecom room)
Reactor Building	010-016	24’ northeast CVCS ion exchanger gallery (utilities area)
Reactor Building	010-017	Boric acid storage tank room (boric acid storage area)
Reactor Building	010-018	24’ southeast CVCS ion exchanger gallery (utilities area)
Reactor Building	010-019	24’ south telecommunication room (telecom room)
Reactor Building	010-020	24’ south gallery area (utilities area)
Reactor Building	010-022, 010-023, 010-024, 010-422, 010-423	Reactor pool area, spent fuel pool and dry dock area (24’ level submerged under water)
Reactor Building	010-022-01	Module 1 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-02	Module 2 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-03	Module 3 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-04	Module 4 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-05	Module 5 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-06	Module 6 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-07	Module 7 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-08	Module 8 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-09	Module 9 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-10	Module 10 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-11	Module 11 area beneath bioshield (not labeled on drawings)
Reactor Building	010-022-12	Module 12 area beneath bioshield (not labeled on drawings)
Reactor Building	010-026	Module 1 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-027	Module 2 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-028	Module 3 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-029	Module 4 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-030	Module 5 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-031	Module 6 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-032	Module 12 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-033	Module 11 CVCS recirculation pump room (reactor coolant filter room)

Table 9A-9: Fire Areas (Continued)

Building	Room Code(S)	Description
Reactor Building	010-034	Module 10 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-035	Module 9 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-036	Module 8 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-037	Module 7 CVCS recirculation pump room (reactor coolant filter room)
Reactor Building	010-040	Module 1 ion exchanger room
Reactor Building	010-041	Module 2 ion exchanger room
Reactor Building	010-042	Module 3 ion exchanger room
Reactor Building	010-043	Module 4 ion exchanger room
Reactor Building	010-044	Module 5 ion exchanger room
Reactor Building	010-045	Module 6 ion exchanger room
Reactor Building	010-046	Module 12 ion exchanger room
Reactor Building	010-047	Module 11 ion exchanger room
Reactor Building	010-048	Module 10 ion exchanger room
Reactor Building	010-049	Module 9 ion exchanger room
Reactor Building	010-050	Module 8 ion exchanger room
Reactor Building	010-051	Module 7 ion exchanger room
Reactor Building	010-052	Pool cleanup demineralizer room 1
Reactor Building	010-053	Pool cleanup demineralizer room 3
Reactor Building	010-054	Pool cleanup demineralizer room 2
Reactor Building	010-106	Spent fuel pool heat exchanger gallery (utilities area)
Reactor Building	010-106-01	Spent fuel pool heat exchanger gallery pipe chase (not labeled on drawings)
Reactor Building	010-107, 010-138	Utilities area (HVAC AHUs on mezzanine room 010-138)
Reactor Building	010-112	50’ north telecommunications room (telecom room)
Reactor Building	010-114, 010-115, 010-116, 010-117, 010-118, 010-119, 010-120, 010-139	50’ northeast CVCS makeup pump gallery (utilities area, heat exchanger areas)
Reactor Building	010-121, 010-123	Hot lab and chemistry count room
Reactor Building	010-122	Hot lab corridor (utilities area)
Reactor Building	010-125, 010-126, 010-127, 010-128, 010-129, 010-130, 010-131, 010-140	50’ southeast CVCS makeup pump gallery (utilities area, heat exchanger areas)
Reactor Building	010-133	50’ south telecommunications room (telecom room)
Reactor Building	010-134, 010-137	Reactor pool heat exchanger gallery (utilities area, HVAC AHUs on mezzanine room 010-137)
Reactor Building	010-139-01	Vertical pipe chase module 1 (not labeled on drawings)
Reactor Building	010-139-02	Vertical pipe chase module 2 (not labeled on drawings)
Reactor Building	010-139-03	Vertical pipe chase module 3 (not labeled on drawings)
Reactor Building	010-139-04	Vertical pipe chase module 4 (not labeled on drawings)
Reactor Building	010-139-05	Vertical pipe chase module 5 (not labeled on drawings)
Reactor Building	010-139-06	Vertical pipe chase module 6 (not labeled on drawings)
Reactor Building	010-140-07	Vertical pipe chase module 7 (not labeled on drawings)
Reactor Building	010-140-08	Vertical pipe chase module 8 (not labeled on drawings)
Reactor Building	010-140-09	Vertical pipe chase module 9 (not labeled on drawings)
Reactor Building	010-140-10	Vertical pipe chase module 10 (not labeled on drawings)
Reactor Building	010-140-11	Vertical pipe chase module 11 (not labeled on drawings)
Reactor Building	010-140-12	Vertical pipe chase module 12 (not labeled on drawings)
Reactor Building	010-206	Remote shutdown station corridor (utilities area)

Table 9A-9: Fire Areas (Continued)

Building	Room Code(S)	Description
Reactor Building	010-207	Remote shutdown station (remote shutdown room)
Reactor Building	010-208, 010-242, 010-275	75’ electrical gallery (utilities area)
Reactor Building	010-209	Module 1 EDSS-MS battery room C (battery room)
Reactor Building	010-210	Module 1 EDSS-MS battery room A (battery room)
Reactor Building	010-211	Module 1 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-211-01	Module 1 division I electrical chase (not labeled on drawings)
Reactor Building	010-212	Module 1 EDSS-MS battery room B (battery room)
Reactor Building	010-213	Module 1 EDSS-MS battery room D (battery room)
Reactor Building	010-214	Module 2 EDSS-MS battery room A (battery room)
Reactor Building	010-215	Module 2 EDSS-MS battery room C (battery room)
Reactor Building	010-216	Module 2 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-216-01	Module 2 division I electrical chase (not labeled on drawings)
Reactor Building	010-217	Module 2 EDSS-MS battery room D (battery room)
Reactor Building	010-218	Module 2 EDSS-MS battery room B (battery room)
Reactor Building	010-219	75’ north telecommunications room (telecom room)
Reactor Building	010-220	Module 3 EDSS-MS battery room C (battery room)
Reactor Building	010-221	Module 3 EDSS-MS battery room A (battery room)
Reactor Building	010-222	Module 3 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-222-01	Module 3 division I electrical chase (not labeled on drawings)
Reactor Building	010-223	Module 3 EDSS-MS battery room B (battery room)
Reactor Building	010-224	Module 3 EDSS-MS battery room D (battery room)
Reactor Building	010-225	Module 4 EDSS-MS battery room A (battery room)
Reactor Building	010-226	Module 4 EDSS-MS battery room C (battery room)
Reactor Building	010-227	Module 4 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-227-01	Module 4 division I electrical chase (not labeled on drawings)
Reactor Building	010-228	Module 4 EDSS-MS battery room B (battery room)
Reactor Building	010-229	Module 4 EDSS-MS battery room D (battery room)
Reactor Building	010-230	Module 5 EDSS-MS battery room A (battery room)
Reactor Building	010-231	Module 5 EDSS-MS battery room C (battery room)
Reactor Building	010-232	Module 5 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-232-01	Module 5 division I electrical chase (not labeled on drawings)
Reactor Building	010-233	Module 5 EDSS-MS battery room B (battery room)
Reactor Building	010-234	Module 5 EDSS-MS battery room D (battery room)
Reactor Building	010-235	Module 6 EDSS-MS battery room A (battery room)
Reactor Building	010-236	Module 6 EDSS-MS battery room C (battery room)
Reactor Building	010-237	Module 6 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-237-01	Module 6 division I electrical chase (not labeled on drawings)
Reactor Building	010-238	Module 6 EDSS-MS battery room B (battery room)
Reactor Building	010-239	Module 6 EDSS-MS battery room D (battery room)
Reactor Building	010-244	Module 7 EDSS-MS battery room A (battery room)
Reactor Building	010-245	Module 7 EDSS-MS battery room C (battery room)
Reactor Building	010-246	Module 7 MPS division I equipment room (I/O Cabinet room)
Reactor Building	010-246-01	Module 7 division I electrical chase (not labeled on drawings)
Reactor Building	010-247	Module 7 EDSS-MS battery room B (battery room)
Reactor Building	010-248	Module 7 EDSS-MS battery room D (battery room)
Reactor Building	010-249	Module 8 EDSS-MS battery room A (battery room)
Reactor Building	010-250	Module 8 EDSS-MS battery room C (battery oom)
Reactor Building	010-251	Module 8 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-251-01	Module 8 division I electrical chase (not labeled on drawings)
Reactor Building	010-252	Module 8 EDSS-MS battery room D (battery room)
Reactor Building	010-253	Module 8 EDSS-MS battery room B (battery room)

Table 9A-9: Fire Areas (Continued)

Building	Room Code(S)	Description
Reactor Building	010-254	Module 9 EDSS-MS battery room C (battery room)
Reactor Building	010-255	Module 9 EDSS-MS battery room A (battery room)
Reactor Building	010-256	Module 9 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-256-01	Module 9 division I electrical chase (not labeled on drawings)
Reactor Building	010-257	Module 9 EDSS-MS battery room B (battery room)
Reactor Building	010-258	Module 9 EDSS-MS battery room D (battery room)
Reactor Building	010-259	Module 10 EDSS-MS battery room A (battery room)
Reactor Building	010-260	Module 10 EDSS-MS battery room C (battery room)
Reactor Building	010-261	Module 10 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-261-01	Module 10 division I electrical chase (not labeled on drawings)
Reactor Building	010-262	Module 10 EDSS-MS battery room B (battery room)
Reactor Building	010-263	Module 10 EDSS-MS battery room D (battery room)
Reactor Building	010-264	75′ south telecommunications room (telecom room)
Reactor Building	010-265	Module 11 EDSS-MS battery room A (battery room)
Reactor Building	010-266	Module 11 EDSS-MS battery room C (battery room)
Reactor Building	010-267	Module 11 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-267-01	Module 11 division I electrical chase (not labeled on drawings)
Reactor Building	010-268	Module 11 EDSS-MS battery room D (battery room)
Reactor Building	010-269	Module 11 EDSS-MS battery room B (battery room)
Reactor Building	010-270	Module 12 EDSS-MS battery room C (battery room)
Reactor Building	010-271	Module 12 EDSS-MS battery room A (battery room)
Reactor Building	010-272	Module 12 MPS division I equipment room (I/O cabinet room)
Reactor Building	010-272-01	Module 12 division I electrical chase (not labeled on drawings)
Reactor Building	010-273	Module 12 EDSS-MS battery room B (battery room)
Reactor Building	010-274	Module 12 EDSS-MS battery room D (battery room)
Reactor Building	010-280	Module 1 EDSS-MS switchgear room C (charger room)
Reactor Building	010-281	Module 1 EDSS-MS switchgear room A (charger room)
Reactor Building	010-282	Module 1 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-282-02	Module 1 division II electrical chase (not labeled on drawings)
Reactor Building	010-283	Module 1 EDSS-MS switchgear room B (charger room)
Reactor Building	010-284	Module 1 EDSS-MS switchgear room D (charger room)
Reactor Building	010-285	Module 2 EDSS-MS switchgear room A (charger room)
Reactor Building	010-286	Module 2 EDSS-MS switchgear room C (charger room)
Reactor Building	010-287	Module 2 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-287-02	Module 2 division II electrical chase (not labeled on drawings)
Reactor Building	010-288	Module 2 EDSS-MS switchgear room B (charger room)
Reactor Building	010-289	Module 2 EDSS-MS switchgear room D (charger room)
Reactor Building	010-290	North storage room (storage room)
Reactor Building	010-291	Module 3 EDSS-MS switchgear room C (charger room)
Reactor Building	010-292	Module 3 EDSS-MS switchgear room A (charger room)
Reactor Building	010-293	Module 3 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-293-02	Module 3 division II electrical chase (not abeled on drawings)
Reactor Building	010-295	Module 3 EDSS-MS switchgear room D (charger room)
Reactor Building	010-296	Module 3 EDSS-MS switchgear room B (charger room)
Reactor Building	010-297	Module 4 EDSS-MS switchgear room C (charger room)
Reactor Building	010-298	Module 4 EDSS-MS switchgear room A (charger room)
Reactor Building	010-299	Module 4 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-299-02	Module 4 division II electrical chase (not labeled on drawings)
Reactor Building	010-300	Module 4 EDSS-MS switchgear room B (charger room)
Reactor Building	010-301	Module 4 EDSS-MS switchgear room D (charger room)
Reactor Building	010-302	Module 5 EDSS-MS switchgear room A (charger room)

Table 9A-9: Fire Areas (Continued)

Building	Room Code(S)	Description
Reactor Building	010-303	Module 5 EDSS-MS switchgear room C (charger room)
Reactor Building	010-304	Module 5 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-304-02	Module 5 division II electrical chase (not labeled on drawings)
Reactor Building	010-305	Module 5 EDSS-MS switchgear room B (charger room)
Reactor Building	010-306	Module 5 EDSS-MS switchgear room D (charger room)
Reactor Building	010-307	Module 6 EDSS-MS switchgear room A (charger room)
Reactor Building	010-308	Module 6 EDSS-MS switchgear room C (charger room)
Reactor Building	010-309	Module 6 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-309-02	Module 6 division II electrical chase (not labeled on drawings)
Reactor Building	010-310	Module 6 EDSS-MS switchgear room B (charger room)
Reactor Building	010-311	Module 6 EDSS-MS switchgear room D (charger room)
Reactor Building	010-312	Module 7 EDSS-MS switchgear room A (charger room)
Reactor Building	010-313	Module 7 EDSS-MS switchgear room C (charger room)
Reactor Building	010-314	Module 7 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-314-02	Module 7 division II electrical chase (not labeled on drawings)
Reactor Building	010-315	Module 7 EDSS-MS switchgear room D (charger room)
Reactor Building	010-316	Module 7 EDSS-MS switchgear room B (charger room)
Reactor Building	010-317	Module 8 EDSS-MS switchgear room C (charger room)
Reactor Building	010-318	Module 8 EDSS-MS switchgear room A (charger room)
Reactor Building	010-319	Module 8 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-319-02	Module 8 division II electrical chase (not labeled on drawings)
Reactor Building	010-320	Module 8 EDSS-MS switchgear room D (charger room)
Reactor Building	010-321	Module 8 EDSS-MS switchgear room B (charger room)
Reactor Building	010-322	Module 9 EDSS-MS switchgear room A (charger room)
Reactor Building	010-323	Module 9 EDSS-MS switchgear room C (charger room)
Reactor Building	010-324	Module 9 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-324-02	Module 9 division II electrical chase (not labeled on drawings)
Reactor Building	010-325	Module 9 EDSS-MS switchgear room D (charger room)
Reactor Building	010-326	Module 9 EDSS-MS switchgear room B (charger room)
Reactor Building	010-327	Module 10 EDSS-MS switchgear room C (charger room)
Reactor Building	010-328	Module 10 EDSS-MS switchgear room A (charger room)
Reactor Building	010-329	Module 10 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-329-02	Module 10 division II electrical chase (not labeled on drawings)
Reactor Building	010-330	Module 10 EDSS-MS switchgear room B (charger room)
Reactor Building	010-331	Module 10 EDSS-MS switchgear room D (charger room)
Reactor Building	010-332	South storage room (storage room)
Reactor Building	010-333	Module 11 EDSS-MS switchgear room A (charger room)
Reactor Building	010-334	Module 11 EDSS-MS switchgear room C (charger room)
Reactor Building	010-335	Module 11 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-335-02	Module 11 division II electrical chase (not labeled on drawings)
Reactor Building	010-336	Module 11 EDSS-MS switchgear room D (charger room)
Reactor Building	010-337	Module 11 EDSS-MS switchgear room B (charger room)
Reactor Building	010-338	Module 12 EDSS-MS switchgear room C (charger room)
Reactor Building	010-339	Module 12 EDSS-MS switchgear room A (charger room)
Reactor Building	010-340	Module 12 MPS division II equipment room (I/O cabinet room)
Reactor Building	010-340-02	Module 12 division II electrical chase (not labeled on drawings)
Reactor Building	010-341	Module 12 EDSS-MS switchgear room B (charger room)
Reactor Building	010-342	Module 12 EDSS-MS switchgear room D (charger room)
Reactor Building	010-405	Southwest stair vestibule (vestibule)
Reactor Building	010-406	Northwest stair vestibule (vestibule)
Reactor Building	010-407	Northeast stair vestibule (vestibule)

Table 9A-9: Fire Areas (Continued)

Building	Room Code(S)	Description
Reactor Building	010-408	Southeast stair vestibule (vestibule)
Reactor Building	010-409	100' northwest reactor component cooling water pump gallery (utilities area)
Reactor Building	010-410	100' north telecommunications room (telecom)
Reactor Building	010-411	100' northeast containment evacuation pump gallery (hydraulic control stations)
Reactor Building	010-412	East gallery area (utilities area)
Reactor Building	010-414	Power channel A EDN switchgear area (charger room)
Reactor Building	010-415	Power channel A EDN battery area (battery room)
Reactor Building	010-416	Power channel B EDN battery area (battery room)
Reactor Building	010-417	Power channel B EDN switchgear area (charger room)
Reactor Building	010-418	100' southeast containment evacuation pump gallery (hydraulic control stations)
Reactor Building	010-419	100' south telecommunications room (telecom)
Reactor Building	010-420	100' southwest reactor component cooling water pump gallery (utilities area)
Reactor Building	010-506	125' north telecommunications room (telecom)
Reactor Building	010-507, 010-601	125' north CRDS gallery (mechanical equipment area)
Reactor Building	010-508	125' east reactor pool air recirculation AHU area (mechanical equipment area)
Reactor Building	010-509, 010-602	125' south CRDS gallery (mechanical equipment area)
Reactor Building	010-510	125' south telecommunications room (telecom)
Reactor Building	010-600	Elevator machine room
Radioactive Waste Building	030-001, 030-100	North stair (stair)
Radioactive Waste Building	030-002	North electrical room (electrical room)
Radioactive Waste Building	030-003, 030-010, 030-032	Service area (service area, storage)
Radioactive Waste Building	030-004, 030-005	Charcoal decay bed rooms (tank rooms)
Radioactive Waste Building	030-006	Gas cooler room (tank room)
Radioactive Waste Building	030-007	Drum storage area
Radioactive Waste Building	030-009, 030-104	South stair (stair)
Radioactive Waste Building	030-010-01	Vertical material lift
Radioactive Waste Building	030-012, 030-013, 030-015, 030-016, 030-018, 030-019, 030-020, 030-021, 030-024, 030-025, 030-026, 030-027	Rad waste tank rooms (tank rooms)
Radioactive Waste Building	030-017, 030-014, 030-011	South rad waste pumps rooms (pump rooms)
Radioactive Waste Building	030-022, 030-023, 030-028	North rad waste pumps rooms (pump rooms)
Radioactive Waste Building	030-029	Telecom room
Radioactive Waste Building	030-030	Battery room
Radioactive Waste Building	030-031	Charger room

Table 9A-9: Fire Areas (Continued)

Building	Room Code(S)	Description
Radioactive Waste Building	030-101	Mechanical room
Radioactive Waste Building	030-102, 030-103, 030-105, 030-106, 030-107, 030-108, 030-110, 030-111, 030-112, 030-113	100' Rad Waste Building general area (trolley bay, truck bay, drum dryer rooms, liquid radwaste processing area, class "A" waste storage low level solid radwaste sorting, future flex space, warehouse)
Radioactive Waste Building	030-114	Stack Monitoring Equipment Room
Radioactive Waste Building	030-115	Waste Management Control Room
Control Building	170-001	North air bottle room (air bottle room)
Control Building	170-002	Central air bottle room (air bottle room)
Control Building	170-003	South air bottle room (air bottle room)
Control Building	170-004	Tunnel (utility access)
Control Building	170-005	Tunnel (utility access)
Control Building	170-006, 170-113, 170-213, 170-301	Southeast stair (stair)
Control Building	170-007	South battery room (battery room)
Control Building	170-008	South switchgear room (charger room)
Control Building	170-009	Central battery room (battery room)
Control Building	170-010	Central switchgear room (charger room)
Control Building	170-011	North switchgear room (charger room)
Control Building	170-012	North battery room (battery room)
Control Building	170-013	50’ north airlock (airlock)
Control Building	170-014, 170-121, 170-122, 170-304	Northeast stair (stair)
Control Building	170-015	East I/O cabinet room (I/O cabinets)
Control Building	170-016	West I/O abinet room (I/O cabinets)
Control Building	170-017	50’ corridor (passage)
Control Building	170-018	Control building elevator (elevator “A”)
Control Building	170-020	Control room air compressor area (utility access)
Control Building	170-021	Electrical room
Control Building	170-100, 170-102	Main control room (control room, break area)
Control Building	170-101	76’ telecom room (telecom room)
Control Building	170-103, 170-104	RXB airlock and access tunnel (airlock, access tunnel)
Control Building	170-106, 170-107, 170-108, 170-109, 170-110, 170-111, 170-112, 170-114, 170-115, 170-116, 170-117, 170-118, 170-119, 170-120, 170-123, 170-124	Control room office support area (office areas, toilets, emergency equipment room, reference files room, conference rooms, STA area, airlock, vestibule
Control Building	170-200, 170-203, 170-205, 170-206, 170-207, 170-210, 170-211, 170-212, 170-214, 170-215, 170-216, 170-217, 170-218, 170-220, 170-221, 170-223, 170-224	Technical support center and surrounding rooms (technical support center, records storage, offices, toilet, conference rooms, break room, corridor, data maintenance, vestibule, fire riser room
Control Building	170-201	Data equipment room (data equipment)
Control Building	170-202	100’ telecom room (telecom room)
Control Building	170-208	Reserved (“reserved”)
Control Building	170-300, 170-302, 170-303	Mechanical equipment room (mechanical equipment room, airlocks)
Control Building	170-305	Elevator machine room (elevator equipment room)

Table 9A-10: MSOs Challenging Safe Shutdown

Generic MSO ID	Challenge to NuScale Safe Shutdown
6	Failing to isolate letdown can result in the potential for reactor coolant system inventory to be lost from the reactor pressure vessel. This failure can be mitigated by assuring that one division of the MPS is capable of isolating the letdown line via the containment isolation valves.
7	A combination of failures can result in a loss of reactor coolant system inventory should the CVCS makeup pumps spuriously operate in conjunction with a failure to isolate the CVCS makeup isolation valves. The failure involves overfilling the reactor pressure vessel and subsequently lifting the reactor safety valves. This failure would be compounded by a subsequent failure of the CVCS makeup pumps. Additionally, should makeup continue, the makeup pumps ultimately fill the containment vessel at a high enough pressure that the containment vessel may be challenged. This failure can be mitigated by assuring that one division of the MPS is capable of isolating the CVCS makeup and spray lines via the containment isolation valves.
24	Spuriously opening or failing to close the main steam isolation valves and the nonsafety-related backup isolation valves on the main steam lines may result in the loss of inventory in the steam generator and DHRS heat exchangers that results in a failure of the DHRS. This failure can be mitigated by assuring that one division of the MPS is capable of isolating the main steam isolation valves.
25	Spuriously opening or failing to close the main steam isolation bypass valves and the nonsafety-related backup isolation valves on the main steam lines may result in the loss of inventory in the steam generator and DHRS heat exchangers that results in a failure of the DHRS. This failure can be mitigated by assuring that one division of the MPS is capable of isolating the main steam isolation bypass valves.
30	NuScale Power Plant has no auxiliary feedwater system; however a failure to isolate the feedwater lines, particularly when coupled with continued operation of the main feedwater pumps, can result in overfilling the steam generator and the DHRS heat exchanger. This overflow can result in a failure of the DHRS. This failure can be mitigated by assuring that one division of the MPS is capable of isolating the feedwater isolation valves.
33a	NuScale Power Plant has no auxiliary feedwater system; however a failure to isolate the feedwater lines, particularly when coupled with continued operation of the main feedwater pumps, can result in overfilling the steam generator and the DHRS heat exchanger. This overflow can result in a failure of the DHRS. This failure can be mitigated by assuring that one division of the MPS is capable of isolating the feedwater isolation valves.
37	Operation of the pressurizer heaters when the heating elements are uncovered can result in a failure of the heating element sheaths. These sheaths constitute a portion of the reactor coolant pressure boundary and their failure can accordingly result in a loss-of-coolant accident inside containment. This failure can be mitigated by assuring that one division of the MPS is capable of tripping the pressurizer heater breakers.
38	Spurious operation of the CVCS makeup pumps with the pump suction aligned to the demineralized water system can result in the potential for a boron dilution event. This failure can be mitigated by assuring that one division of CVCS demineralized isolation valves isolate. The CVCS demineralized isolation valves are safety related so that the containment isolation valves can remain open in an accident scenario without risk of boron dilution which will allow flexibility for operations.
49	Spurious operation of the backup diesel generators or the auxiliary AC power supply, depending on the specific auxiliary AC power supply utilized for a given application, may lead to non-synchronous paralleling of power supplies. This can result in a failure of the paralleled power supplies and may result in a consequential secondary fire ignition. This failure can be mitigated by assuring that power supply output breakers and the bus supply breakers on supported buses are protected by appropriate protective devices. This failure cannot, by itself, challenge safe shutdown, but the consequences of the potential secondary fire are evaluated.

Table 9A-10: MSOs Challenging Safe Shutdown (Continued)

Generic MSO ID	Challenge to NuScale Safe Shutdown
49.2	Non-synchronous paralleling of the main turbine generator to an otherwise energized bus, similar to MSO 49 can result in the possibility of a secondary fire developing. Additionally, spurious closure to the main generator output breaker when the steam supply to the turbine has been isolated may result in motoring the turbine generator. This may also result in a consequential secondary fire developing. This failure can be mitigated by assuring that power supply output breakers and the bus supply breakers on supported buses are protected by appropriate protective devices. This failure cannot, by itself, challenge safe shutdown, but the consequences of the potential secondary fire are evaluated.
56	Spurious operation, provided the operation goes to completion, of any engineered safety feature is not a failure that can challenge safe shutdown. However, fire induced failures of subsets of the equipment associated with DHRS or ECCS actuations can challenge safe shutdown. Such failures of the DHRS are completely addressed in MSOs 24, 25, 30, and 33a. Fire induced failures of the ECCS valves such that only the reactor vent valves or only the reactor recirculation valves open can essentially induce a loss-of-coolant accident inside the containment which challenges safe shutdown. This failure can be mitigated by assuring that at least two reactor vent valves and one reactor recirculation valve remain free of fire damage.