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DESIGN CONTROL DOCUMENT TIER 2

CHAPTER 9
AUXILIARY SYSTEMS

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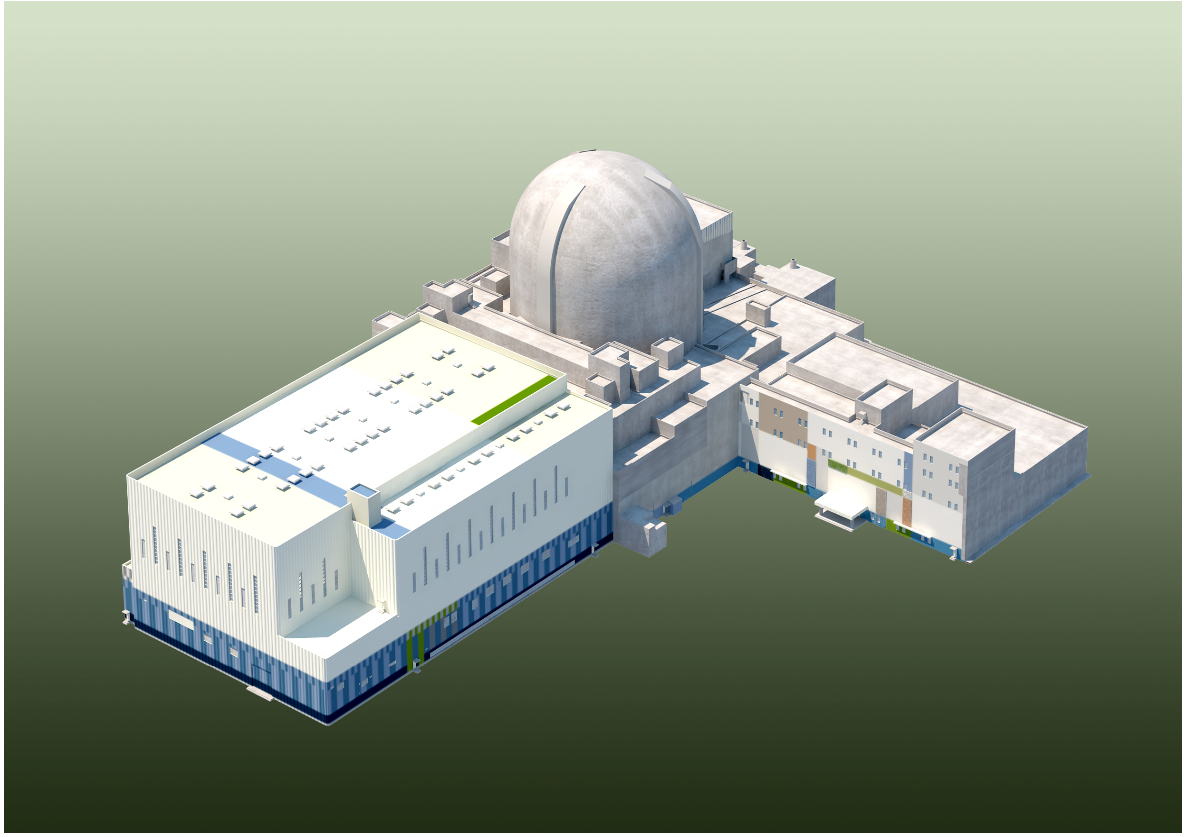

KOREA ELECTRIC POWER CORPORATION
KOREA HYDRO & NUCLEAR POWER CO., LTD

CHAPTER 9 – AUXILIARY SYSTEMS

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ACRONYM AND ABBREVIATION LIST

AAC	Alternate Alternating Current
AB	Auxiliary Building
ACP	Auxiliary Charging Pump
ACU	Air Cleaning Unit
ADV	Atmospheric Dump Valve
AFAS	Auxiliary Feedwater Actuation Signal
AFWS	Auxiliary Feedwater System
AFWST	Auxiliary Feedwater Storage Tank
AHU	Air Handling Unit
ALARA	As Low As Is Reasonably Achievable
ALWR	Advanced Light-Water Reactor
AMCA	Air Movement and Control Association
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOO	Anticipated Operational Occurrence
AOV	Air Operated Valve
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
BABT	Boric Acid Batching Tank
BAC	Boric Acid Concentrator
BAMP	Boric Acid Makeup Pump
BAST	Boric Acid Storage Tank
BM	Boronometer
CAS	Compressed Air System
CAS	Central Alarm Station
CCP	Centrifugal Charging Pump
CCS	Component Control System

CCW	Component Cooling Water
CCWS	Component Cooling Water System
CEA	Control Element Assembly
CEDM	Control Element Drive Mechanism
CFR	Code of Federal Regulations
CIAS	Containment Isolation Actuation Signal
CIP	Cleaning In Place
CIV	Containment Isolation Valve
CMAA	Crane Manufacturers Association of America
COL	Combined License
COLA	Combined License Application
CP	Condensate Polishing
CRE	Control Room Envelope
CS	Containment Spray
CSAS	Containment Spray Actuation Signal
CST	Condensate Storage Tank
CV	Control Valve
CVCS	Chemical and Volume Control System
DBA	Design Basis Accident
DMDS	Diagnostic Monitoring and Display System
DO	Dissolved Oxygen
DWST	Demineralized Water Storage Tank
ECCS	Emergency Core Cooling System
ECWS	Essential Chilled Water System
EDECAIES	Emergency Diesel Engine Combustion Air Intake and Exhaust System
EDECWS	Emergency Diesel Engine Cooling Water System
EDEFOS	Emergency Diesel Engine Fuel Oil System
EDELS	Emergency Diesel Engine Lubrication System
EDESS	Emergency Diesel Engine Starting System
EDG	Emergency Diesel Generator
EDGB	Emergency Diesel Generating Building

EDH	Electric Duct Heater
EDT	Equipment Drain Tank
EFDS	Equipment and Floor Drainage System
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EOF	Emergency Operation Facility
EPRI	Electric Power Research Institute
ESF	Engineering Safety Feature
ESFAS	Engineered Safety Features Actuation Signal
ESFAS-CIAS	Engineered Safety Feature Actuation System - Containment Isolation Actuation Signal
ESFAS-CREVAS	Engineered Safety Feature Actuation Signal - Control Room Emergency Ventilation Signal
ESFAS-SAIS	Engineered Safety Feature Actuation Signal-Safety Injection Actuation Signal
ESFAS-SIAS	Engineered Safety Feature Actuation Signal - Safety Injection Actuation Signal
ESF-CIAS	Engineered Safety Feature-Containment Isolation Actuation Signal
ESF-CPIAS	Engineered Safety Feature-Containment Purge Isolation Actuation Signal
ESF-FHEVAS	Engineered Safety Feature-Fuel handling Area Emergency Ventilation Actuation Signal
ESW	Essential Service Water
ESWS	Essential Service Water System
FDS	Floor Drain System
FHA	Fire Hazard Analysis
FHEVAS	Fuel Handling Area Emergency Ventilation Actuation Signal
FW	Feedwater
FMEA	Failure Modes and Effects Analysis
FPP	Fire Protection Program
FPS	Fire protection System
FSSA	Fire Safe Shutdown analysis

GDC	General Design Criteria (of 10 CFR 50, Appendix A)
GL	Generic Letter
GRS	Gaseous Radwaste System
GRV	Gravity Roof Ventilator
GTG	Gas Turbine Generator
GWMS	Gaseous Waste Management System
HEPA	High-Efficiency Particulate Air
HID	High-Intensity Discharge
HT	High-Temperature
HX	Heat Exchanger
HVAC	Heating, Ventilation and Air Conditioning
HVT	Holdup Volume Tank
I&C	Instrumentation and Control
IAS	Instrument Air System
ICI	In-Core Instrumentation
IHA	Integrated Head Assembly
ILRT	Integrated Leakage Rate Test
IRWST	In-Containment Refueling Water Storage Tank
ISI	Inservice Inspection
ISLOCA	Intersystem LOCA
LAN	Local Area Network
LCP	Local Control panel
LED	Light-Emitting Diode
LLHS	Light Load Handling System
LOCA	Loss of Coolant Accident
LOOP	Loss of Offsite Power
LRS	Liquid Radwaste System
LT	Low-Temperature
LWMS	Liquid Waste Management System
LWR	Light Water Reactor
MCR	Main Control Room

MDS	Makeup Demineralizer System
MG	Main Generator
MG Set	Motor-Generator Set
MOV	Motor Operated Valve
MOX	Mixed Oxide
MSIS	Main Steam Isolation Signal
MSIV	Main Steam Isolation Valve
MSO	Multiple Spurious Operation
MUX	Multiplexer
NDE	Nondestructive Examination
NEC	National Electrical Code
NFR	New Fuel Rack
NPSH	Net Positive Suction Head
NPSS	Normal Primary Sampling System
NRC	U.S. Nuclear Regulatory Commission
NSAC	The Nuclear Safety Analysis Center
NUREG	Nuclear Regulation
OHLHS	Overhead Heavy Load Handling System
OSC	Operational Support Center
PABX	Private Automatic Branch Telephone Exchange
PACU	Packaged Air Conditioning Unit
PASS	Post-Accident Sampling System
PBX	Plant Telephone Exchange
PCWS	Pant Chilled Water System
PI	Pressure Indicator
PLC	Programmable Logic Controller
PMF	Probable Maximum Flood
PNS	Permanent Non-Safety
PRA	Probabilistic Risk Assessment
PRM	Process Radiation Monitor
PWR	Pressurized Water Reactor

RCB	Reactor Containment Building
RCFC	Reactor Containment Fan Cooler
RCP	Reactor Coolant Pump
RCPB	Reactor Coolant Pressure boundary
RCS	Reactor Coolant System
RDS	Radioactive Drain System
RDT	Reactor Drain Tank
RFI	Radio Frequency Interference
RG	Regulatory Guide
RLS	Radioactive Laundry Subsystem
RMWT	Reactor Makeup Water Tank
RSR	Remote Shutdown Room
RSSH	Resin Sluice Supply Header
RV	Reactor Vessel
SAS	Service Air System
SBO	Station Blackout
SC	Shutdown Cooling
SCS	Shutdown Cooling System
SFHM	Spent Fuel Handling Machine
SFP	Spent Fuel Pool
SFPCCS	Spent Fuel Pool Cooling and Cleanup System
SFPCL	SFP Cleanup loop
SFR	Spent Fuel Rack
SG	Steam Generator
SGBDS	Steam Generator Blowdown Systems
SI	Safety Injection
SIAS	Safety Injection Actuation Signal
SIS	Safety Injection System
SIT	Safety Injection Tank
SRP	Standard Review Plan
SSC	Structure, System, and Component

SSE	Safe Shutdown Earthquake
SSS	Secondary Sampling System
SWGR	Switchgear
SWMS	Solid Waste Management System
TDH	Total Dynamic Head
TGBCCW	Turbine Generator Building Closed Cooling Water
TGBOCWS	Turbine Generator Building Open Cooling Water System
TI	Temperature Indicator
TSC	Technical Support Center
UGS	Upper Guide Structure
UHS	Ultimate Heat Sink
UPS	Uninterruptible Power Supply
USNRC	United States Nuclear Regulatory Commission
VCT	Volume Control Tank
VFTP	Ventilation Filter Testing Program
VPN	Virtual Private Network
WWTF	Waste Water Treatment Facility

CHAPTER 9 – AUXILIARY SYSTEMS

9.1 Fuel Storage and Handling

9.1.1 Criticality Safety of New and Spent Fuel Storage

9.1.1.1 Design Bases

New and spent fuel storage facilities are located in the fuel handling area of the auxiliary building (AB), which is designed to meet the seismic Category I requirements. New fuel is stored in standard stainless steel racks installed in a dry new fuel storage pit. Spent fuel is stored in high-density racks installed in a spent fuel pool (SFP) filled with borated water. The high-density racks consist of structural metal (stainless steel) and hot-rolled composite plate material (METAMIC™) used as a neutron absorber.

The new fuel storage racks provide onsite storage capacity of 112 new fuel assemblies corresponding to one refueling batch plus additional margin. This capacity, which represents about 46 percent of the fuel assemblies in the core, envelops a reload batch based on a refueling cycle of 18 months. The center-to-center spacing between adjacent fuel assemblies is designed to be 35.5 cm (14 in) to maintain subcriticality.

The spent fuel storage pit is made up of region I and region II. The fresh or spent fuel assemblies including damaged fuel assemblies are stored in region I, which has a storage capacity for one full core, one refueling batch, and five damaged fuel. Region I storage area is designed to accommodate fuel assemblies with initial enrichment up to 5.0 weight percent U-235. Region II has a storage capacity of spent fuel assemblies generated during plant operation of twenty years at full power in case of an 18-month fuel cycle. Spent fuel storage racks are capable of receiving 1,792 fuel assemblies and the center-to-center spacing between adjacent fuel assemblies is designed to be 27.5 cm (10.83 in) and 22.5 cm (8.86 in) for regions I and II, respectively, to maintain subcriticality.

Criticality is precluded by adequate design of fuel handling and storage facilities and by administrative control procedures, considering the double contingency principle. The basic method of preventing criticality is the control of geometrically safe configurations, especially, the safe spacing between assemblies to reduce neutron interaction. Burnup credit is taken for the spent fuel storage racks by including actinides and fission products in

the criticality calculation with the fixed neutron absorbers in the rack. Soluble boron is credited in the evaluation for normal conditions and postulated accidents. The fuel maximum reactivity assumption, worst-case moderator density, and tolerances and uncertainties of the fuel and racks are considered to maximize the calculated K_{eff} for normal conditions and postulated accidents.

The design of the new fuel storage racks is such that K_{eff} (with all biases and uncertainties) must not exceed 0.95 with full density unborated water and 0.98 with optimum moderation in the new fuel rack, at a 95 percent probability and 95 percent confidence level. For spent fuel storage racks, the maximum K_{eff} value, including all biases and uncertainties, must remain below 1.00 with full density unborated water, at a 95 percent probability and 95 percent confidence level.

The criticality safety evaluation for the new and spent fuel storage racks is performed in accordance with the following acceptance criteria and relevant guidance: 10 CFR 50 Appendix A, General Design Criterion (GDC) 62 (Reference 1), 10 CFR Part 50.68 (Reference 2), NRC guidance (Reference 3), and NUREG/CR-6698 (Reference 4). The 10 CFR Part 50.68 (b) item (2) and (3) for new fuel storage racks and item (4) for spent fuel storage racks are applied as the criticality safety design criteria. Criticality analysis codes are validated in accordance with NUREG/CR-6698 (Reference 4).

9.1.1.2 Facilities Description

The description of new and spent fuel storage facilities is presented in Subsection 9.1.2.2.

9.1.1.3 Safety Evaluation

Prevention of an inadvertent criticality is provided by adequate design of fuel handling and storage facilities and by administrative control procedures, considering the double contingency principle. The main methods for criticality control are (1) limiting the size of the array of fuel assemblies; and, (2) limiting the assembly neutron interaction by fixing the minimum separation and/or providing neutron poisons. In addition, rack cells are maintained in a safe geometry with no deformation in any design basis event. Flooding in the new fuel storage racks and boron dilution in the SFP water are prevented or minimized. Fuel mishandling is prevented by the fuel handling procedures.

For criticality safety design, the following analyses are performed to evaluate the degree of subcriticality and to verify compliance with the design criteria:

a. New fuel storage rack: The K_{eff}s are calculated for new fuel storage pit filled with various density of unborated water. The K_{eff} must not exceed 0.95 for flood with unborated water and 0.98 for flood with optimum moderation conditions, assuming single failure of sources of moderation and potential firefighting activities.

b. Spent fuel storage rack: The minimum required soluble boron concentrations are evaluated for normal conditions pursuant to the criteria of 10 CFR 50.68(b) item (4). Postulated accident conditions are considered for dropping of a fuel assembly, abnormal location of a fuel assembly, and rack movement in the event of seismic activity. Boron dilution events, if any, can be concluded to have no effect on criticality safety.

Criticality analysis conditions are described below, including the design criteria, criticality analysis code with its validation for establishing code bias and bias uncertainty, and calculation model.

9.1.1.3.1 Design Criteria

The design criteria are pursuant to 10 CFR 50.68(b), items (2) and (3), for the new fuel storage rack, and item (4) for the spent fuel storage racks.

For new fuel storage racks, the maximum K_{eff} value, including all biases and uncertainties, must not exceed 0.95 for the flooded condition with unborated water and 0.98 for optimum moderation, at a 95 percent probability and 95 percent confidence level. Rack cells are assumed to be loaded with fuel of the maximum fuel assembly reactivity.

For spent fuel storage racks, the maximum Keff value, including all biases and uncertainties, must remain below 1.0 with full density unborated water, at a 95 percent probability and 95 percent confidence level. Rack cells are assumed to be loaded with fuel of the maximum fuel assembly reactivity.

9.1.1.3.2 Computer Codes and Validation

SCALE 6.1 (Reference 5) is used for the depletion and criticality calculations. The TRITON module is used for the determination of the isotopic content with depletion, and the CSAS5 module is used for the calculation of the neutron multiplication factor, k, using the TRITON-produced atom densities. The SCALE analysis can be done with a number of different cross-section libraries. The ENDF/B-VII (Reference 6) 238-group library is used for the depletion and criticality calculations.

Depletion calculations are performed using the TRITON t-DEPL sequence. The TRITON t-DEPL sequence uses the NEWT computer code to obtain the detailed 2D flux solutions. The neutron fluxes are used in multiple ORIGEN-S depletion calculations to get the isotope inventories compositions which can be used directly in a criticality calculation. The NEWT calculations are performed using the SCALE 238-energy-group ENDF/B-VII library.

Criticality or K_{eff} calculations are performed using the CSAS5 sequence and the ENDF/B-VII 238-energy-group library. CSAS5 uses the KENO V.a, a 3D Monte Carlo transport code.

The validation of KENO V.a code is performed using the benchmark experiments in the international handbook (Reference 7) and NUREG/CR-6361 (Reference 8), and HTC critical experiments (Reference 9). Through the validation of criticality code, the bias and bias uncertainty are evaluated for new and spent fuel storage racks. The guidance and procedure recommended in the NUREG/CR-6698 (Reference 4) is followed for the validation of KENO V.a computer code.

9.1.1.3.3 Analysis Condition

New Fuel Storage Rack

The following analysis conditions are considered in the design of the new fuel storage racks:

a. The new fuel storage rack is located in the cavity surrounded by a concrete structure. The new fuel storage racks are surrounded by a 0.61 m (2 ft) thick

concrete reflector on all five sides of the new fuel storage rack array. The concrete walls surrounding the new fuel storage racks are separated adequately from the racks.

b. The dry new fuel storage pit for new fuel assemblies is designed to store two 8 × 7 racks. The criticality analysis is not performed for the normal condition because there is no moderator in a dry condition.

c. For postulated accidents, a pure water of density range from 0 to 100 percent of full density is assumed to fill the new fuel storage racks. Full density of unborated water is assumed to be 1,000 kg/cm^3 (62.4 lb/ft^3).

d. Actual geometrical model is used in the criticality calculation. The fuel assembly is assumed to have a maximum enrichment of 5 weight percent of U-235 and the rack is assumed to be filled with fuel assemblies to design capacity.

e. No burnable poison rods or other supplemental neutron poisons (e.g., control element assemblies (CEAs)) are assumed to be present in the fuel assemblies.

f. The materials above the active fuel constitute a substantially poorer reflector than a thick concrete reflector.

g. Under postulated conditions of envelopment by aqueous foam or mist, a range of foam or mist densities is examined to provide reasonable assurance that the maximum reactivity of the array is established. The foam or mist is assumed to be pure water.

h. Uncertainties from fuel assembly fabrication tolerances, computer code and Monte Carlo calculation are considered in the calculated K_{eff}.

i. The K_{eff} must not exceed 0.95 in the event the fuel area becomes flooded with pure, unborated water. The K_{eff} must not exceed 0.98 in the event of envelopment of the entire array in a uniform aqueous foam or mist of optimum density that maximizes the reactivity of the finite array.

<u>Spent Fuel Storage Rack</u>

The following analysis conditions are considered in the design of the spent fuel storage racks:

a. The fuel assembly is assumed to have a maximum enrichment of 5 weight percent of U-235 in the criticality calculation for spent fuel storage rack region I. For the normal condition, infinite array of fresh fuel assembly is modeled in the criticality calculation. Criticality for damaged fuel assemblies is separately evaluated and the effects of gap between racks are also evaluated.

b. For the region II analyses, infinite array of 2 × 2 fuel assembly having various U-235 enrichment changing from 1.8 to 5.0 weight percent is used for the criticality calculation. Moderator of pure water is at the temperature (density) within the design limits that yields the largest reactivity. The full density of unborated water is assumed to be 1,000 kg/cm^3 (62.4 lbm/ft^3).

c. Credit is taken for the neutron absorption in the rack structural materials and neutron absorbers. The steel plate thickness is conservatively set to a minimum and only 75 percent of B-10 density in the neutron absorbers is assumed in order to reflect the deformation of the neutron absorber.

d. The neutron absorption effects associated with the soluble boron normally in the SFP water are neglected in the criticality analysis for normal operations and are considered for the postulated accidents. The SFP boron concentration is assumed to be about one-half of the minimum concentration level defined in the Technical Specifications.

e. No cooling time is assumed to avoid fission product accumulation and Xe-135 is not included in the criticality calculation to conservatively evaluate the K_{eff}.

f. The nuclear characteristics of the spent fuel are affected by the core operation parameters, such as coolant temperature, soluble boron concentration in the coolant, and axial burnup profile. Thus, the most severe operating conditions are conservatively assumed in the fuel burnup calculation.

g. No CEAs or burnable poison rods in the fuel assembly, and no neutron absorption effect in the fuel assembly support materials are assumed to be present.

h. The rack is filled with fuel assemblies up to the initial onsite storage capacity with the SFP filled with water.

i. The bias and bias uncertainty obtained from benchmark calculation are reflected in the calculated K_{eff}. Uncertainties from mechanical tolerances and variations in the design parameters are added to the total uncertainty. For region II analyses, the effects of axial burnup profile and burnable poison rods, and uncertainty from the depletion calculation methodology are considered in the calculation K_{eff}.

Calculated K_{eff} including all biases and uncertainties is compared with design criterion in 10 CFR 50.68 in order to show the subcriticality of the new and spent fuel storage racks for normal conditions and postulated accidents. For the spent fuel pool region II, the curve for the minimum-burnup and initial loading enrichment is generated based on the K_{eff}s calculated for each enrichment and burnup.

9.1.1.3.4 Criticality Analysis for New and Spent Fuel Storage Racks

Criticality analyses for new and spent fuel storage racks are performed. The results show that the design criterion in 10 CFR 50.68 is met and that the subcriticality is maintained.

9.1.2 New and Spent Fuel Storage

9.1.2.1 Design Bases

The following design bases are imposed on the storage of new and spent fuel assemblies:

New Fuel Storage

a. The new fuel storage pit is protected from the effects of natural phenomena, including earthquakes, tornadoes, hurricanes, floods, and external missiles. The new fuel storage racks meet the guidance in NRC RG 1.13 (Reference 10), NRC RG 1.29 (Reference 11), NRC RG 1.115 (Reference 12), NRC RG 1.117

(Reference 13), and ANSI/ANS 57.3 (Reference 14) as applicable to General Design Criterion (GDC) 2.

b. All requirements of NRC RG 1.13 (Reference 10) are met excluding those regarding the spent fuel pool water supply because new fuel storage is dry condition. The new fuel storage pit is designed to provide reasonable assurance that any light load, as described in Subsection 9.1.4.2.1, does not exceed the design impact energy capacity of the rack if the load is postulated to fall from its operational height over the new fuel storage racks. In addition, all heavy loads, as described in Subsection 9.1.4.2.1, are prevented from traveling over the new fuel storage racks by the use of mechanical and electrical interlocks on the cask handling hoist.

c. The new fuel storage racks and facilities are designed to meet GDC 2, 5, 61, 62 and 63 of 10 CFR Part 50 Appendix A and qualified as seismic Category I per NRC RG 1.29 (Reference 11) as described in Subsection 9.1.1.3.3.

d. The fuel handling equipment located in the new fuel storage area meets the requirements of ANSI/ANS 57.1 (Reference 15). The new fuel storage racks meet the requirements of ANSI/ANS 57.3 (Reference 14).

e. The new fuel storage racks provide onsite storage capacity of 112 new fuel assemblies. This capacity, which represents 46 percent of the fuel assemblies in the core, envelops a reload batch based on a refueling cycle of 18 months.

f. The new fuel storage racks are designed to meet the requirements of Standard Review Plan (SRP) 3.8.4 Appendix D, which addresses appropriate combinations of seismic and dropped loads with allowable stress/deformation limits.

Spent Fuel Storage

a. The spent fuel pool is protected from the effects of natural phenomena, including earthquakes, tornadoes, hurricanes, floods, and external missiles. The spent fuel storage racks meet the guidance in NRC RG 1.13 (Reference 10), NRC RG 1.29

(Reference 11), NRC RG 1.115 (Reference 12), NRC RG 1.117 (Reference 13), and ANSI/ANS 57.2 (Reference 16) as applicable to GDC 2.

b. All requirements of NRC RG 1.13 (Reference 10) are met. The spent fuel pool is designed to prevent a loss of water in the spent fuel pool resulting in uncovery of the fuel, to prevent heavy loads from traversing over the spent fuel storage racks when the racks contain fuel assemblies, to withstand the impact of fuel assembly or a handling tool or a combination of both falling from the maximum handling elevation, to incorporate components that meet the seismic classification designated in Table 3.2-1, and to incorporate water level and radiation monitoring instrumentation.

c. The spent fuel storage racks and facilities are designed to meet the GDC 2, 4, 5, 61, and 62 of 10 CFR 50 Appendix A and qualified as seismic Category I per NRC RG 1.29 (Reference 11) as described Subsection 9.1.1.3.3.

d. The fuel handling equipment in the spent fuel storage area meets the requirements of ANSI/ANS 57.1 (Reference 15). The spent fuel pool meets the requirements of ANSI/ANS 57.2 (Reference 16).

e. The spent fuel storage racks provide onsite storage capability for one full core and one maximum refueling batch including the storage of five damaged fuel canisters plus a 20-year quantity of discharged fuel based on a refueling cycle of 18 months. All components within the area of the fuel racks meet the requirements of Table 3.2-1 to preclude rack damage.

f. The spent fuel storage racks are designed to meet the requirements of SRP 3.8.4 Appendix D, which addresses appropriate combinations of seismic and dropped loads with allowable stress/deformation limits.

g. The spent fuel storage racks are not anchored to the pool floor or the wall. Clearances are allowed for rack tipping but the rack design and loading preclude rack overturning.

9.1.2.2 Facilities Description

9.1.2.2.1 New Fuel Storage

New Fuel Storage Pit

The approximately 5.18 m (17 ft) deep dry, unlined, reinforced, concrete, new fuel storage pit is designed to provide support for the new fuel storage racks. The new fuel storage pit is designed to maintain its structural integrity following an SSE and perform its intended function following a postulated event such as a fire, internal/external missiles, or pipe break. The walls surrounding the fuel handling area and new fuel storage pit protect the fuel from missiles generated inside the auxiliary building. The fuel handling area does not contain a credible source of missiles. The auxiliary building is a seismic Category I structure and is described in Subsection 1.2.14.2. Subsection 3.5 addresses missile sources and protection of the new fuel storage pit.

The structure of the new fuel storage pit supports the weight of the new fuel storage rack at the floor level. The new fuel storage racks (see Figure 9.1.2-1) consists of individual vertical cells interconnected to each other at several elevations. The rack module is anchored to the pit floor. The new fuel storage pit is covered by steel plates and an access platform. The access platform provides passage between racks for inspection of the new fuel. Both the steel plates and access platform are designed not to fall or collapse in the event of an SSE.

The new fuel storage pit is provided with a drain system, which is connected to the auxiliary building sump to prevent the new fuel storage pit from being flooded by an unanticipated release of water. The design of the drain piping system includes a check valve to prevent backflow into the new fuel storage pit through the drain system. All cells of the new fuel storage racks are each designed with a openings at the bottom of each of the four sides, which can drain an unanticipated release of water.

New Fuel Storage Rack

The rack is an assembly cells. The minimum edge-to-edge spacing between fuel assemblies in adjacent rows is maintained to keep the fuel assemblies in a subcritical

configuration. The minimum spacing is satisfied even after allowances are made for the rack fabrication tolerances and the predicted deflections resulting from postulated accident conditions. The stainless steel used for fabrication of the new fuel storage racks is physically and chemically compatible with clad-fuel made of Zircaloy. All cells have openings at the bottom to facilitate draining under a flooding accident. Each storage cell in the racks has a lead-in guide to facilitate fuel assembly insertion without damaging the assembly.

The racks are bolted to embedments at the bottom of the rack storage cavity to preclude tipping.

A new fuel inspection area is provided for the inspection of new fuel assemblies after they are withdrawn from their shipping container and before being placed in the new or spent fuel racks. It contains a seismic Category II inspection device to ascertain whether the fuel assemblies meet the dimensional requirements for installation into the reactor vessel. Visual inspection is also performed to check for shipping damage and to provide reasonable assurance that all protective wrapping material has been removed.

The center-to-center spacing between adjacent fuel assemblies is designed to be 35.5 cm (14 in) to the north and south, and 35.5 cm (14 in) to the east and west, to maintain subcriticality.

9.1.2.2.2 Spent Fuel Storage

Spent Fuel Pool

The spent fuel handling area consists of three separate, water-filled, fuel storage and handling areas—the spent fuel cask loading pit, SFP, and fuel transfer canal. Each area can be sealed from its adjacent area by a hinged gate equipped with elastomer seals. The gates allow the spent fuel cask loading pit and the fuel transfer canal to be drained without affecting the water level in the SFP. The gates are designed to withstand the water pressure in the SFP when the adjacent areas are dewatered.

The fuel transfer canal contains the fuel transfer system that is used for transporting fuel assemblies to and from the containment building. The spent fuel cask loading pit contains

the spent fuel cask that is used for the transport of spent fuel assemblies from the fuel storage area in the auxiliary building.

All the preceding areas are stainless-steel-lined and concrete-walled pools that are integral parts of the fuel handling area building structure.

The SFP is approximately 7.31 m (42 ft) deep and made of reinforced concrete lined with stainless steel plate. The SFP is sufficiently deep that when a spent fuel assembly is being carried over the spent fuel storage racks by the spent fuel handling machine (SFHM) at its maximum lift height, there is sufficient water coverage to provide reasonable assurance that personnel on the SFHM or on the operating floor around the pool are not exposed to radiation levels exceeding 0.025 mSv per hour.

Piping penetrations to the SFP are at least 3.05 m (10 ft) above the top of the fuel assemblies seated in the spent fuel storage racks. The bottom of the gates that lead from the SFP to the fuel transfer canal and the spent fuel cask loading pit are above the top of the stored fuel assemblies. The spent fuel storage racks and the pool floor are designed to withstand the maximum impact energy of a fuel handling tool or a fuel assembly with its handling tool dropped from the maximum lift height. Redundant low- and high-level water alarms and temperature measurement instruments, as described in Subsection 9.1.3.5, minimize the potential for overfilling the pool. The ventilation system for the SFP area is described in Subsection 9.1.3.1.

Pipes that discharge into the spent fuel pool include a siphon break between the normal water level and the level of the SFP pumps' suction connection.

The makeup water to the SFP is provided by a Safety Class 3, seismic Category I, water supply, as described in Subsection 9.1.3.2.

A liner leakage collection system is provided to collect possible leakage from liner plate welds on the pool walls and floor. The stainless steel liners are welded to the C-shaped embedment in the pool walls, and the floors and embedment are interconnected and drain through the leakage collection pipe to a monitored collection point.

The SFP leakage collection pipes connected to the C-shaped embedment are closed by valves or caps in the collection points. Any leakage from liner plate welds is detected by opening the valves or caps during weekly patrols. To meet the requirements of 10 CFR 20.1406 (Reference 17), the inside of the leakage collection pipes is inspected using a device (e.g., fiberscope) approximately every refueling outage. If any materials (e.g., accumulated boric acid residue, minerals) are detected, the pipes are cleaned. The leakage collection pipes are sized to allow cleaning as specified in NRC RG 4.21 (Reference 18).

Spent Fuel Storage Racks

Spent fuel storage racks are typically stainless steel structures with rectangular fuel storage cells with neutron absorber attached on the outside of it for high-density storage (see Figure 9.1.2-2).

Spent fuel storage rack modules are free-standing on embedments in the pool floor. Sufficient space is provided between adjacent modules and between modules and other obstructions in the SFP to allow the modules to slide without contacting each other or other obstructions during a seismic event. The modules are equipped with stable, adjustable feet that rest on the embedments. The adjustable feet and lifting lugs permit the modules to be installed in the pool. The stainless steel used for the fabrication of the racks is compatible with fuel assembly materials and the spent fuel borated water environment.

Neutron-absorbing material is inserted into the cover plate so that it is located between adjacent fuel storage cells. The neutron-absorbing material extends the full length of the active fuel. Provisions are made for installing surveillance specimens of the neutron-absorbing material to the rack modules in an accessible location. The surveillance specimens are removed in accordance with a preplanned schedule using remotely operated tools.

Spent fuel is stored in two regions of the pool. The fresh or spent fuel assemblies including damaged fuel assemblies are stored in Region I (see Figure 9.1.2-2.1), which has a storage capacity for one full core, one refueling batch, and five damaged fuel assemblies. The Region I storage area is designed to accommodate fuel assemblies with initial enrichment of up to 5.0 weight percent U-235.

Region II (see Figure 9.1.2-2).2) has a storage capacity for only spent fuel assemblies generated during 20 years of plant operation. The maximum initial enrichment of 5.0 weight percent U-235 and the minimum burnup to each enrichment are applied for Region II design.

The center-to-center spacing between adjacent fuel assemblies is designed to be 27.5 cm (10.83 in) for Region I racks and 22.50 cm (8.86 in) for Region II racks to maintain subcriticality.

The SFSR is also provided with an array of five storage spaces for damaged fuel assembly containers. These racks contain the neutron absorber, and the center-to-center spacing of this array is 27.5 cm (10.83 in).

No overhead crane, except the light load fuel handling machine, passes over the SFP. The fuel handling machine is designed to withstand seismic Category I loads to preclude its fall or collapse due to an SSE.

Spent fuel storage racks are free-standing, and each rack module is supported by four legs. A lead-in guide is provided to provide reasonable assurance of easy insertion of fuel assemblies.

Design of the spent fuel storage facility is in accordance with NRC RG 1.13 (Reference 10).

9.1.2.2.3 New and Spent Fuel Storage Rack Design

The fuel storage facilities are designed to meet the guidelines of ANS 57.2 (Reference 16) and ANS 57.3 (Reference 14). The structural design and stress analysis of the new and spent fuel storage racks are evaluated in accordance with the seismic Category I requirements of NRC RG 1.29 (Reference 11).

The dynamic and stress analyses are performed as described in the structural and seismic analysis report (Reference 19). Loads and load combinations considered in the structural design and stress analysis are shown in Table 3.8A-9C and are based on SRP, Section 3.8.4, Appendix D.

An uplift force analysis is conducted for new and spent fuel storage racks design and is described in the structure and seismic analysis report (Reference 19). Each rack is evaluated for its ability to withstand a maximum uplift force of 2,268 kg (5,000 lb) based on the lifting capacity of the suspension hoist and the fuel handling machine. Structural analysis is conducted to verify that the resultant stress in the critical part of the rack is within acceptable stress limits and that the deformation of the rack array is limited to maintain a subcritical array.

A fuel assembly drop analysis is conducted for each fuel rack to maintain a subcritical array. Drop weight is determined from the fuel assembly weight along with the handling tool (total weight 1,100 kg (2,425 lb)). The drop height is determined from the higher value of 0.61 m (2 ft) or the design height for handling fuel above each rack.

9.1.2.3 Safety Evaluation

9.1.2.3.1 New Fuel Storage Racks

The new fuel storage racks are designed to seismic Category I requirements and are capable of withstanding normal and postulated dead loads, live loads, and loads caused by an SSE.

The new fuel storage rack is located in the new fuel storage pit. No loads are required to be carried over the new fuel storage pit while the cover is in place. The cover is designed so that it will not fall and damage the fuel or fuel rack during a seismic event. Administrative controls are used when the cover is removed for new fuel transfer operations to limit the potential for dropped object damage.

Materials used in rack fabrication are compatible with the storage pit environment and surfaces that come into contact with the fuel assemblies are made of annealed austenitic stainless steel. Structural materials are corrosion resistant and will not contaminate the fuel assemblies or pit environment.

The new fuel assemblies are stored dry. The rack structure is designed to maintain a safe geometric array for normal and postulated accident conditions. The rack structure maintains the required degree of subcriticality for normal and postulated accident conditions such as flooding with pure water and worst-case moderator density.

9.1.2.3.2 Spent Fuel Storage Racks

The spent fuel storage racks are designed to seismic Category I requirements (described in Section 3.2) and are capable of withstanding normal and postulated dead loads, live loads, loads resulting from thermal effects, and loads caused by an SSE.

The spent fuel racks are designed with adequate energy absorption capabilities to withstand the impact of a dropped fuel assembly from the maximum lift height of the fuel handling machine, as described in Subsection 9.1.2.3.3. Handling equipment capable of carrying loads heavier than fuel components (e.g., spent fuel cask handling crane) is prevented by design from carrying heavy loads over the spent fuel storage area. The spent fuel storage racks can withstand an uplift force greater than or equal to the uplift capability of the fuel handling machine (2,268 kg [5,000 lb]).

Materials used in rack fabrication are compatible with the storage pool environment, and surfaces that come into contact with the fuel assemblies are made of annealed austenitic stainless steel. Structural materials are corrosion resistant and do not contaminate the fuel assemblies or pool environment. The neutron absorbing material used in the rack design is suitable for the storage environment.

Design of the spent fuel storage facility is in accordance with NRC RG 1.13 (Reference 10).

The thermal-hydraulic analysis demonstrating that the flow through the spent fuel rack is adequate for decay heat removal from the spent fuel assemblies during anticipated operating conditions is provided in the thermal-hydraulic analysis report.

The spent fuel storage racks and storage facility are designed to seismic Category I requirements. The spent fuel storage rack is designed to meet the following criteria under plant conditions such as seismic or fuel handling accidents:

a. Prevent physical damage to the stored fuel

b. Maintain the stored fuel in a subcritical configuration

c. Maintain the capability to remove and insert fuel assemblies

d. Maintain the stored fuel in a coolable geometry

The spent fuel storage racks and storage facility are designed to maintain the minimum allowable fuel spacing during the fuel storage. The structural material of the spent fuel storage rack is designed to withstand corrosion from contact with the cooling water.

9.1.2.3.3 Fuel Assembly Drop Analysis

New and spent fuel storage racks are evaluated for withstanding a postulated drop of a fuel assembly and its associated handling tool to maintain a subcritical array assuming the maximum weight handled on each rack and the maximum drop height, as described in Table 9.1.2-1.

9.1.2.4 Inspection and Testing Requirements

Refer to Section 14.2 (test abstract #038) for the initial plant startup test program related to the proper operation of the fuel handling equipment, including the spent fuel storage rack positions.

A coupon surveillance program monitors the neutron absorbing material (METAMIC™) over the lifetime of the racks to verify their integrity. The coupons are taken from the same production lot as used for fabrication of the rack and characterized for comparison with subsequent measurements. At least one archive specimen is retained for later comparison with the irradiated coupons.

A minimum of 14 coupons are immersed into the storage racks in the SFP. Additional coupons may be used to address potential license extensions and post-shutdown fuel storage. Each coupon is large enough to obtain a tensile test specimen (approximately 10.16 × 20.32 cm [4 × 8 in]). The coupons are adjacent to freshly discharged irradiated fuel in an empty fuel compartment in Region I and Region II.

The recommended schedule for coupon monitoring is to remove and examine one coupon at approximately 1.5, 3, 4.5, 6, 7.5, 9, 10.5, 12, 18, 22.5, 27, 31.5, 36, and 39 years from the time the SFP is permanently filled with water, as described in Table 9.1.2-2. Coupons are measured and visually examined to monitor changes in the physical properties of the

neutron absorbing material (METAMIC^{TM}). B-10 areal density is also measured. Coupons that are not destroyed may be returned to the pool for continued use in the surveillance program.

The poison surveillance program is intended to monitor changes in physical and chemical properties of neutron-absorbing material by performing the following measurements on a pre-planned schedule:

a. Visual observation and photography

b. Neutron attenuation

c. Dimensional measurements (length, width, and thickness)

d. Weight and specific gravity

Qualification Program for the METAMIC^{TM} Neutron Absorber

The potential environmental deterioration mechanism is corrosion. Corrosion testing is performed, and the results are evaluated. The neutron absorbing material has sufficient strength and ductility for handling and fabrication and supporting its own weight in the rack.

9.1.3 Spent Fuel Pool Cooling and Cleanup System

The spent fuel pool cooling and cleanup system (SFPCCS) consists of the spent fuel pool (SFP) cooling system and the SFP cleanup system. The SFPCCS is designed to remove the decay heat generated by the spent fuel assemblies stored in the SFP, and purify the water of the SFP and the in-containment refueling water storage tank (IRWST). Cooling is accomplished by taking heated water from the pool, pumping it through a heat exchanger, and returning the cooled water to the pool. The SFPCCS is also used to clarify and purify water in the fuel transfer canal and refueling pool during the refueling operation.

9.1.3.1 Design Bases

Specific design bases for the SFPCCS are as follows:

a. The SFP chemistry parameters for cleanliness during normal operation are shown in Table 9.1.3-1. The SFPCCS is designed to clean and purify the water in the SFP, refueling pool, cask loading pit, fuel transfer canal, and refueling canal without causing any interruption in the refueling operation. The filters and demineralizers of the SFP cleanup system are designed to provide adequate purification to maintain the maximum radiation dose to 0.025 mSv per hour for personnel.

b. The SFP cooling system consists of two redundant divisions that are independent with each other. The SFP cooling system, during normal and accident conditions, is designed to remove the decay heat that is produced by the spent fuel assemblies of the newest batch just offloaded from the core and the accumulated assemblies resulting from previous refueling. Each of the two cooling divisions is capable of maintaining the SFP water temperature below 60 °C (140 °F) with the SFP heat exchanger through the component cooling water system (CCWS) at the design flow and temperature. The system is designed to maintain an SFP temperature below 60 °C (140 °F) in an SFPCCS single active failure.

c. Decay heat is removed by pumping the SFP water through the heat exchanger using SFP cooling pumps. The heat exchangers are supplied with cooling water of the CCWS.

d. The SFP cooling system is located in a seismic Category I building, which provides protection from the effects of natural phenomena and external missiles, as described in Sections 3.3, 3.4, and 3.5.

e. The SFPCCS is designed to accommodate expected the environmental conditions and is capable of performing its intended safety functions.

f. The SFP cooling system (piping, pumps, valves, and heat exchangers) is safety-related, seismic Category I, safety Class 3, and designed in accordance with American Society of Mechanical Engineers (ASME) Section III.

g. To preclude loss of minimum SFP water level that provides proper shielding, all piping that penetrate the pool are located the approximately 3 m (10 ft) above the

top of the spent fuel assemblies and all piping extending down into the pool have siphon breaker holes at or above this level.

h. The SFPCCS is designed to collect system leakage. Floor drains in the SFP area are provided to collect and route radioactive liquid to the liquid radwaste system (LRS) for processing. The design features of the equipment and floor drainage system (EFDS) are described in Subsection 9.3.3. The SFPCCS includes the following features:

   1) A means for detecting leakage from the system or components of the system

   2) Components and headers designed to provide individual isolation capability to provide reasonable assurance of system function, control system leakage, and allow system maintenance

   3) A means for detecting radioactive leakage and chemical contamination from interfacing systems and the ability to preclude the long-term effects of chemical contamination or the spreading of radioactivity

i. Instrumentation is provided to maintain SFP water level and temperature within design limit.

j. The SFPCCS is designed to be capable of maintaining safe radiation levels for personnel during anticipated operating and accident conditions. The SFPCCS is designed to maintain radiation dose to plant personnel as low as is reasonably achievable (ALARA). To maintain low radiation levels, the SFPCCS includes demineralizers, filters, and strainers for the removal and retention of radioactive material, such as irradiated corrosion products. The design features of the SFPCCS include:

   1) Provisions for the transfer of spent filter cartridges and resins to the solid waste management system (SWMS) for processing and disposal

   2) Routing of spent resin transfer lines through shielded pipe chases to the SWMS

3) Provisions of a flushing capability for spent resin transfer lines to prevent clogging, which would create hot spots and require additional maintenance

The fuel handling area heating, ventilation and air conditioning (HVAC) system for the SFPCCS is described in Subsection 9.4.2.

9.1.3.2 System Description

The SFPCCS is composed of two redundant 100 percent capacity cooling divisions that are used to remove heat from the SFP and two 100 percent capacity combined cleanup divisions that are used to purify water in the SFP, IRWST, the fuel transfer canal, and the refueling pool. The SFPCCS flow diagram is shown in Figure 9.1.3-1.

Each cooling division consists of one heat exchanger and pump, and associated piping, valves, and instrumentation. Design parameters for the major safety-related components are shown in Table 9.1.3-2. Each cooling division is designed to maintain the SFP water temperature below 60 °C (140 °F) during normal and accident conditions.

The SFP cooling system removes decay heat from fuel stored in the SFP. Heat is transferred from the SFP cooling system, through two heat exchangers, using the CCWS.

When each cooling division is in operation, the SFP water is circulated through the hot side of a heat exchanger by an SFP cooling pump. The pool level is not lowered below the required level by gravity drainage, because the SFP suction connections are located above the required minimum water level. Each return line contains an anti-siphon device to prevent gravity drainage of the pool. To assist in maintaining SFP water clarity, floating impurities on the pool surface are removed by skimmers.

Each cleanup division consists of a strainer, a pump, a cleanup filter, a demineralizer, and a demineralizer filter to maintain the clarity and purity of SFP, fuel transfer canal, refueling pool, and IRWST water. This cleanup loop capacity is sufficient for removing fission products and other contaminants that may be introduced if a leaking fuel assembly is transferred to the SFP. The cleanup division can clean and purify the refueling water while SFP heat removal operations proceed.

The SFP cooling system is located in a seismic Category I building that provides protection from the effects of natural phenomena and external missiles. The SFP cooling system components, such as piping, pumps, valves, and heat exchangers, is safety-related and designed as safety Class 3.

The SFP is initially filled with water that has a boron concentration range of 4,000 to 4,400 ppm. The SFP receives normal borated makeup water from the boric acid storage tank (BAST) from the boric acid makeup pump (BAMP). The BAST, BAMP, and all associated piping are classified as seismic Category I and safety Class 3.

The seismic Category I makeup water sources are the auxiliary feedwater storage tanks (AFWSTs). The makeup water is delivered to the SFP by the component cooling water (CCW) makeup pumps. The non-seismic category makeup water source is the demineralized water storage tank (DWST), and the makeup water is delivered via a manually operated valve in the connecting line. These makeup water supplies compensate for normal evaporative losses.

The failure of the spent fuel pool cooling portion would raise the SFP water temperature and then would increase evaporative loss. Minor leakage from SFPCCS piping, components, or the SFP liner also lowers the SFP water level. A liner leakage collection system drains any possible leakage from SFP liner plate welds and floor to the auxiliary building sumps. Component or system leakage from the SFPCCS is detected by several means, including area sump and floor drain level monitoring, radiation monitoring, SFP level monitoring, and refueling pool level monitoring during refueling operations. Once a low-level alarm signal from SFP to the main control room (MCR) is detected, the SFP makeup is provided to the SFP manually and compensates the losses from make-up water sources.

The safety-related boric acid water makeup line is connected from the BAST to the SFP. The BAST, as a primary water source of water to the SFP, is classified as seismic Category I, and the makeup line from the BAST to the SFP is classified as seismic Category I and designed in accordance with ASME Section III.

Another seismic Category I makeup line is provided from the auxiliary feedwater storage tanks (AFWST), as a backup water sources to the SFP. The makeup water is delivered to the SFP via CCW makeup pumps.

The demineralized water storage tank (DWST) is a non-seismic category source of makeup water to the SFP. In addition, the makeup line from the DWST to the SFP is a non-seismic category. The SFP water is separated from the water in the fuel transfer canal by a gate. The gate is installed so the fuel transfer canal is drained after the refueling operation is finished or to allow maintenance of the fuel transfer equipment.

The cooling portion of the SFPCCS is designed to maintain its functionality during and following an SSE. Each cooling portion is designed to service the SFP under the condition of the temperatures and heat loads described in Subsection 9.1.3.1. The performance of the system satisfies the requirements of GDC 2, 4, 61, and 63. In Table 9.1.3-3, a failure modes and effects analysis (FMEA) for the SFP cooling system is presented. The cooling and cleanup flow paths are shown in Figure 9.1.3-1.

The cleanup portion of the SFPCCS, piping, demineralizers, and filters is non-safety related.

9.1.3.2.1 Component Description

The SFP cooling pumps and heat exchangers are classified as safety Class 3 and are designed to ASME Section III, Subsection ND. The SFP cleanup pumps, filters, strainers, and demineralizers are classified as non-safety related. All containment isolation valves and associated piping of the SFPCCS are classified as safety Class 2, and are designed to ASME Section III, Subsection NC.

9.1.3.2.1.1 Spent Fuel Pool Cooling Pumps

Two identical pumps are installed in parallel in the SFP cooling system. Each pump is sized to deliver sufficient coolant flow through an SFP cooling heat exchanger to meet the system cooling requirements. The pumps are horizontal, centrifugal type, with all wetted surfaces being stainless steel or an equivalent corrosion-resistant material. The net positive suction head (NPSH) available from the system exceeds each pump's required NPSH. This is based on the minimum pool level and the maximum pool temperature of 60 °C (140 °F). The pumps are controlled manually from the MCR.

9.1.3.2.1.2 Skimmer

The skimmers are designed to circulate surface water through the SFP cleanup system and return it to the pool via the SFP cleanup pumps.

9.1.3.2.1.3 Spent Fuel Pool Cooling Heat Exchangers

The SFP cooling heat exchanger is a plate-type exchanger constructed of austenitic stainless steel. The heat exchangers consist of a pack of corrugated metal plates with portholes for the passage of the two fluids between which heat transfer takes place. Heat is transferred from the SFP water to the CCW through the heat exchangers. The corrugated metal plate and gasket materials are selected to be compatible with the SFP water and CCW chemistry. The two independent heat exchangers exist for redundancy for safety functions assuming a single failure.

9.1.3.2.1.4 Spent Fuel Pool Cleanup Pumps

Two SFP cleanup pumps are used to circulate water for the spent fuel pool, refueling canal, fuel transfer canal, and the refueling pool, through SFP cleanup demineralizers and filters. The SFP cleanup pumps are also used to circulate water from the IRWST in the same fashion.

9.1.3.2.1.5 Spent Fuel Pool Cleanup Filters and Demineralizer Filters

Two vertical, cylindrical cartridge-type SFP cleanup filters are located upstream of the SFP cleanup demineralizers to improve the pool water clarity by removing insoluble particles that obscure visibility. Two vertical, cylindrical cartridge-type SFP demineralizer filters are located downstream of the SFP cleanup demineralizers. Each cartridge filter is designed for a flow rate of approximately 1,324.89 L/min (350 gpm). The filter assembly is constructed of austenitic stainless steel.

9.1.3.2.1.6 Strainers

Strainers are located in each pool cleanup pump suction line for removal of relatively large particles that might otherwise clog the demineralizers or damage the pumps. The strainer is made of stainless steel.

9.1.3.2.1.7 Spent Fuel Pool Cleanup Demineralizers

Two vertical, cylindrical-type SFP demineralizers are designed to provide adequate clarity of the SFP, IRWST or refueling pool water, and reduce the radiation level at the fuel handling working area. Each demineralizer is designed for a flow rate of approximately 1,324.89 L/min (350 gpm) and contains a flow distributor on the influent to prevent channeling of the resin bed and a resin retention element on the effluent to preclude discharge of resin with the effluent process fluid. Connections are provided to sluice spent resin to the SWMS. The vessel material is austenitic stainless steel.

9.1.3.2.1.8 Valves

Manual stop valves are for component isolation, and manual throttle valves are provided for flow control. Valves in contact with SFP water are made of austenitic stainless steel.

9.1.3.2.1.9 Piping

All piping in contact with pool water is made of austenitic stainless steel. The piping is welded except for flanged connections for the pumps and heat exchangers being used to facilitate maintenance.

9.1.3.2.2 System Operation

The SFPCCS is not directly associated with plant startup, normal operation, or shutdown but is operated when there is a need to lower the SFP water temperature or when there is a need to clean or purify the water in the SFP, refueling pool, fuel transfer canal, or the in-containment refueling water storage tank (IRWST). All situations are dependent upon the fuel loading and refueling cycle. Components for each cooling and cleanup division are interchangeable while in service using interconnection lines between divisions.

9.1.3.2.2.1 Spent Fuel Pool Cooling Operation

The SFP cooling pumps and cleanup pumps are started manually in the MCR. The SFP heat exchangers are provided with temperature indicators to indicate a cooling water loss.

Each cooling division, during normal power operation, is capable of removing the decay heat generated by one refueling batch offloaded from core after 100 hours following shutdown, plus the spent fuel assemblies accumulated from the previous refueling operations, while maintaining an SFP temperature of 48.9 °C (120 °F) or less. In case of an SFPCCS single active failure, the system is designed to maintain an SFP temperature below 48.9 °C (120 °F).

Each of the two redundant spent fuel pool cooling divisions, during refueling operation, is capable of removing the decay heat generated by one full core offloaded after 100 hours following shutdown, plus the spent fuel assemblies accumulated from the previous refueling operations, while maintaining an SFP temperature of 60 °C (140 °F) or less. In case of any single active failure, the system is designed to maintain an SFP temperature below 60 °C (140 °F).

The SFP water chemistry is checked at local sample points. If purification is required, the SFPCCS functions to demineralize and filter the water and return it to the pool. Local sample connections are provided in the purification return line to check the effectiveness of either the filter and the demineralizer or one of them, as well as the boron concentration.

9.1.3.2.2.2 Spent Fuel Pool Cleanup Operation

Normal operation of the SFP cleanup loop (SFPCL) is intermittent and is manually actuated. The system is started, operated, and secured from the MCR to maintain optical clarity and to limit corrosion and fission product concentration in the spent fuel pool and the refueling pool. The SFPCL also removes the surface debris from the spent fuel pool and the fuel transfer canal by the skimmer, which consists of weirs positioned just below the water surface. Samples are periodically taken from the cleanup loop to determine the quality of the water.

After the refueling pool is filled with borated water from the IRWST, the SFPCL processes water by circulating it from refueling pool through the filter and demineralizer and back to the refueling pool.

Following transfer of the irradiated fuel to the spent fuel pool, the cleanup discharge lines to the refueling pool are manually isolated and spent fuel pool cleanup is initiated, and this switchover during refueling is determined by the conditions of spent fuel pool and refueling pool.

After refueling operation, the SFPCL is used to pump down the water in the refueling pool and fuel transfer canal to the IRWST.

The drain isolation valve is locked closed during refueling operation. After refueling operation, this valve is opened to drain the refueling pool water completely.

After the refueling pool water is drained to the IRWST, the SFPCL is isolated from the refueling pool and the IRWST is manually aligned to the SFPCL.

9.1.3.2.3 Design Features for Minimization of Contamination

The SFPCCS is designed with features that meet the requirements of 10 CFR 20.1406 (Reference 17) and NRC RG 4.21 (Reference 18). The basic principles of NRC RG 4.21 and the methods of control suggested in the regulations are delineated into four design objectives and two operational objectives, which are addressed in Subsection 12.3.1.10. The following description summarizes the primary features that address the design and operational objectives for the SFPCCS.

The SFPCCS has been evaluated for leak identification from the SSCs that contain radioactive or potentially radioactive materials, the areas and pathways where probable leakage may occur, and the methods of leakage control incorporated into the design of the system. The leak identification evaluation indicates that the SFPCCS is designed to facilitate early leak detection and the prompt assessment and response to manage collected fluids. Thus, unintended contamination to the facility and the environment is minimized and/or prevented by the SSC design, supplemented by operational procedures and programs and inspection and maintenance activities.

Prevention/Minimization of Unintended Contamination

a. The SFPCCS components are located in elevated cubicles inside the auxiliary building. The cubicle floors are sloped, coated with epoxy, and provided with drains that are routed to the local drain hubs. This design approach prevents the spread of contamination within the facility and to the environment.

b. The spent fuel pool, refueling pool, refueling canal, and cask loading pit are installed with stainless steel liner plates and welded seam drain channels. Other components, including heat exchangers, filters, demineralizers, and pumps, are fabricated from stainless steel material and utilize welded construction for life-cycle planning, thus minimizing leakage and unintended contamination of the facility and the environment.

Adequate and Early Leak Detection

a. The SFPCCS is designed to include sight glasses for visual inspections. Early leak detection can be achieved through the use of sight glasses and operating procedures.

b. Adequate instrumentation, including level, flow rate, temperature, and pressure elements, is provided to monitor the system operation to prevent undue interruption.

Reduction of Cross-Contamination, Decontamination, and Waste Generation

a. The SSCs are designed with life-cycle planning through the use of nuclear industry-proven materials that are compatible with the chemical, physical, and radiological environment, thus minimizing waste generation.

b. Plate-type heat exchangers are used for thermal transfer from the spent fuel pool cooling side to the component cooling water side. The heat exchangers are designed with stainless steel plates to minimize the potential for pinhole leaks between the potentially contaminated system and component cooling water. The heat exchangers are designed for the component cooling water to operate at a

higher pressure than the process fluid side, which prevents the spread of contamination to the clean system side through leakage. The gaskets between the plates are also designed to direct leakage to the outside of the heat exchangers. The leakage is then collected in the local floor drain sump. This design approach minimizes the spread of contamination to the facility and the environment.

c. The utility connections are designed with a minimum of two barriers to prevent the contamination of clean systems.

Decommissioning Planning

a. The SSCs are designed for the full service life and are fabricated as individual assemblies for easy removal, with the exception of the liner plates.

b. The SSCs are designed to facilitate decontamination. Design features, such as the welding techniques that are used and surface finishes, are included to minimize the need for decontamination and the resultant waste generation.

c. The SFPCCS is designed with minimum embedded or buried piping. Piping between buildings is equipped with piping sleeves with leakage directed back to the auxiliary building for collection, thus preventing unintended contamination to the environment.

Operations and Documentation

a. The removal and packaging of spent filter elements and spent resin is designed for remote manual operation. Adequate space is provided around the equipment to enable prompt assessment and responses when required.

b. The COL applicant is to provide operational procedures and maintenance programs as related to leak detection and contamination control (COL 9.1(1)). Procedures and maintenance programs are to be completed before fuel is loaded.

c. The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations (COL 9.1(2)). Documentation requirements are included as a COL information item.

Site Radiological Environmental Monitoring

a. The SFPCCS is designed to manage radioactive contamination through the storage of spent fuel. The integrity of the SFPCCS is maintained through monitoring, in-service inspection, and the implementation of lessons learned from industry experience. Maintaining the SFPCCS results in a low level of contamination to the facility. Because the SFPCCS is located at higher plant elevations, the potential for environmental contamination of soil and groundwater from pool liquid leakages is minimized. However, because the pool is open, contamination from the evaporation of water from the SFPCCS and other systems is included in the site radiological environmental monitoring program. The program is included as a COL information item.

9.1.3.3 Safety Evaluation

9.1.3.3.1 Spent Fuel Pool Cooling

The safety function of the SFPCCS is to transfer heat from the SFP to the CCWS according to the design parameters established in Subsection 9.1.3.1. This function is achieved under both normal and accident conditions. Suitable redundancy provides reasonable assurance that this function can be achieved assuming a single failure of a component coincident with the loss of either onsite or offsite power. In the event of a failure of a pool cooling pump or loss of cooling water to a heat exchanger, the second cooling division provides backup capability, thus providing reasonable assurance of continued cooling of the SFP. The pool cooling pumps and heat exchangers are physically separated by the divisional wall in the auxiliary building. A cooling division may be shut down for limited periods of time for maintenance or replacement of malfunctioning components.

A non-safety-related component failure in the SFP cleanup system will not affect the functional performance of any safety-related components. The SFP cleanup system has

independent flow paths along with components that are physically separated from the SFP cooling system. An FMEA for the SFP cooling system is presented in Table 9.1.3-3.

9.1.3.3.2 Spent Fuel Pool Water Supply

As the SFP cooling process progresses, natural evaporation losses are expected to occur. The leakage probability is very low because the SFP stainless steel liner is a seismic Category I structure. Consequently, makeup water connections are essential to compensate for the water lost based on the assumed natural evaporation losses.

A station blackout (SBO) event, where there is total loss of cooling functions, is the most critical condition that challenges SFP integrity during a full core offload and with the SFP fully loaded with previously discharged spent fuel. The alternate ac (AAC) power source is promptly activated from the onset of SBO, and then one division of SFPCCS equipment is reactivated to resume SFP cooling, thereby precluding boiling. Furthermore, the SFP water volume allows an approximately 3.7-hour margin prior to SFP water boiling during a total loss of cooling condition or SBO at full core offloads. The SFP has been thermal-hydraulically analyzed for the integrity evaluation of the SFPCCS cooling function. Hence, the need for SFP water makeup is ultimately based on natural evaporation losses.

The SFP receives normal borated makeup water from the BAST, which is seismic Category I, safety Class 3, via the BAMP. The BAST is able to supply 643.52 L/min (170 gpm) of boric acid water through a seismic makeup line to the SFP.

The seismic Category I backup makeup water sources are also provided for SFP water makeup. The AFWSTs, as seismic Category I backup water sources, are able to supply 946.35 L/min (250 gpm) of non-borated water to the SFP via a CCW makeup pump. Non-borated water from a non-seismic category makeup water source is used to make up for the normal evaporation losses of the SFP from the DWST, and the makeup water is delivered via a manually operated valve in the connecting line.

Two makeup lines and two spray lines from outside the building are installed to establish a flexible means. Makeup water flow of 1,892 L/min (500 gpm) and spray water flow of 757 L/min (200 gpm) from an external water source can be injected into the SFP. The makeup lines and spray lines are provided as dry-pipes located on opposite corners of the

SFP and are designed to withstand a safe shutdown earthquake. A portable makeup pump, such as a fire truck, can be used to supply SFP makeup water and spray water through these connection lines.

9.1.3.3.3 Spent Fuel Pool Dewatering

The SFPCCS is designed to prevent the reduction in spent fuel pool coolant inventory under accident conditions. To prevent the SFP cooling water loss, the pool is designed to maintain a minimum of approximately 3 m (10 ft) of water above the top of the spent fuel for proper cooling and shielding in accordance with NRC RG 1.13 (Reference 10). All piping that penetrates the pool is located at approximately 3 m (10 ft) above the top of the spent fuel assemblies and all piping extending down into the pool has siphon breaker holes at or above this level.

The SFP cleanup system piping in the SFP is arranged so that any pipe failure cannot drain the SFP below the minimum water level.

9.1.3.3.4 Water Quality

The SFP cleanup loop maintains radiation doses to plant personnel as low as is reasonably achievable (ALARA).

Whenever a fuel assembly with defective cladding is transferred from the fuel transfer canal to the SFP, a small amount of water is interchanged between the refueling canal and the SFP as fuel assemblies are transferred in the refueling process. The cleanup loops remove fission products and other contaminants from the water. Liquid sampling of the spent fuel pool is performed to monitor the concentrations of chemistry. Radioactivity concentrations can be maintained so low that the dose rate at the surface of the SFP is 0.025 mSv in accordance with ANSI/ANS 57.2 (Reference 16).

The design flow rate and filtering capability of the SFP cleanup system are determined so that the refueling pool water chemistry and clarity can be maintained adequate for fuel handling work.

The SFPCCS piping located in the pool is designed to provide reasonable assurance of the proper circulation of pool water and refueling canal water.

The SFPCCS maintains the refueling pool and SFP water chemistry and clarity within the specified water chemistry requirements in Table 9.1.3-1.

9.1.3.3.5 Natural Phenomena and Missiles

The essential components of the SFPCCS are designed to withstand natural phenomena and external missiles.

9.1.3.4 Inspection and Testing Requirements

Hydrostatic testing of the SFPCCS is carried out prior to initial startup. Preoperational testing is described in Section 14.2. During normal operation, system performance is verified by monitoring system pressures, temperatures, levels, and flows.

Inservice inspection (ISI) of pumps, valves, and piping is carried out in compliance with the requirements of ASME Section XI.

Inservice testing of active pumps and valves is carried out to provide reasonable assurance of operational readiness as described in Subsection 3.9.6.

Sampling of the spent fuel pool water is performed for gross activity and particulate concentration. The components of the SFPCCS are so arranged that periodic testing and ISI are possible.

9.1.3.5 Instrumentation Requirements

The instrumentation provided for the SFPCCS is described in the following paragraphs. Alarms and indications are provided as noted. SFP cooling system temperature and level instrumentation are powered from the Class 1E electrical system.

9.1.3.5.1 Temperature

Instrumentation classified as safety Class 3 is provided to measure the temperature of the water in the SFP, and non-safety instrumentation is needed to measure the temperature of the refueling pool. The instrumentation is provided to give local and MCR indication as well as annunciations in the MCR when there is a deviation from normal temperatures.

Safety-related instrumentation is also provided to give local indication of the temperature of the SFP water as it leaves the cooling heat exchanger.

If the SFP water is being purified, instrumentation is provided to measure the temperature of the water in the SFP. A high pool water temperature is alarmed in the MCR, and cleanup flow is diverted if it is above the demineralizer resin temperature limits.

9.1.3.5.2 Pressure

Instrumentation is provided to measure and give indication of the pressures in the SFPCCS pump discharge lines. A deviation from normal pressure in the SFP cooling pump discharge lines is alarmed in the MCR. Instrumentation is also provided upstream and downstream of each cleanup filter, demineralizer, and demineralizer filter to measure the pressure differential across the filters, demineralizers, and demineralizer filters.

9.1.3.5.3 Flow

Instrumentation is installed downstream of the SFP heat exchanger that measures the SFP cooling portion flow and shows local indication of the SFP cooling portion flow. This instrument is used to check whether the flow rate of the cooling water returning to the SFP via the SFP heat exchanger is maintained at the specified value. Alarms that indicate a loss of cooling function are provided to the MCR to detect low flow rates.

A local flow indicator for measuring the purification flow is installed at the outlet of each purification line.

9.1.3.5.4 Water Level

Two safety-related SFP water level transmitters are installed in the SFP to measure the SFP water level from a 100 percent water level to the top level of the spent fuel assemblies. The SFP water level transmitters annunciate high water level, low water level, and low-low water level of the SFP to the MCR, RSR, and locally.

The SFP cooling pump and cleanup pump are interlocked with SFP water level to stop the pumps automatically as the SFP water level is decreased to a predetermined setpoint. The interlock prevent the pumps from cavitation and failure.

9.1.3.5.5 Radiation

Gamma radiation is continuously monitored in the fuel handling area. A high-level signal is alarmed locally and annunciated in the MCR.

9.1.4 Light Load Handling System (Related to Refueling)

The light load handling system (LLHS) consists of equipment, tools, and procedures for refueling, handling, and storage of fuel assemblies from receipt of the new fuel container to shipment of the spent fuel cask.

9.1.4.1 Design Bases

The LLHS is designed to meet requirements of 10 CFR 50 Appendix A, GDC 2, 5, 61, 62, and ANSI/ANS 57.1-1992 (Reference 15).

The LLHS is designed to meet requirements of the GDC 2, 5, 61, 62, and ANSI/ANS 57.1 as follows:

a. For seismic conditions, the combined dead loads, live loads, and seismic loads do not cause any portion of the equipment to disengage from its supports and fall into the pool.

b. Grapples and mechanical latches that carry fuel assemblies or control element assemblies (CEAs) are mechanically interlocked against the inadvertent opening.

c. All spent fuel transfer and storage operations are designed to be conducted underwater to provide reasonable assurance of adequate shielding during refueling and to permit visual control of the operation at all times. A positive mechanical stop is provided to prevent the fuel from being lifted above the minimum safe water shield depth and not cause damage or distortion to the fuel or the fuel handling equipment when engaged at full operating hoist speed.

d. Electrical interlocks provide reasonable assurance of the reliability of system components, to simplify the performance of sequential operations, and to limit travel and loads so that design conditions will not be exceeded. In no case will they be used to prevent inadvertent criticality or reduce the minimum water coverage for personnel protection. No single interlock failure will result in a condition that will allow equipment malfunction, damage to the fuel, or the reduction of shielding water coverage.

e. The components of the LLHS such as the bridges, trolleys, hoist units, hoisting cables, grapples, and hooks conform to the requirements of ASME NOG-1 (Reference 20).

f. The fuel handling equipment includes interlocks, travel-limiting features, and other protective devices to minimize the possibility of mishandling or equipment malfunction that could result in inadvertent damage to fuel assemblies and potential fission product release.

g. Equipment located within the reactor containment building during plant operation is capable of withstanding, without damage, the containment building test pressure.

h. The seismic and quality group classifications for the LLHS are specified in Section 3.2. The LLHS is designed to meet the requirements of the seismic and quality group classifications.

i. No components in the LLHS are shared among nuclear power plants.

9.1.4.2 System Description

The LLHS is an integrated system of equipment, tools, and procedures for refueling, handling, and storage of fuel assemblies from receipt of the new fuel container to shipment of the spent fuel cask.

The equipment is designed to handle the fuel assemblies in dry or wet condition from the time they arrive at the site until they are placed in a cask for shipment from the site. Underwater transfer of fuel assemblies provides a transparent radiation shield, as well as a cooling medium for removal of decay heat. Boric acid is added to the SFP water in an amount that provides reasonable assurance of maintaining subcritical conditions.

The major components of the LLHS are the refueling machine (Figure 9.1.4-1), CEA change platform (Figure 9.1.4-2), fuel transfer system (Figures 9.1.4-3A and 9.1.4-3B), spent fuel handling machine (SFHM) (Figure 9.1.4-4), CEA elevator (Figure 9.1.4-5), and new fuel elevator (Figure 9.1.4-6). The fuel movement path for new fuel receipt and storage, reactor refueling operations, and spent fuel storage and shipment is shown in Figure 9.1.4-7. The fuel transfer system moves the fuel between the containment building and the fuel handling area in the auxiliary building through the transfer tube. The building layouts related to refueling operations are also shown in Figure 9.1.4-8 and Figure 9.1.4-9.

All of the LLHS equipment is classified as non-nuclear safety with the single exception of the double-blind flange assembly.

An intermediate fuel storage rack is located in the refueling cavity for the temporary storage of fuel assembly if required during the refueling operation. A stored assembly is removed from the rack prior to reinstallation of the reactor vessel (RV) internals. A storage rack for holding the CEA/in-core instrumentation (ICI) transport container during CEA and ICI disposal operations is also located within the refueling cavity. Because the CEA/ICI transport container is essentially the same size as a fuel assembly (for compatibility with the transfer system), the storage rack is designed to contain a fuel assembly in the event a fuel assembly is inadvertently placed within it.

The two cavity fuel carriers, the intermediate fuel storage rack, and the CEA/ICI transport container storage rack are designed to meet the same criticality considerations as the spent fuel storage racks.

Tools and lift rigs are also used to disassemble reactor components. The major tools and servicing equipment that are used for refueling are listed in Table 9.1.4-1.

In the design of fuel handling equipment, mechanical stops and positive locks are provided to prevent damage to or dropping of the fuel assemblies.

All machines in each refueling system are networked together to provide a simple, powerful method for communicating machine status and other pertinent information from one machine to another.

9.1.4.2.1 Components and Tools

9.1.4.2.1.1 Refueling Machine

The refueling machine is shown in Figure 9.1.4-1. The refueling machine is a traveling bridge and trolley that is located above the pool, and rides on rails set in the concrete on each side of the refueling pool. Motors on the bridge and trolley position the machine over each fuel assembly location within the reactor core or fuel transfer carrier. During withdrawal or insertion of a fuel assembly, the load on the hoist cable is monitored at the console to provide reasonable assurance that movement is not being restricted.

Locking between the grapple and the fuel assembly is provided by the engagement of the grapple actuator arm in axial channels running the length of the fuel hoist assembly. Therefore, it is not possible to uncouple even with inadvertent initiation of an uncoupling signal to the actuator assembly. The drives for both the bridge and the trolley provide close control for accurate positioning, and brakes are provided to maintain the position once achieved. In addition, interlocks are installed so that movement of the refueling machine is not possible when the hoist is withdrawing or inserting a fuel assembly. The movement of bridge and trolley is allowed when the fuel assembly has reached the up-limit.

An anti-collision device at the bottom of the mast assembly prevents damage to the fuel, should the mast be inadvertently driven into an obstruction, and a positive mechanical up-stop is provided to prevent the fuel from being lifted above the minimum safe water cover depth.

Manually operated handwheels are provided for bridge, trolley, and winch motions in the event of a power loss. Manual operation of the grappling device is also possible in the event that service air pressure is lost. The refueling machine is designed to hold its load during a safe shutdown earthquake, a loss of power, or the loss of service air.

9.1.4.2.1.2 Fuel Transfer System

The major components of the fuel transfer system are a carriage with a carrier for two fuel assemblies, two upenders, and two hydraulic power units as described below.

a. Transfer carriage

   The transfer carriage, as shown in Figure 9.1.4-3A and 9.1.4-3B, conveys the fuel assemblies through the transfer tube. Fuel assemblies are inserted into the transfer carriage in a vertical position, lowered to the horizontal position, moved to the fuel handling area through the fuel transfer tube, and then restored to a vertical position. The load in the transfer drive cables is displayed at the control console. A cable overload condition interrupts the transfer operation.

b. Upender

   Upenders, as shown in Figures 9.1.4-3A and 9.1.4-3B, are provided at each end of the transfer tube. Each machine consists of a structural support base from which is pivoted an upending straddle frame that engages the two-cavity fuel carrier. When the carriage with its fuel carrier is in position within the upending frame, the pivots for the fuel carrier and the upending frame are coincident. A long tool is also provided to allow manual rotation of the fuel carrier in the event that either cylinders fail or hydraulic power is lost.

c. Hydraulic power unit

The hydraulic power unit, as shown in Figure 9.1.4-10, provides the motive force for raising and lowering the upender with the fuel carrier. It consists of a stand containing a motor coupled to a hydraulic pump, a pump reservoir, valves, and the necessary hoses to connect the power package to the hydraulic cylinders on the upender.

9.1.4.2.1.3 Fuel Transfer Tube Assembly

A fuel transfer tube extends through the containment wall. During reactor operation, the transfer tube is sealed by means of a double-blind flange and a penetration sleeve, located inside the containment building.

The transfer tube arrangement, as shown in Figure 9.1.4-11, consists of a 0.91 m (36 in) diameter transfer tube contained within a penetration sleeve that is sealed to the containment. The transfer tube and penetration sleeve are sealed to each other by bellows-type expansion joints to allow for relative movement between the tube and penetration sleeve. A double-blind flange is attached to the penetration sleeve, and sealing is accomplished through O-rings, which can be tested for adequacy by pressurizing the annulus between the seals. In this arrangement, the transfer tube is not subjected to containment pressure during reactor operation.

9.1.4.2.1.4 Control Element Assembly Change Platform

The CEA change platform is shown in Figure 9.1.4-2. This platform operates above the upper guide structure (UGS) after the UGS has been placed in the storage area and the UGS lift rig is removed. The platform travels on the same rails as does the refueling machine.

9.1.4.2.1.5 Fuel Handling Tools

Two fuel handling tools, as shown in Figure 9.1.4-12, are used to move fuel assemblies in the SFP area. A new fuel handling tool is provided for dry transfer of new fuel, and a spent fuel handling tool is provided for underwater movement of both spent and new fuel assemblies in the SFP. The spent fuel handling tool, when attached to the SFHM auxiliary

hoist, is operated manually from the bridge on the SFHM. The spent fuel handling tool provides a backup means of handling fuel assemblies in the SFP. The normal method is to handle the fuel assemblies with the SFHM grapple. The new fuel handling tool is attached to the fuel handling hoist of the overhead crane and is manually controlled.

9.1.4.2.1.6 Spent Fuel Handling Machine

The SFHM is a traveling bridge and trolley that rides on rails over the refueling canal, spent fuel pool, cask loading pit, and new fuel elevator. The spent fuel handling machine is used to transfer fuel assemblies from the new fuel elevator to the upender, from the upender to the spent fuel storage racks, or from the spent fuel storage racks to the fuel shipping cask.

The SFHM has an auxiliary hoist that is provided to handle the light loads or fuel assembly using appropriate handling tool. The auxiliary hoist also has a load-weighing system including a load cell and load indication to prevent the auxiliary hoist from being subjected to excessive force.

Interlocks are installed so that movement of the SFHM is not possible when the hoist is withdrawing or inserting a fuel assembly. Movement of the bridge and trolley is allowed when the fuel reached at up limit.

The SFHM, as shown in Figure 9.1.4-4, is a refueling machine modified for use in the fuel handling area. The major differences are the longer bridge span and SFHM zones interlocks.

9.1.4.2.1.7 New Fuel Elevator

The new fuel elevator, as shown in Figure 9.1.4-6, is used to lower new fuel from the operating floor to the bottom of the pool, where it is grappled by the SFHM. The elevator is powered by a cable winch and fuel is contained in a simple support structure whose wheels are captured in two rails. New fuel is loaded into the elevator by means of the fuel handling hoist of the overhead crane and a new fuel handling tool.

The elevator is powered by a cable winch, and fuel is contained in a simple support structure whose wheels are captured at the two rails. Interlocks are installed to prevent a fuel assembly from being raised.

9.1.4.2.1.8 Underwater Television

A closed-circuit television system, as shown in Figure 9.1.4-13, monitors the fuel handling operations within the refueling cavity. The camera is mounted on the refueling machine fuel hoist box (Figure 9.1.4-1) so that the fuel assembly can be sighted prior to and during grappling and removal from the core.

A similar underwater television camera is provided on the SFHM so that the fuel assembly can be sighted prior to and during grappling. The positions of the fuel assemblies in the racks are verified by the camera.

9.1.4.2.1.9 Control Element Assembly Elevator

A CEA elevator, as shown in Figure 9.1.4-5, is used to assemble new CEAs and to disassemble irradiated CEAs. The elevator is powered by a cable winch, and the CEAs are contained in a simple support structure whose wheels are captured at the two rails. Tooling used to handle CEAs within the elevator is supported from the CEA change platform.

9.1.4.2.1.10 Transport Container

The transport container is used to store and move cut-up pieces of spent CEAs and ICI from the containment building to the fuel handling area.

The container has the same outside dimensions as a fuel assembly and has a top fitting that joins the fuel grapple, enabling the container to be moved by fuel-handling equipment.

9.1.4.2.1.11 Refueling Pool Seal

The refueling pool seal is designed to connect the RV seal ledge to the embedment ring in the refueling pool floor to permit filling of the refueling cavity for fuel handling activities.

During normal refueling operations, the pool seal is designed to withstand the pressure resulting from a water head that is the full depth of the refueling cavity from the elevation of the operating floor. Pool seal welds required for structural integrity or sealing integrity are inspectable. The openings for ex-core detector servicing and inspection and for cavity ventilation are designed to permit pressure testing to verify their integrity before filling with the refueling water. The pool seal is designed for the impact of a fuel assembly drop from the maximum height. Transfer of heavy loads over the RV is prohibited during fuel handling operations. Therefore, the drop of such loads is not considered credible in the design of the pool seal. The COL applicant is to provide plant procedures for preventing and mitigating inadvertent reactor cavity drain down events, maintenance procedures for the maintenance and inspection of refueling pool seal, and emergency response procedures for the proper measures during pool drain down events.

9.1.4.2.1.12 In-Core Instrumentation and Control Element Assembly Cutters

A portable underwater hydraulic cutter, similar to that shown in Figure 9.1.4-14, is provided to cut the expended CEAs into lengths that are suitable for conveyance to the fuel handling area of auxiliary building using transport container. A second cutter is used for disposal of the ICI leads.

9.1.4.2.1.13 Gripper Operating Tool

The gripper operating tool is approximately 5.18 m (17 ft) long and consists of two concentric tubes with a funnel at the end to facilitate engagement with the CEA extension shafts. When installed, pins attached to the outer tube are engaged with the extension shaft. The inner tube of the tool is then lifted and rotated relative to the outer tube, which compresses a spring, allowing the gripper to release, thus separating the extension shaft from the CEA.

9.1.4.2.2 System Operation

9.1.4.2.2.1 New Fuel Transfer

After arrival of the new fuel shipping containers, the containers are transferred to the fuel handling area and secured to the operating floor. The fuel assembly strongback is raised

to the vertical position and locked. The new fuel handling tool, attached to the fuel handling hoist, is then locked to the fuel assembly, the fuel assembly clamping fixtures are removed, and the fuel assembly is removed from the shipping container. Next, the protective wrapping is removed and the fuel assembly is moved over to the new fuel storage racks, where it is placed into its designated cavity. New fuel is inspected by a new fuel inspection device before placement into the new fuel racks and the operation is repeated until all assemblies have been placed in the racks. Prior to refueling operations, the new fuel is removed from the new fuel storage racks and transferred to the new fuel elevator by using the fuel handling hoist and the new fuel handling tool.

The new fuel elevator lowers the fuel assembly into the cask loading pit to allow the SFHM to transfer the fuel assembly to the spent fuel racks in Region I of the SFP or to the transfer system upender.

During refueling operations, the new fuel assembly is placed in the upender. If a spent fuel assembly is present in the fuel carriers, it is removed from the other position in the fuel carrier and transferred to a designated position in the spent fuel storage racks using the SFHM. The new fuel is then transferred to the containment building.

9.1.4.2.2.2 Spent Fuel Transfer

The SFHM transfers the spent fuel assemblies from the storage racks to the spent fuel cask. This operation is implemented when the spent fuel cask loading pit is filled with SFP water and the gate between the SFP and the spent fuel cask loading pit is opened. When the spent fuel assemblies are loaded into the cask, the cask is sealed and transferred to the cask decontamination pit with the cask handling hoist. In the decontamination pit, the cask surface is washed off with an applicable-grade demineralized-water hydro-jet. It is then transferred to the truck loading/unloading bay with the cask handling hoist through the auxiliary building transfer hatch for intermediate and/or ultimate storage.

9.1.4.2.2.3 Refueling Procedure

9.1.4.2.2.3.1 Reactor Disassembly

The control element drive mechanisms (CEDMs) are disengaged from their driveshaft extensions by deenergizing the motor coils. The head area cables, which include the

CEDM cables, the heated junction thermocouple cables, and the acoustic leak monitoring system/loose parts monitoring system cables, are disconnected from the refueling disconnect panels. The CEDM cooling fan cables are disconnected from the fan disconnect panels.

The RV head vent pipe is removed from the integrated head assembly (IHA) vent pipe flange. The seismic restraints are lifted vertically by winch assembly and wire prior to lifting the IHA.

The studs are detensioned using the single stud tensioner (Figure 9.1.5-5). The stud hole plugs are installed to minimize contamination of the empty stud holes. Two RV alignment pins are reinstalled into the RV flange to assist in subsequent operations. The ICI assemblies are then disconnected and withdrawn from the core region to allow the fuel assembly to be removed. Next, the blind flange of the transfer tube is removed. The IHA is lifted with RV closure head and placed on the RV closure head storage stands by the polar crane while the refueling cavity is filled with borated water.

The UGS lift rig is installed on and locked to the UGS. The extension shafts and CEAs are withdrawn into the lift rig and the extension shafts latched to the work platform. The UGS is removed from the RV and placed on its storage stand. During transfer of the core support barrel or UGS and their lift rigs over the refueling pool seal, the SFP is isolated from the refueling cavity. After the RV internals are moved to their storage areas, water levels are equalized in the refueling cavity and SFP, and the transfer tube is opened. Components are not lifted over the reactor cavity pool when the refueling machine handles a fuel assembly.

9.1.4.2.2.3.2 Fuel Handling

Following reactor disassembly, the refueling machine hoist mechanism is positioned at the desired location over the core. Alignment of the hoist to the top of the fuel assembly is accomplished through the use of a digital readout system and is monitored by closed-circuit television. After the fuel hoist is lowered, minor adjustments can be made to properly position the hoist if misalignment is indicated on the monitor. The operator then energizes the actuator assembly, which rotates the grapple at the bottom of the hoist and locks the fuel assembly to the hoist. The hoist motor is started and the fuel assembly is withdrawn into the fuel hoist box assembly, which protects the fuel during transportation to the upender.

After removal from the core, the spent fuel assembly is moved underwater to the transfer area of the refueling cavity. The spent fuel assembly is lowered into the empty cavity of the transfer carriage in the refueling cavity. The upender lowers the spent fuel assembly to a horizontal position, and a cable drive then transports the transfer carriage on tracks through the transfer tube.

After the fuel has passed through the transfer tube, another upender returns the transfer carrier to the vertical position. The spent fuel handling machine can install a new fuel assembly into the fuel carrier, then remove the spent fuel assembly from the transfer carriage and transport it to the spent fuel storage rack. The operations vary slightly under complete core offload conditions.

For a complete core offload, the fuel assemblies are removed one at a time from the core using the refueling machine. The refueling machine transfers the fuel assembly to the transfer carriage in the upender. The upender lowers the fuel assembly to a horizontal position and the fuel carriage moves to the fuel handling area upender while the refueling machine retrieves the next fuel assembly from the core. The SFHM removes the fuel assembly from the upended fuel carriage and places the fuel assembly in its designated position in the spent fuel storage racks. This process continues until all fuel assemblies have been transferred to the spent fuel storage racks.

During and after spent fuel discharge from the reactor core to the SFP, the spent fuel assemblies may be examined by visual inspection and ultrasonic testing. After completion of the fuel examination, the new fuel assemblies and acceptable irradiated fuel assemblies are reloaded into the transfer carriage and carried through the transfer tube to the refueling cavity where they are upended to allow the refueling machine to pick them up and place them in their proper position in the core.

The refueling machine can also be used to shuffle fuel assemblies within the core in accordance with the fuel management scheme. In parallel with the refueling operation, the ICI changeout operation can be carried out. This operation may not be performed for each refueling. Also in parallel, and at a location separate from the fuel handling operations, the CEAs are relocated as required, within the UGS using long handling tools and the CEA change platform. This operation may not be performed for each refueling.

If new CEAs are required, they may be introduced into the UGS at this time. The expended CEAs are moved to the CEA elevator, adjacent to the UGS storage area, where the upper CEA casting is removed from the CEA rods using special tooling. Each rod is picked up individually and placed into the transport container where the lower 4.42 m (14 ft 6 in) section is cut off using the portable underwater hydraulic CEA cutter. The upper 1.68 m (5 ft 6 in) section of the CEA rod is then placed into the transport container, and the operation is repeated until all CEA rods have been cut. The transport container is then moved to the transfer carriage where it is transported to the spent fuel storage area for CEA rod disposal.

9.1.4.2.2.3.3 Reactor Assembly

The reactor assembly is executed by reversing the process in Subsection 9.1.4.2.2.3.1.

9.1.4.3 Safety Evaluation

The LLHS is evaluated to provide reasonable assurance that the LLHS operates under adequately safe conditions for any natural phenomena like earthquakes and avoids criticality accidents and consequent release of radioactive materials from damage to the fuel by geometrical configuration and systems design during fuel handling. The LLHS is designed in accordance with ANSI/ANS 57.1-1992 as follows:

a. To prevent mechanical damage to fuel assemblies and withstand natural phenomena

b. To prevent unacceptable radioactivity release, unacceptable radiation exposure, and criticality accidents

The LLHS equipment has the following design features:

a. The major systems of the LLHS are electrically interlocked with each other to assist the operator in properly conducting the fuel handling operation.

b. Miscellaneous special design features that facilitate handling operations include the following:

   1) Manual operation of the refueling machine hoist and drives and CEA change platform traverse drives in the event of power failure

   2) Transfer system motor with a two-stage gearbox to permit applying an increased pull on the transfer carriage in the event it becomes stuck

   3) Viewing port in the refueling machine trolley deck to provide visual access to the reactor for the operator

   4) Protective shroud into which the fuel assembly is drawn by the refueling machine

   5) Removal of the transfer system components from the refueling pool for servicing without draining the water from the pool

c. The fuel transfer tube is sufficiently large to provide natural circulation cooling of a fuel assembly in the unlikely event that the transfer carriage should be stopped in the tube. The manual operator for the fuel transfer tube valve extends from the valve to the operating deck. Also, the valve operator has enough flexibility to allow for operation of the valve even with thermal expansion of the fuel transfer tube.

d. Mechanical stops in both the refueling machine and the spent fuel handling machine restrict withdrawal of the spent fuel assemblies. The resulting radiation level at a minimum water depth from the spent fuel is designed to meet the radiation dose limits in the work area when the shielding of the fuel handling equipment is taken into account.

The LLHS meets positions C.1 and C.2 of NRC RG 1.29 (Reference 11) and positions C.1, C.5, C.6, and C.8 of NRC RG 1.13 (Reference 10), as they relate to the ability of the equipment to withstand the effects of earthquakes. With respect to radioactive release as a result of fuel damage, the machines conform to the guidelines of positions C.1 and C.5 of

NRC RG 1.13, ANSI/ANS 57.1, ANSI/ANS 57.2 (Reference 16), and NUREG-0612 (Reference 21).

9.1.4.4 Inspection and Testing Requirements

During the manufacture of the fuel and CEA handling equipment at the supplier's shop, various process inspections and checks are required, including certification of materials and heat treating and liquid-penetrant or magnetic-particle inspection of critical welds. Following completion of manufacture, compliance with design and specification requirements is determined by assembling and testing the equipment in the supplier's shop. The equipment is run through several complete operational cycles using a dummy fuel assembly with the same weight, center of gravity, exterior size, and end geometry as an actual assembly. In addition, the equipment is checked for its ability to perform under the maximum limits of load, fuel mislocation and misalignment, and static and dynamic load conditions. All traversing mechanisms are tested for speed and positioning accuracy. All hoisting equipment is tested for vertical functions and controls, rotation, and load misalignment.

Hoisting equipment is also tested at 125 percent of specified hoist capacity. Fuel handling tools are proof-tested at 150 percent of the maximum handling load, and setpoints are determined and adjusted and the adjustment limits are verified. Equipment interlock function and backup systems operations are checked. Those functions having manual operation capability are exercised manually.

During these tests, the various operating parameters such as motor speed, voltage, current, hydraulic system pressures, and load measuring accuracy and setpoints are recorded. On completion of these tests, the equipment is checked for cleanliness, and the locking of fasteners by lock wire or other means is verified.

Equipment installation and testing at the plant site are controlled by approved installation procedures and preoperational test procedures designed to verify conformance with procurement specifications. Each component is inspected and cleaned prior to installation into the system. Preoperational tests also include checks of all control circuits including interlocks and alarm functions.

The following testing and inspections will be performed for the fuel handling hoists related to fuel handling.

a. Hoists and cable will be load tested at 125 percent of the rated load.

b. The equipment will be assembled and checked for proper functional and running operation at the shop and prior to using the equipment.

c. Inspection and maintenance will be performed in accordance with plant maintenance procedures.

The COL applicant is to provide plant operating procedure guidelines for preoperational load testing and checkouts of interlocks, blocks, hoisting cables, control circuitry, and lubrication of fuel handling equipment.

9.1.4.5 Instrumentation Requirements

The LLHS consists of instrumentation and control (I&C) systems including the limit and safety devices, communication devices, and indicators for reliable fuel handling. The required interlocks shown in Table 1 of ANS 57.1-1992 are provided for the spent fuel handling machine, new fuel elevator, fuel transfer system including upenders, and refueling machine. The fuel hoists are provided with load-measuring devices and interlocks to interrupt hoisting if the load increases above the overload setpoint and to interrupt lowering if the load decreases below the underload setpoint.

The computer, which is in direct communication with the programmable logic controller (PLC), is designed to log the data files and fuel loading/reloading sequences. The refueling machine, spent fuel handling machine, and fuel transfer system are provided with an automatic control panel. The control panel indicators enable the operator to identify the status of interlocks visually.

Dedicated voice communication lines are provided between the refueling supervisory console and both the refueling machine in the containment building and the spent fuel handling machine in the fuel handling area. The LLHS is designed such that, in the event of a power loss, the hoisting equipment maintains the load in a safe condition.

9.1.5 Overhead Heavy Load Handling System

The overhead heavy load handling system (OHLHS) consists of mechanical and electrical equipment and building structural features to handle heavy loads. Heavy loads are loads weighing more than one fuel assembly and its handling device. For the APR1400, a fuel assembly weighs approximately 639 kg (1,409 lb) with a handling tool weighing approximately 82 kg (181 lb). For the APR1400, a heavy load is any load greater than the combined weight of approximately 721 kg (1,590 lb). This encompasses the handling of critical heavy loads where inadvertent operations or equipment malfunctions, separately or in combination, could cause the following:

a. Significant release of radioactivity

b. Loss of margin to criticality

c. Uncovery of irradiated fuel in the reactor vessel or spent fuel pool

d. Damage to equipment essential to achieve or maintain safe shutdown

This subsection focuses on the OHLHS handling of critical heavy loads in the fuel handling area of the auxiliary building and in the reactor vessel area of the reactor containment building, where the system is used to transfer the largest heavy load of a spent fuel shipping cask and to lift the integrated head assembly (IHA) and reactor vessel (RV) internals during refueling, respectively.

9.1.5.1 Design Bases

The overhead heavy load handling system meets the following design basis criteria:

a. The OHLHS and equipment are designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

b. The OHLHS is designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, and hurricanes without loss of the capability to perform its safety function.

c. The OHLHS is designed to provide mechanical stops or electrical interlocks to prevent movement of heavy loads over the irradiated fuel or in proximity to essential safe shutdown equipment.

d. The effects of load drops are analyzed and the results provide reasonable assurance that a load drop would not damage stored irradiated fuel to the extent that a significant offsite release would occur or preclude the operation of equipment that is required to achieve safe shutdown.

e. The probability for a load drop is minimized by using a single-failure proof crane designed in accordance with the guidelines of NUREG-0554 (Reference 22) and lifting devices that comply with ASME B30.9 (Reference 23).

f. The OHLHS is not shared by other units.

g. The OHLHS complies with the general approaches in Section 5.1.1 of NUREG-0612 to provide acceptable measures for the control of heavy loads.

The containment polar crane is designed as a single-failure-proof crane, ASME NOG-1 Type I, in compliance with NUREG-0554 (Reference 22). The other cranes such as fuel handling overhead crane, miscellaneous cranes and hoists are designed in accordance with CMAA-70, 2000 (Reference 24) and Chapter 2-1 of ASME B30:2-2005, "Overhead and Gantry Cranes" (Reference 25).

Miscellaneous cranes and hoists that are not categorized as OHLHS are designed to meet the criteria in ASME NOG-1 (Reference 20), ASME NUM-1 (Reference 27), or codes and standards recommended by manufacturers.

9.1.5.2 System Description

The fuel handling area overhead crane and the containment polar crane are used to handle critical heavy loads in areas of the reactor vessel and in the fuel handling area. The specifications of the fuel handling area overhead crane and the polar crane are given in Table 9.1.5-1. Additionally, other hoists and cranes as listed in Table 9.1.5-2 are used to handle critical heavy loads in other plant areas where their accidental drops could damage safe shutdown equipment.

9.1.5.2.1 Fuel Handling Area Overhead Crane

The fuel handling area overhead crane with a cask handling hoist and a fuel handling hoist is mounted on the rail that extends the entire length of the fuel handling area. During construction, the overhead crane travels the entire rail without any provisions for restrictions; however, once fuel assemblies are onsite, provisions are installed permanently to restrict movement of the crane over the spent fuel pool (SFP) area. These provisions are mechanical, electrical, or a combination of mechanical and electrical, including the automatic stop of bridge, trolley and hoist movement, automatic control of bridge and hoist speed, and automatic cutoff of heavy load limit and lifting height. In addition, procedural and administrative controls are provided to provide reasonable assurance of safe operation for the fuel handling area overhead and to control the safe load path and safe lifting practice.

The cask handling hoist is used to transfer the shipping cask among the cask loading pit, cask decontamination pit, and truck bay. The hoist has a minimum capacity of 150 tons and incorporates a variable-speed hoist and electrical interlocks to control bridge and trolley travel.

The fuel handling hoist is used for handling the new fuel container and new fuel assemblies during transfer from the new fuel shipping container to the new fuel elevator, new fuel storage racks, or new fuel inspection station. The hoist has a minimum capacity of 10 tons and incorporates electrical interlocks to control the transfer path of the new fuel assemblies and to restrict fuel handling loads. The hoist is mechanically restricted from passing over the spent fuel racks.

The safe load handling paths of the cask handling hoist are shown in Figure 9.1.5-6. The design of the hoists and cranes conforms to the requirements of ASME NOG-1, Type II crane, CMAA-70, and Section 2-1 of ASME B30.2. The fuel handling area overhead crane complies with the requirements of NUREG-0612 (Reference 21), NRC RG 1.13 (Reference 10), and NRC SRP 9.1.5, and are designed as seismic Category II in accordance with NRC RG 1.29 (Reference 11). During an SSE, the fuel handling area overhead crane and all its components retain control and hold all loads up to the maximum critical load for all loading conditions, and the bridge and trolley remain in place on their respective runways with their wheels prevented from leaving the tracks. The crane is not required to be functional during and after the SSE, but structural integrity is preserved.

The design of the fuel handling area overhead crane limits the impact energy of postulated dropped loads on the new fuel storage racks, spent fuel storage racks, fuel transfer system fuel carrier, and SFP. The shipping cask is prevented from traveling over the new fuel storage racks and the spent fuel storage racks by mechanical stops and electrical interlocks. The defined load path prevents the shipping cask from traveling within 4 m (13 ft) of the edge of the SFP and provides reasonable assurance that the shipping cask is not lifted above the operating floor elevation. This restriction on the lift height also precludes passage of the shipping cask over the new fuel racks.

All loads that are handled over the new fuel storage racks, spent fuel storage racks, SFP, and fuel transfer system fuel carrier are limited in weight and lift height so that, if they fall, the resultant impact will not exceed the design impact energy of the fuel storage racks and SFP.

The design impact energy is equal to the postulated drop of a fuel assembly, its handling tool or a combination of both the tool and the fuel assembly, and any other fuel handling component attached to the hoisting cable during fuel assembly handling, from their maximum lifted elevation above the fuel racks during normal handling. The elevation to which the fuel assembly is lifted is limited by interlocks on the fuel handling hoist and the design of the handling tools. The weight that is lifted is limited by load interlocks and/or hoist motor stall torque.

9.1.5.2.2 Containment Polar Crane

The containment polar crane is mounted on a circular rail along the containment inside wall and travels the entire circumference of the containment. The containment polar crane has a main hoist and an auxiliary hoist to handle the various loads during refueling. Provisions are made to provide reasonable assurance of safe heavy load handling in the containment. These provisions include automatic control of the bridge and hoist, automatic control of heavy load limits and lifting height, and a load handling path to prevent any fuel damage from a heavy load drop. The safe load handling paths of the containment polar crane are shown in Figure 9.1.4-9.

The design of the containment polar crane conforms to the requirements of ASME NOG-1, Type 1 cranes, NUREG-0612, and Section 2-1 of ASME B30.2. The containment polar crane is designed as a single-failure-proof crane, so that a single failure will not result in the crane losing the capability to perform its safety function with the hoisting system and braking system on the drum for trolley and bridge through redundancy or duality in braking components, and through two independent reeving systems. The containment polar crane is also designed as seismic Category II in accordance with NRC RG 1.29. The dynamic behaviors according to the seismic event are restricted by the seismic restraints, which prevent the bridge or trolley from jumping the rails during an earthquake.

The containment polar crane is used to handle the integrated head assembly (IHA) and reactor vessel (RV) internals. The containment polar crane, which has a 450-ton rated capacity for normal operation, is used with various lifting rigs to remove the IHA with the RV closure head and RV upper and lower internals, as described in Subsections 9.1.5.2.2.1 through 9.1.5.2.2.3. A 60-ton auxiliary load block is used for routine maintenance and for inservice inspection (ISI). During construction, the polar crane is equipped with a special trolley arrangement that increases the load block rated capacity to 900 tons. The crane is controlled from its bridge-mounted cab or a festooned pendant control. The polar crane is designed to maintain its integrity without dropping its load during an SSE. The main hoist of the polar crane has an inching feature that enables the crane to be properly positioned.

The normal parking position of the polar crane is based on a location that does not interface with the post-accident radiation monitoring functions.

9.1.5.2.2.1 Integrated Head Assembly

The IHA is shown in Figure 9.1.5-1. The IHA is composed of the cooling shroud assembly, lifting frame assembly, control element drive mechanism (CEDM) cooling system, missile shield, head area cable system, and seismic support system. The lifting frame assembly, including the main columns attached to the RV closure head, lifts the IHA with the RV closure head for the refueling operation. The lift system of the IHA is designed, tested, and inspected to meet the design criteria of NUREG-0612 and ANSI N14.6 (Reference 26). When the lift system is designed, the maximum lifting crane acceleration/ deceleration dynamic load factor of 0.l5 g is applied. The IHA is lifted using the main hoist of the containment polar crane.

In order to maintain the CEDM coils within their proper operating temperature range, the cooling air drawn through the inlet opening of the cooling shroud assembly is discharged in the containment building via the CEDM cooling fans after cooling the CEDM coils and the CEDM nozzles. The dynamic behaviors according to the seismic event are restricted by the seismic restraints connected to the refueling pool wall. The electric cables inside the IHA are supported by the cable trays and the refueling disconnect panels on which the cables are connected to the field cables.

9.1.5.2.2.2 Reactor Internals Handling Equipment

The reactor internals lift rig is a structure used to remove either the upper guide structure assembly or the core support barrel assembly from the reactor vessel.

Figure 9.1.5-2 shows the lift rig in the configuration provided for withdrawal of the core support barrel assembly from the reactor vessel for inspection purposes.

The tie-rod assembly is a tripod-shaped structure connecting the lift rig to the containment polar crane lifting hook. The three short columns attached to the spreader weldment assembly of this lift rig are bolted to the core support barrel flange. This is accomplished manually from the refueling machine bridge. Correct positioning of the lift rig is achieved using two attached guide bushings that mate to the reactor vessel guide pins.

Figures 9.1.5-3 and 9.1.5-4 show the lift rig in the configuration provided for removal of the upper guide structure assembly. In this configuration, the spreader weldment assembly supports three long columns providing attachment points to the upper guide structure assembly. Attachment to the upper guide structure assembly is accomplished manually from the working platform (CEA support plate assembly). Correct positioning is achieved by attaching two upper bushings and two lower bushings that mate to the reactor vessel guide pins.

The clevis assembly, tie-rod assembly, and spreader weldment assembly, which are common to the core support barrel lift rig and the upper guide structure lift rig, are installed to meet the lifting purpose prior to lifting the structure using the crane hook. The working platform also incorporates holding fixtures for the extension shafts and CEAs.

9.1.5.2.3 <u>Other Area Hoists and Cranes</u>

Additionally, the OHLHS is used to handle heavy loads such as pumps, motors, valves, heat exchangers, and diesel generators in other areas of the auxiliary building and other buildings where, if such items are dropped in a certain location, they may damage safe shutdown equipment.

Miscellaneous cranes and hoists in Table 9.1.5-2 for handling safe shutdown equipment or systems that are considered as critical heavy loads, are designed as non-single-failure-proof cranes and seismic Category II to prevent unacceptable structural interaction and failure during an SSE. Therefore, a load drop involving miscellaneous cranes and hoists that are located over or close to the safe shutdown system and equipment impacts safe shutdown equipment. However, the safe shutdown equipment or systems are physically separated and redundant so that the consequences of postulated accident load drops do not prevent the capability of their safe shutdown functions. In addition, the safe shutdown equipment or systems will be out of operation when the cranes and hoists are used for handling critical heavy loads over them, and when the safe shutdown equipment or systems are in service, the use of these cranes and hoists is administratively controlled by load handling procedures.

9.1.5.2.4 Load-handling Procedures

Load-handling procedures are established for component handling procedures and plant operating procedures in accordance with ASME B30.2. Component handling procedures include (1) a safe load path for lifting heavy loads to perform special handling component inspections, (2) acceptance criteria prior to lift, and (3) the use of steps and proper sequence in handling the load. Plant operating procedure guidelines include appropriate crane operator training and crane inspections. Load-handling procedures include preparation of operating procedures for preoperational load testing and checkouts of interlocks, brakes, hoisting cables, control circuitry, and lubrication of OHLHS equipment.

The COL applicant is to address the load handling procedures (COL 9.1(3)).

9.1.5.3 Safety Evaluation

The OHLHS is evaluated to provide reasonable assurance that it does not cause a significant release of radioactivity, a loss of margin to criticality, uncovery of irradiated fuel in the reactor vessel or spent fuel pool, or damage to equipment that is essential to achieve or maintain safe shutdown.

The containment polar crane is designed to prevent dropping of the IHA and RV internals by providing single-failure-proof features in accordance with the guidelines of NUREG-0612 and requirements of NUREG-0554.

The fuel handling area overhead crane handles critical heavy loads without single-failure-proof features. The fuel handling area overhead crane is restricted from moving heavy loads over the SFP by the permanent mechanical stops installed on the rails. It is limited to moving in such a manner as to avoid the possibility of falling or tipping into the SFP, in accordance with the regulatory position of NRC RG 1.13, the guidelines of NUREG-0612, and the requirements of NUREG-0554 and GDC 61.

Miscellaneous cranes and hoists for handling safe shutdown equipment move over or in the areas of the safe shutdown equipment. However, the safe shutdown equipment or systems are physically separated and redundant so that the consequences of postulated accident load drops do not impair the capability of their safe shutdown functions.

The effects of a heavy load drop are analyzed. The results provide reasonable assurance that it does not damage stored fuel and preclude the operation of equipment required to achieve safe shutdown. The cranes are equipped with an overload protection device, and the cranes automatically stop hoisting at the setpoint of 125 percent of rated capacity.

Section 5.1 of NUREG-0612 describes in general the alternate approaches to provide acceptable measures for the control of heavy loads. These approaches are amplified in Subsections 5.1.1 through 5.1.3 and 5.1.5 of NUREG-0612. These approaches are as follows:

a. Provide sufficient operator training, handling, handling system design, load handling instructions, and equipment inspection to provide reasonable assurance of a reliable operation of the handling system.

b. Define safe load paths through procedures and operator training so that, to the maximum extent practical, heavy loads are not carried over or near irradiated fuel or safe shutdown equipment.

c. Provide mechanical stops or interlocks to prevent movement of heavy loads over irradiated fuel or close to equipment associated with redundant shutdown paths.

The OHLHS complies with these approaches to provide acceptable measures for the control of heavy loads.

The OHLHS is designed for the safe handling of heavy loads with a high-reliability design having single-failure-proof cranes, mechanical stops/electrical interlocks, well defined safe load handling paths, established load handling procedures, and a plant configuration providing redundancy/duality in certain active components so that the consequences of postulated accident load drops do not adversely affect the safe storage of irradiated fuel or the capability to shut down and cool down the unit.

9.1.5.4 Inspection and Testing Requirements

During the manufacture of the overhead heavy load handling equipment at the manufacturer’s shop, various in-process inspections and checks are required, which

include the certification of materials and heat treating, and liquid-penetrant or magnetic-particle inspection of critical welds as defined in Section 7200 and Paragraph 4251.4 of ASME NOG-1. Compliance with design and specification requirements is determined by assembling and testing the equipment in the manufacturer's shop. The manufacturer's inspection and testing comply with the requirements of ASME NOG-1 and Section 2-2 of ASME B30.2. The manufacturer satisfies the quality assurance requirements specified by the owner.

The OHLHS complies with the requirements of ASME NOG-1 for receipt, storage, and installation.

After the OHLHS has been installed, each crane is subjected to complete preoperational testing and inspection, no-load test, full-load test, and rated load test in accordance with ASME NOG-1. The testing and inspection are performed by or under the direction of a designated or authorized person in accordance with ASME B30.2, and written reports are furnished by that person, confirming the load rating of the crane.

Preoperational testing is carried out as described in Section 14.2 to demonstrate that the OHLHS operates in accordance with applicable test programs and specifications.

The inservice inspection and testing of the OHLHS are performed in accordance with ASME B30.2.

9.1.5.5 Instrumentation Requirements

The automatic controls and limiting devices are designed so that, when disorders due to inadvertent operator action, component malfunction, or failure of subsystem control functions occur singly or in combination during the load handling, and assuming no components have failed in any subsystems, these disorders do not prevent the handling system from stopping and holding the load. Emergency stop buttons are located at the cab on the bridge and at ground level to stop all motions independently of the crane controls.

By adding features that permit manual operation of the hoisting system and the bridge and trolley transfer mechanisms with appropriate emergency devices, a crane is able to hold the

load in the event of a system fault or set the load down while repairs or adjustments are performed.

To prevent the hoisting system from two-blocking, the protective control system includes two travel-limit switches for the main and auxiliary hoist to limit the upward travel, which are set for different heights. Each hoist also stops the hook in the highest and lowest safe positions, or when other parts of the crane system are damaged if power were not shut off. These devices de-energize the hoist drive motor and the main power supply. The protective control system for load hang-up, a part of the overload protection system, consists of load cell systems in the drive train, motor-current-sensing devices, or mechanical load-limiting devices. Mechanical and electrical limiting devices that shut off power to motors are also provided.

The hoisting braking system includes one power control braking system (not mechanical brake type) and two holding brakes. Each holding brake has the capability to withstand 125 percent of the driving motor torque if a malfunction occurs and power to the driving motor cannot be shut off.

The two mechanical holding brakes and their controls that are automatically activated when electric power is off or mechanically tripped by over speed or overload devices in the hoisting system are operable for emergency lowering after a single brake failure to stop and hold the hoisting drums.

Both bridge and trolley drives are provided with control and holding braking systems that are automatically applied when the power is shut off or if an overspeed or overload condition occurred because of malfunction or failure in the drive system. Inching control is provided for bridge and trolley motion of 6.35 mm (0.25 in). Limiting devices, mechanical and/or electrical, are provided to control or prevent overtravel and overspeed of the trolley and bridge. Safety devices such as limit-type switches provided for malfunction, inadvertent operator action, or failure are in addition to and separate from the limiting means or control devices provided for operation.

9.1.6 Combined License Information

COL 9.1(1) The COL applicant is to provide operational procedures and maintenance program as related to leak detection and contamination control.

COL 9.1(2) The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.

COL 9.1(3) The COL applicant is to address the load-handling procedures. Load-handling procedures are established for component handling procedures and plant operating procedures in accordance with ASME B30.2. ASME B30.2 requires establishing component handling procedures that include (1) a safe load path for lifting heavy loads to perform special handling component inspections, (2) acceptance criteria prior to lift, and (3) use of steps and proper sequence in handling the load. ASME B30.2 requires plant operating procedure guidelines that include appropriate crane operator training and crane inspections. ASME B30.2 also requires that the load-handling procedures include preparing operating procedures for preoperational load testing and checkouts of interlocks, brakes, hoisting cables, control circuitry, and lubrication of OHLHS equipment.

COL 9.1(4) The COL applicant is to provide plant procedures for preventing and mitigating inadvertent reactor cavity drain down events, maintenance procedures for the maintenance and inspection of refueling pool seal, and emergency response procedures for the proper measures during pool drain down events.

COL 9.1(5) The COL applicant is to provide plant operating procedure guidelines for preoperational load testing and chekouts of interlocks, blocks, hoisting cables, control circuitry and lubrication of fuel handling equipment.

9.1.7 References

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9. NUREG/CR-6979, “Evaluation of the French Haut Taux de Combustion (HTC) Critical Experiment Data,” U,S. Nuclear Regulatory Commission, September 2008.

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19. APR1400, "Structural and Seismic Analysis Report," 2013.

20. ASME NOG-1, "Rules for Construction of Overhead and Gantry Cranes," The American Society of Mechanical Engineers, 2010.

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25. ASME B30.2-2005, "Overhead and Gantry Cranes – Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist," American Society of Mechanical Engineers, July 2011.

26. ANSI N14.6, "Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4,500 Kg) or More," American National Standards Institute, 2004.

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Table 9.1.2-1

Light Load Drop Condition for New and Spent Fuel Racks

Case	Drop Object	Drop Weight, kgf (lbf)	Drop Situation	Drop Height above Rack Top
Case-1 (NFR)	Fuel assembly plus new fuel handling tool	891 (1,965)	Straight deep drop accident away from pedestal	4.97 m (16.3 ft) above rack baseplate with empty cell
Case-2 (NFR)	Fuel assembly plus new fuel handling tool	891 (1,965)	Straight deep drop accident over pedestal	4.97 m (16.3 ft) above rack baseplate with empty cell
Case-1 (SFR)	Fuel assembly plus new fuel handling tool	891 (1,965)	Straight shallow drop accident	0.6 m (2.0 ft) above rack top
Case-2 (SFR)	Fuel assembly plus new fuel handling tool	215 (475)	Straight shallow drop accident	4.97 m (16.3 ft) above rack baseplate with empty cell
Case-3 (SFR)	Fuel assembly plus new fuel handling tool	891 (1,965)	Straight shallow drop accident over pedestal	4.60 m (15.1 ft) above rack baseplate with empty cell

(1) The only case of drop accident above the baseplate is evaluated because the new fuel storage racks are stored in a dry state and there is no active fuel location.

Table 9.1.2-2

Recommended Coupon Measurement Schedule

Coupon	Years [1]
1	1.5
2	3
3	4.5
4	6
5	7.5
6	9
7	10.5
8	12
9	18
10	22.5
11	27
12	31.5
13	36
14	39

(1) Years after the first loading of spent fuel into the spent fuel storage rack.

Table 9.1.3-1

Spent Fuel Pool Water Chemistry Parameters

No.	Chemistry	Unit	Operating Value	Sampling Frequency	Remarks
1	Boron	ppm	4,000 ~ 4,400	As required	• When fuel is being transferred during refueling • Daily when fuel is being inspected • 1/wk when fuel is stored
2	Chloride	ppm	≤ 0.15	1/wk	—
3	Sulfate	ppm	≤ 0.15	1/wk	—
4	Fluoride	ppm	≤ 0.15	1/wk	—
5	Ammonia	ppm	≤ 2.0	1/wk	—
6	Lithium	ppm	≤ 2.2	1/wk	—
7	Turbidity	NTU	≤ 0.5	1/wk as required	When fuel inspections are required or other work demanding a clear view

Table 9.1.3-2

Spent Fuel Pool Cooling System Principal Component Design Parameters

Cooling Pumps	
Quantity	2
Type	Centrifugal
Design Pressure	10.55 kg/cm^{2}G (150 psig)
Design Temperature	93.3 °C (200 °F)
Design TDH	21.95 m (72 ft)
Normal Flow	15,142 L/min (4,000 gpm)
Normal Operating Temperature	60.0 °C (140 °F)
Cooling Heat Exchangers	
Quantity	2
Type	Plate
Code (Plate)	ASME Section III Class 3
Hot Side	
Fluid	Spent Fuel Pool Water
Design Pressure	10.55 kg/cm^{2}G (150 psig)
Design Temperature	93.3 °C (200 °F)
Operating Temperatures (inlet/outlet)	60 °C (140 °F) / 43.26 °C (109.87 °F)
Normal Flow	15,142 L/min (4,000 gpm)
Material	Austenitic Stainless Steel
Cold Side	
Fluid	Component Cooling Water
Design Pressure	14.1 kg/cm^{2}G (200 psig)
Design Temperature	93.3 °C (200 °F)
Operating Temperatures (inlet/outlet)	35 °C (95 °F) / 53.98 °C (129.16 °F)
Normal Flow	13,249 L/min (3,500 gpm)
Material	Austenitic Stainless Steel

Table 9.1.3-3 (1 of 10)

Failure Modes and Effects Analysis of the Spent Fuel Pool Cooling System

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
1	Spent Fuel Pool Cooling Heat Exchangers Heat Exchanger A Heat Exchanger B	a. Insufficient heat transfer	Corrosion or boron buildup on plates.	Reduced heat removal in one system. Gradual increase in temp in pool.	Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication.	A failed heat exchanger can be isolated by valve FC-1009/1010. A redundant heat exchanger is available through cross connection (valve FC-1150). A redundant division is provided.	
		b. CCWS leakage	Gasket or plate leak, manufacturing defect.	Reduced heat removal in one system. Gradual increase in temp in pool.	Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication.	A failed heat exchanger can be isolated by valve FC-1009/1010. A redundant heat exchanger is available through cross connection (valve FC-1150). A redundant division is provided.	
		c. Pool water leakage	Gasket or plate leak, manufacturing defect.	Contamination of component cooling water system. Increase in pool temp. Decrease in pool water level.	Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication. Low-flow alarm on MCR and local flow indication (F-005/006).	A failed heat exchanger can be isolated by valve FC-1009/1010. A redundant heat exchanger is available through cross connection (valve FC-1150). A redundant division is provided.	Water level in fuel pool can be returned to normal with manual makeup flow with borated water from the CVCS.

Table 9.1.3-3 (2 of 10)

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
2	Spent Fuel Pool Cooling Pumps Pump 1 Pump 2	a. Fails to start	Electrical malfunction, mechanical failure or binding, loss of power.	Fuel pool temp will gradually increase.	Pump malfunction alarm on MCR. Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication. Low discharge pressure alarm on MCR and local pressure indication (P-011/012). Low-flow alarm on MCR and local flow indication (F-005/006).	A redundant division is provided for continued flow for heat removal. A standby pump is started manually.	A single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation.
		b. Stops	Electrical malfunction, mechanical seizure, loss of power.	Loss of flow, Fuel pool temp will gradually increase.	Pump malfunction alarm on MCR. Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication. Low discharge pressure alarm on MCR and local pressure indication (P-011/012). Low-flow alarm on MCR and local flow indication (F-005/006).	A redundant division is provided for continued flow for heat removal. A standby pump is started manually.	A single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation.

Table 9.1.3-3 (3 of 10)

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
2	Spent Fuel Pool Cooling Pumps Pump 1 Pump 2	c. Fails to deliver rated flow	Excess seal leakage, mechanical malfunction.	Reduced flow. Fuel pool temp will gradually increase.	Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication. Low discharge pressure alarm on MCR and local pressure indication (P-011/012). Low-flow alarm on MCR and local flow indication (F-05/006).	A redundant division is provided for continued flow for heat removal. A standby pump is started manually.	Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation.
		d. Spurious startup	Electrical malfunction, spurious signal.	Pool cooling will start.	Motor status in main control room. Local flow indication (F-005/006). Local pressure indication (P-011/012). Local heat exchanger outlet temp indication.	No compensation needed.	Pumps are normally started manually.

Table 9.1.3-3 (4 of 10)

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
3	Pump Suction Valves FC-1003 FC-1004	a. Fails closed	Human error, mechanical failure.	Loss of flow in one division. Gradual increase in temp in pool.	Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication. Low discharge pressure alarm on MCR and local pressure indication (P-011/012). Low-flow alarm on MCR and local flow indication (F-005/006).	A redundant division is provided for continued flow for heat removal.	Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation.
		b. Fails open	Mechanical failure or binding.	Isolation of cooling pumping impossible.	Periodic check.	None.	Valves are normally open.
4	Pump Discharge Valves FC-1005 FC-1006 FC-1007 FC-1008	a. Fails closed	Human error, mechanical failure.	Loss of flow in one division. Gradual increase in temp in pool.	Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication. Low-flow alarm on MCR and local flow indication (F-005/006).	A redundant division is provided for continued flow for heat removal.	Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation.
		b. Fails open	Mechanical failure or binding.	Isolation of cooling pumps impossible if both valves in one division fail open.	Periodic check.	If both valves fail open, the heat exchanger inlet valves FC-1009/1010 can be used to isolate pumps.	Valves are normally open.

Table 9.1.3-3 (5 of 10)

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
5	Pressure Indicating Switch Valve FC-2103 FC-2104	a. Fails closed	Human error, mechanical failure.	Loss of local pressure indication (P-011/012) / discharge pressure alarm on MCR.	Periodic check.	None.	Valves are normally open.
		b. Fails open	Mechanical failure or binding.	Isolation of pressure indicator impossible.	Periodic check.	Pump suction valves (FC-1003/1004) and pump discharge valves (FC-1007/1008) can be used to isolate pressure indicator.	Valves are normally open.
6	Heat Exchanger Inlet Valves FC-1009 FC-1010	a. Fails closed	Human error, mechanical failure.	Loss of one heat exchanger. Gradual temp increases in pool.	Bulk pool temp high alarm on MCR at 60.0 °C (140 °F). High alarm heat exchanger outlet temp on MCR and local temp indication. Low-flow alarm on MCR and local flow indication (F-005/006).	A redundant heat exchanger is available through cross-connection (valves FC-1150). A redundant division is provided.	Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation.
		b. Fails open	Mechanical failure or binding.	Isolation of heat exchanger impossible.	Periodic check.	Pump discharge valves (FC-1007/1008) can be used to isolate the heat exchanger.	Valves are normally open.

Table 9.1.3-3 (6 of 10)

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
7	Heat Exchanger Outlet Valves FC-1011 FC-1012	a. Fails closed	Human error, mechanical failure.	Loss of flow in one division. Gradual increase in temp in pool.	Bulk pool temp high alarm on MCR at 60 °C (140 °F). High alarm heat exchanger outlet temp on MCR and local temp indication. Low-flow alarm on MCR and local flow indication (F-005/006).	Redundant heat exchanger is available through cross connection (valves FC-1150). A redundant division is provided.	Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation.
		b. Fails open	Mechanical failure or binding.	Isolation of heat exchanger impossible.	Periodic check.	None.	Valves are normally open.
8	Cross-Connection Valves FC-1001 FC-1150	a. Fails closed	Human error, mechanical failure or binding.	Switching from one heat exchanger to the other one impossible.	Periodic check.	Pool cooling is available through either division.	Valves are normally closed.
		b. Fails open	Human error, mechanical failure.	None, flow will be through both heat exchangers.	Periodic check. Local flow indication (F-005/006).	Cooling is available.	Valves are normally closed.
9	Pool Cooling Piping Suction Line Inlet	Inlet covered	Foreign objects in spent fuel pool.	Loss of one cooling division. Gradual increase in temp in pool.	Bulk pool temp high alarm on MCR at 60 °C (140 °F). High alarm heat exchanger outlet temp on MCR and local temp indication. Low discharge pressure alarm on MCR and local pressure indication (P-011/012). Low-flow alarm on MCR and local flow indication (F-005/006).	A redundant division is provided for continued heat removal.	Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation.

Table 9.1.3-3 (7 of 10)

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
10	Pool Cooling Piping Pump Suction Line	Break	Accident	Loss of flow in one division. Loss of coolant. Pool drained to level of suction line inlet. Temp in pool rises.	The pool low-level alarm on MCR and local pool level indication. Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication. Low discharge pressure alarm on MCR and local pressure indication (P-011/012). Low-flow alarm on MCR and local flow indication (F-005/006).	A redundant division is provided for continued heat removal. If the pool drains to the level of pump suction inlet, sufficient water remains to allow time to line up makeup to preclude reaching the minimum shielding depth.	
11	Pool Cooling Piping Pump Discharge Line	Break	Accident	Loss of flow in one division. Loss of coolant. Gradual increase in temp in pool.	The pool low-level alarm on MCR and local pool level indication. Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication. Low discharge pressure alarm on MCR and local pressure indication (P-011/012). Low-flow alarm on MCR and local flow indication (F-005/006).	A broken pipe is isolated with valves FC-1003/1004 and FC-1012/1030. A redundant division is provided for continued heat removal. If the pool drains to level of pump suction inlet, sufficient water remains to allow time to line up makeup to preclude reaching the minimum shielding depth.	Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation. Water level in fuel pool can be returned to normal with manual makeup flow with borated water from the CVCS.

Table 9.1.3-3 (8 of 10)

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
12	Pool Cooling Piping Cross-Connection Line	Break	Accident	Loss of flow in one division. Loss of coolant. Gradual increase in temperature in pool.	Pool low-level alarm on MCR and local pool level indication. Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. High alarm heat exchanger outlet temp on MCR and local temp indication. Low discharge pressure alarm on MCR and local pressure indication (P-011/012). Low-flow alarm on MCR and local flow indication (F-005/006).	A broken pipe is isolated with valves FC-1007/1008 and FC-1009/1010. A redundant division is provided for continued heat removal. If the pool drains to level of pump suction inlet, sufficient water remains to allow time to line up makeup to preclude reaching the minimum shielding depth.	Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation. Water level in fuel pool can be returned to normal with manual makeup flow with borated water from the CVCS.
13	Pool Cooling Piping Return Line	Break	Accident	Loss of flow in one division. Loss of coolant. Gradual increase in temperature in pool.	Pool low-level alarm on MCR and local pool level indication. Bulk pool temp high alarm on MCR at 60 °C (140 °F) and local pool temp indication. Low discharge pressure alarm on MCR and local pressure indication (P-011/012). Local flow alarm on MCR and local flow indication (F-005/006).	A broken pipe is isolated with valves FC-1009/1010 or FC-1011/1012, A redundant division is provided for continued heat removal. If pool drains to level of pump suction inlet, sufficient water remains to allow time to line up makeup to preclude reaching the minimum shielding depth.	Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for normal power operation. Water level in fuel pool can be returned to normal with manual makeup flow with borated water from the CVCS.

Table 9.1.3-3 (9 of 10)

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
14	Pump Discharge Pressure Indicating Switch P-011 P-012	False low-pressure indication.	Electrical or mechanical malfunction. Setpoint drift.	No direct impact on system operation.	No coincident low-pressure alarm with low pressure gauge indication (P-011/012). Periodic test.	Local pressure indication (P-011/012). A redundant division is provided.	No direct impact on system even if the operator closes one division and indicating switches to the redundant division. Single division is sufficient to maintain fuel pool temp at 48.89 °C (120 °F) for power operation.
15	Heat Exchanger Outlet Temperature Elements	False high-temp indication.	Electrical or mechanical malfunction. Setpoint drift.	No direct impact on system operation.	No coincident bulk pool temp high alarm with high temp gauge indication. Periodic test.	Spent fuel pool temp alarm. A redundant division is provided.	
16	Heat Exchanger Outlet Flow Indicating Switches F-005 F-006	False low-flow indication.	Electrical or mechanical malfunction. Setpoint drift.	No direct impact on system operations.	No coincident bulk pool temp high alarm with low flow gauge indication (F-005/006). Periodic test.	A redundant division is provided.	
17	Spent Fuel Pool Temperature Elements	False high-temp alarm.	Electrical or mechanical malfunction. Setpoint drift.	No direct impact on system operation.	No coincident high alarm heat exchanger outlet temp on MCR and local temp indication with high-temp alarm when pump is running. Periodic test.	Heat exchanger outlet temperature elements when pump is running.	Low pool temp is desired.

Table 9.1.3-3 (10 of 10)

No.	Name/ Number	Failure Mode	Cause	Effects on System	Method of Detection	Inherent Compensating Provision	Remarks
18	Spent Fuel Pool Level Transmitters	a. False low-level alarm.	Electrical or mechanical malfunction. Setpoint drift.	No direct impact on system operation.	No coincident low-level alarm on MCR with local low-level indication. Periodic test.	A redundant division is provided.	
		b. False high-level alarm.	Electrical or mechanical malfunction. Setpoint drift.	No direct impact on system operation.	No coincident high-level alarm on MCR with local high-level indication. Periodic test.	A redundant division is provided.	

Table 9.1.4-1

Major Tools and Servicing Equipment for Refueling Functions

Item No.	Item	Quantity
1	4-finger CEA handling tool	1
2	12-finger CEA handling tool	1
3	CEA cutter assembly	1
4	Transport container handling tool	2
5	Spent fuel handling tool	1
6	Surveillance capsule retrieval tool	1
7	Neutron source handling tool	1
8	CEA/ICI transport container	1
9	Gripper operating tool	1
10	CEA assembly/disassembly tool set	1
11	New fuel handling tool	1
12	Dummy fuel assembly	1
13	Cutter for in-core instrumentation	1

Table 9.1.5-1 (1 of 2)

Specification of Major Equipment

Polar Crane

1. Type		Overhead bridge crane	
2. Operating device		Pendant control on operating floor, Cab on crane	
3. Component supplied		Trolley	
4. Electric power supply		Power	480 V ac, 60 Hz, 3 Phase
		Space Heater	120 V ac, 60 Hz, Single Phase
5. Bridge Span		43.6 m (143 ft 0 in)	
6. Top level of the rail		73.5 m (241 ft 0 in)	
		Main Hoist	Auxiliary Hoist
7. Capacity	Metric ton	430.9	81.6
8. Lift	m (ft in)	36.88 m (121 ft 0 in)	53.34 m (175 ft 0 in)
9. Hoist Coverage	m (ft in)	Refer to Figure 9.1.4-9	
10. Hoisting Speed	m/min	0.366 ~ 0.914	2.438 ~ 6.096
11. Traveling Speed	m/min	Bridge: 0.366 ~ 9.144	
		Trolley: 3.048 ~ 7.62	
12. ASME NOG-1 Type		I	
13. Seismic Category		II	

Table 9.1.5-1 (2 of 2)

Fuel Handling Area Overhead Crane

1. Type		Overhead bridge crane	
2. Operating device		Pendant Control on operating floor	
3. Component supplied		Trolley	
4. Electric power supply		Power	480 V ac, 60 Hz, 3 Phase
		Space Heater	120 V ac, 60 Hz, Single Phase
5. Bridge Span		21.9 m (72 ft 0 in)	
6. Top level of the rail		57.9 m (190 ft 0 in)	
		Cask Handling Hoist	Fuel Handling Hoist
7. Capacity	Metric ton	136	9.1
8. Lift	m (ft in)	27.127 m (89 ft 0 in)	27.737 m (91 ft 0 in)
9. Hoist Coverage	m (ft in)	Refer to Figure 9.1.5-6	
10. Hoisting Speed	m/min	0.15 ~ 1.5	0.18 ~ 1.83
11. Traveling Speed	m/min	Bridge: 0.91 ~ 9.14	
		Trolley: 0.91 ~ 9.14	
12. ASME NOG-1 Type		II	
13. Seismic Category		II	

Table 9.1.5-2 (1 of 6)

Specification of Miscellaneous Equipment

Single Girder and Suspension Cranes

Building	Service	Hoist Capa. (Metric ton)	Operating Floor Elevation m (ft)	Seismic Category	Crane Type (ASME NOG-1)
Aux. Bldg.	EDG Room	3	30.48 (100)	II	II
	MS Valve Room	5	47.55 (156) to 36.58 (120)	II	II
	Radwaste Filters, Spent Filter Cask	7.5	23.77 (78)	II	II

Table 9.1.5-2 (2 of 6)

Monorail Hoists

Building.	Service	Hoist Capa. (Metric ton)	Operating Floor Elevation m (ft)	Seismic Category	Crane Type (ASME NOG-1)
Reactor Cont. Bldg.	VQ Sys Valves	3	47.55 (156)	II	II
	Personnel Hatch	5	24.77 (81) to 30.48 (100)	II	II
	Misc.	1	30.48 (100)	II	II
Aux. Bldg.	Boric Acid Conc.	3	23.77 (78)	II	II
	SG Blowdown Regen. Heat Exchanger	4	36.58 (120)	II	II
	Misc. Equip. El. 137 ft 6 in	4	36.58 (120) to 41.94 (137.6)	II	II
	MF Valve	4	41.94 (137.6)	II	II
	Gate and Misc.	5	33.83 (111) to 47.55 (156)	II	II
	Gate Valve	4	34.75 (114) to 47.55 (156)	II	II
	Misc. Equip El. 174 ft 0 in	5	47.55 (156) to 53.04 (174)	II	II
	Misc. Equip El. 195 ft 0 in	5	30.48 (100) to 59.44 (195)	II	II
	Heat Exchangers	15	30.48 (100) to 16.76 (55)	II	II

Table 9.1.5-2 (3 of 6)

Monorail Hoists (cont.)

Bldg.	Service	Hoist Capa. (Metric ton)	Operating Floor Elevation m (ft)	Seismic Category	Crane Type (ASME NOG-1)
Aux. Bldg. (cont.)	Spent Filter Cask	10	30.48 (100) to 23.77 (78)	II	II
	Post Tensioning	10	30.48 (100) to 16.76 (55)	II	II
	Misc. Equipment EL. 137 ft 6 in	5	30.48 (100) to 41.94 (137.6)	II	II
	Misc. Equipment EL. 137 ft 6 in	3	36.58 (120) to 41.76 (137.6)	II	II
	Misc. Equipment EL. 174 ft 0 in	5	41.76 (137.6) to 53.04 (174)	II	II
	Gate Valve	4	34.75 (114) to 47.55 (156)	II	II
	SDT Equip.	1	47.55 (156)	II	II
	Single Stud Tensioner	3	47.55 (156)	II	II
	SST Equip.	3	47.55 (156)	II	II
	CEDM M/G Set	6	41.76 (137.6)	II	II

Table 9.1.5-2 (4 of 6)

Pillar-Mounted Jib Cranes

Bldg.	Service	Hoist Capa. (Metric ton)	Operating Floor Elevation m (ft)	Seismic Category	Crane Type (ASME NOG-1)
Reactor Cont. Bldg.	Misc. Equipment	3	30.48 (100) to 47.55 (156)	II	II
	IRWST Covered Hatch	5	24.7 (81) to 30.48 (100)	II	II
Aux. Bldg.	Misc. Equip. EL. 120 ft 0 in	5	30.48 (100) to 36.58 (120)	II	II
	Misc. Equip. EL. 156 ft 0 in	3	41.76 (137) to 41.76 (156)	II	II

Wall-Mounted Jib Cranes

Bldg.	Service	Hoist Capa. (Metric ton)	Operating Floor Elevation m (ft)	Seismic Category	Crane Type (ASME NOG-1)
Reactor Cont. Bldg.	Misc.	3	24.7 (81) to 34.75 (114)	II	II
	Misc.	3	30.48 (100) to 41.94 (137.6)	II	II

Table 9.1.5-2 (5 of 6)

Geared Trolley

Bldg.	Trolley Capa. (Metric ton)	Service	Operating Floor Elevation m (ft)	Seismic Category	Crane Type (ASME NOG-1)
Aux. Bldg.	28	CS Heat Exchanger	16.76 (55)	II	II
	5	CCW Pump	16.76 (55)	II	II
	3	CS Miniflow Heat Exchanger	16.76 (55)	II	II
	9	CS Pumps	16.76 (55)	II	II
	5.5	SI Pumps	16.76 (55)	II	II
	28	SC Heat Exchangers	16.76 (55)	II	II
	3	SC Miniflow Heat Exchangers	16.76 (55)	II	II
	9	SC Pumps	16.76 (55)	II	II
	5	Changing pumps	16.76 (55)	II	II
	3	Changing Pump Miniflow Heat Exchanger	16.76 (55)	II	II
	3	Aux. Charging Pump	16.76 (55)	II	II
	0.5	Seismic Cat. I Fire Water Pumps	16.76 (55)	II	II
	5	Central Chillers	16.76 (55)	II	II
	1	Central Chilled Water Pumps	16.76 (55)	II	II
	1	Condensate Receiver Tank	16.76 (55)	II	II
	6	Turbine Driven Aux. Feedwater Pumps	23.77 (78)	II	II
	6	Motor Driven Aux. Feedwater Pumps	23.77 (78)	II	II
	5	Essential Chillers	23.77 (78)	II	II
	3	Gas Stripper	20.72 (68)	II	II
	2	SFP Cooling Pumps	30.48 (100)	II	II

Table 9.1.5-2 (6 of 6)

Geared Trolley (cont.)

Bldg.	Trolley Capa. (Metric ton)	Service	Operating Floor Elevation m (ft)	Seismic Category	Crane Type (ASME NOG-1)
Aux. Bldg.	4	Misc.	30.48 (100)	II	II
	2	Starting Air Compressor Skids	30.48 (100)	II	II
	1	Boric Acid Batch Tank	36.58 (120)	II	II
	6	FW Flow Element	41.94 (137.6)	II	II
	5	MF V/V	41.94 (137.6)	II	II
	3	MS V/V Room	41.94 (137.6)	II	II
	5	CCW Pumps	16.76 (55)	II	II
	5	Charging Pumps	16.76 (55)	II	II
	3	Essential Chilled Water	23.77 (78)	II	II
	4	Misc. Equipment, Turbine-Driven Aux. Feedwater Pump	23.77 (78)	II	II
	5	Emergency Diesel Generator	30.48 (100)	II	II
	4	MS Valve	41.94 (137.6)	II	II
	3	Ion Exchanger	23.77 (78)	II	II
	3	Purification Ion Exchanger	23.77 (78)	II	II
	3	Boric Acid Condensate Ion Exchanger	23.77 (78)	II	II
	3	SG Blowdown Demineralizer	23.77 (78)	II	II
	3	Cleanup Demineralizer	23.77 (78)	II	II
	2	SFP Cooling Pumps	30.48 (100)	II	II
Reactor Cont. Bldg.	5	Letdown HX	30.48 (100)	II	II

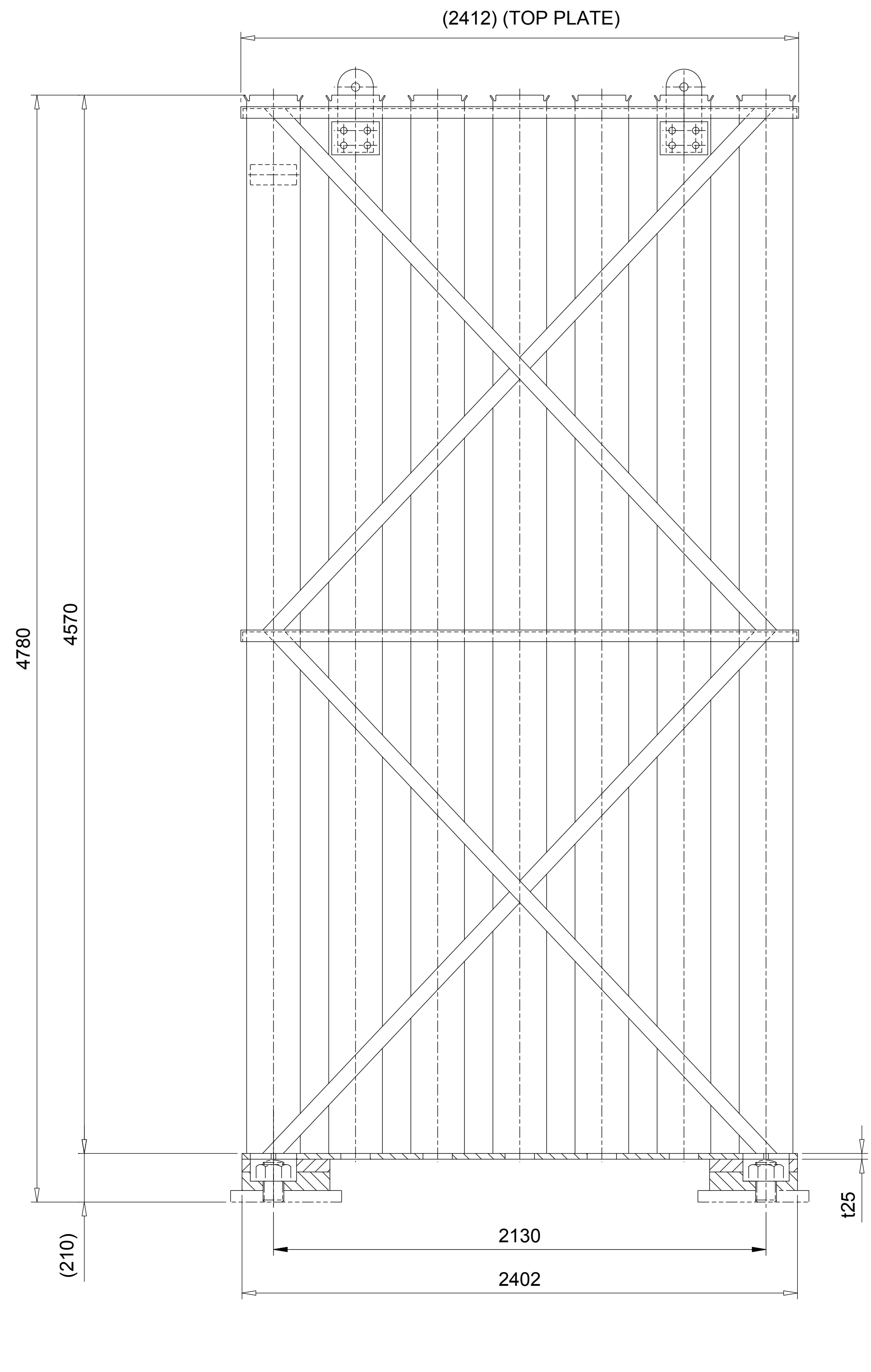


Figure 9.1.2-1 New Fuel Storage Racks

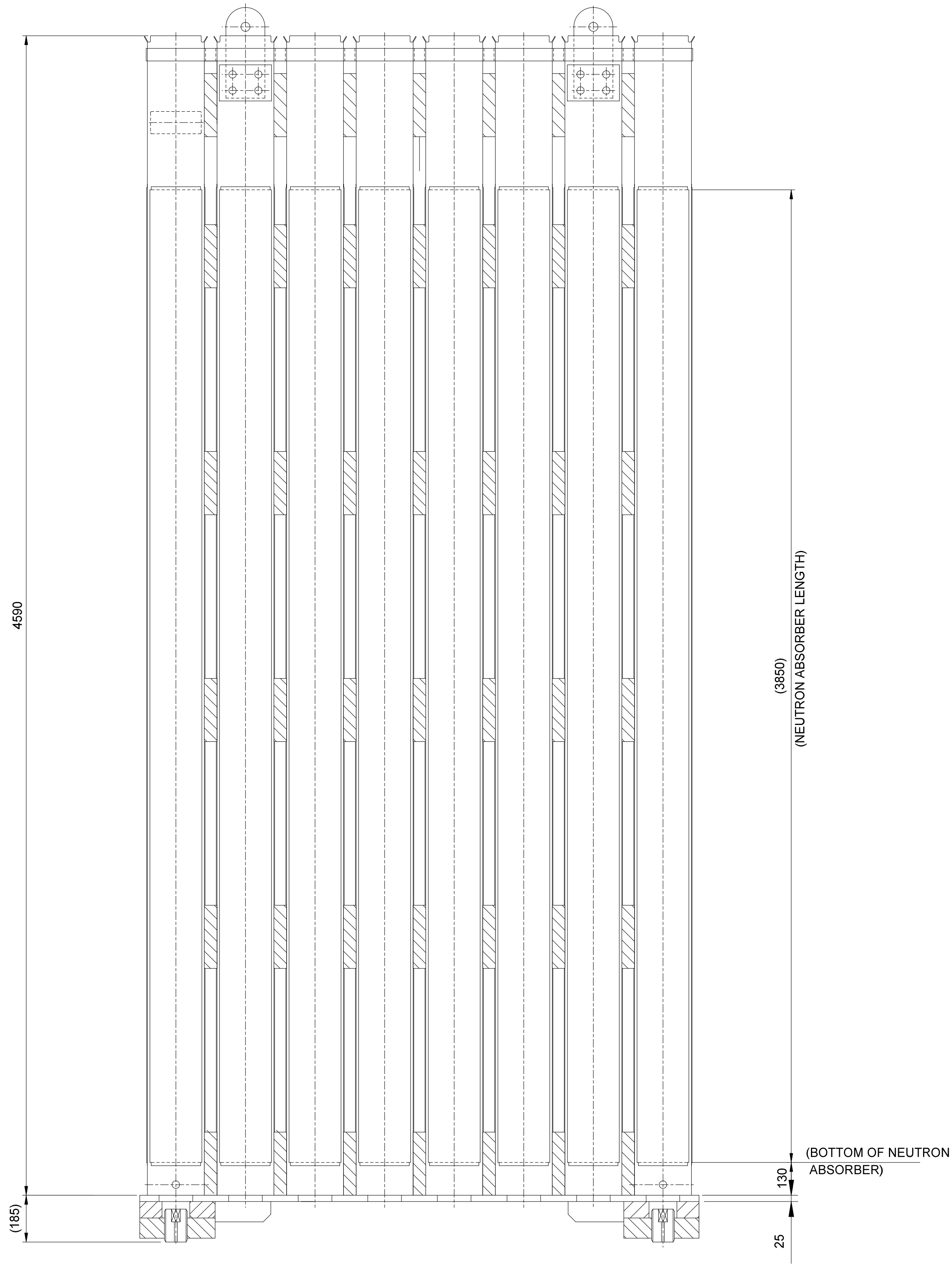


Figure 9.1.2-2A Spent Fuel Storage Rack Region I

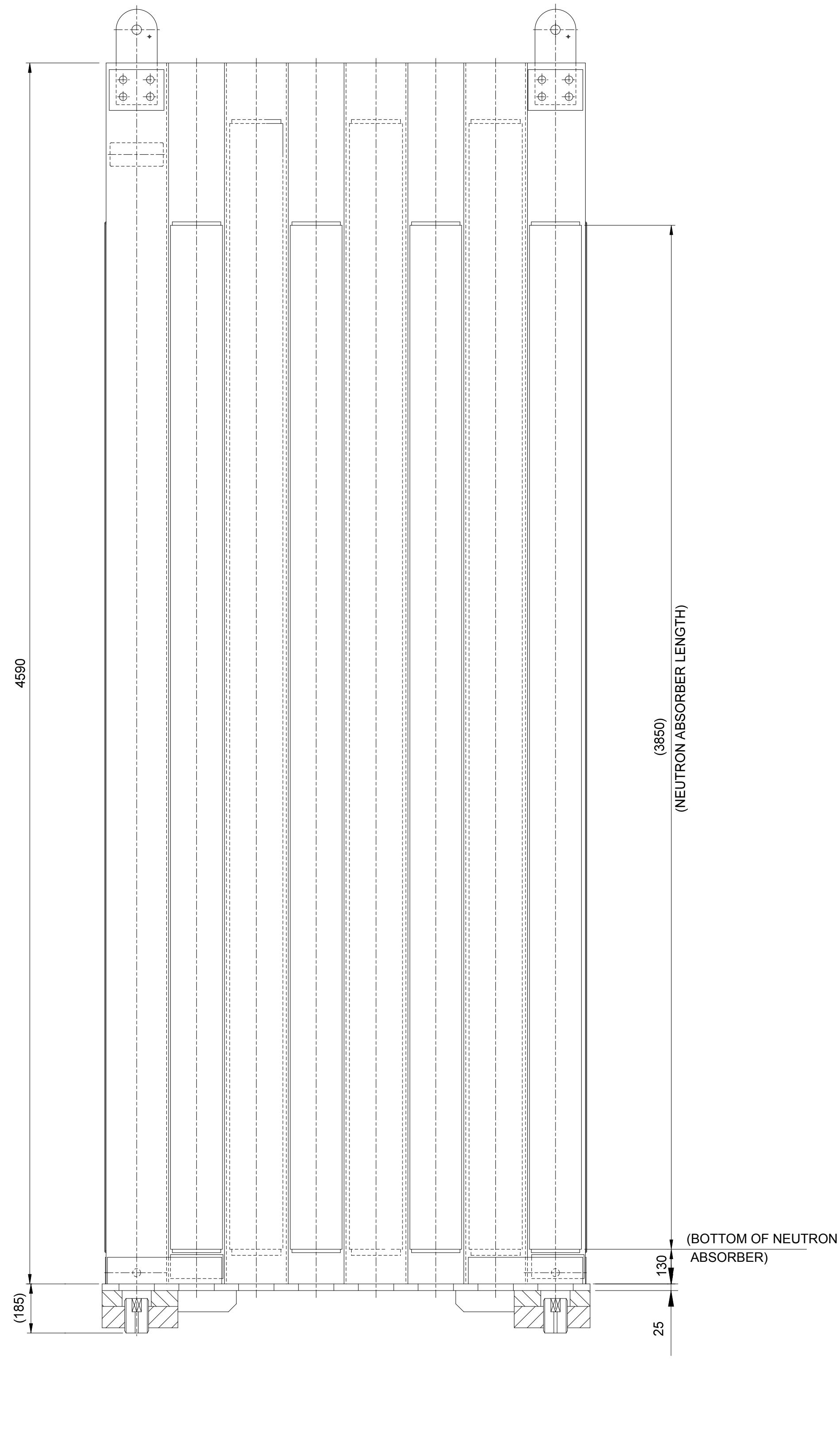


Figure 9.1.2-2-2B Spent Fuel Storage Rack Region II

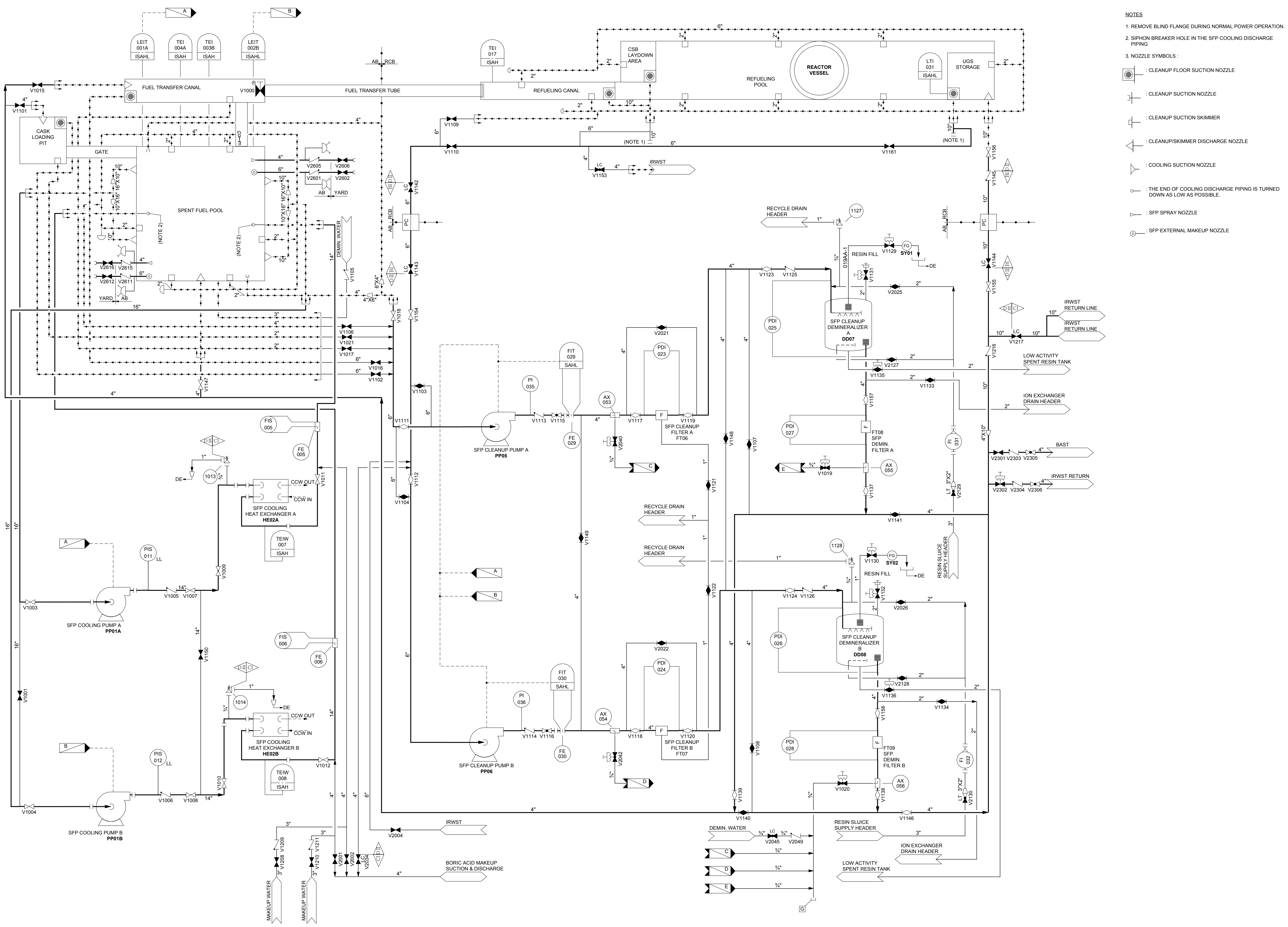


Figure 9.1.3-1 Spent Fuel Pool Cooling and Cleanup System Flow Diagram (1 of 1)

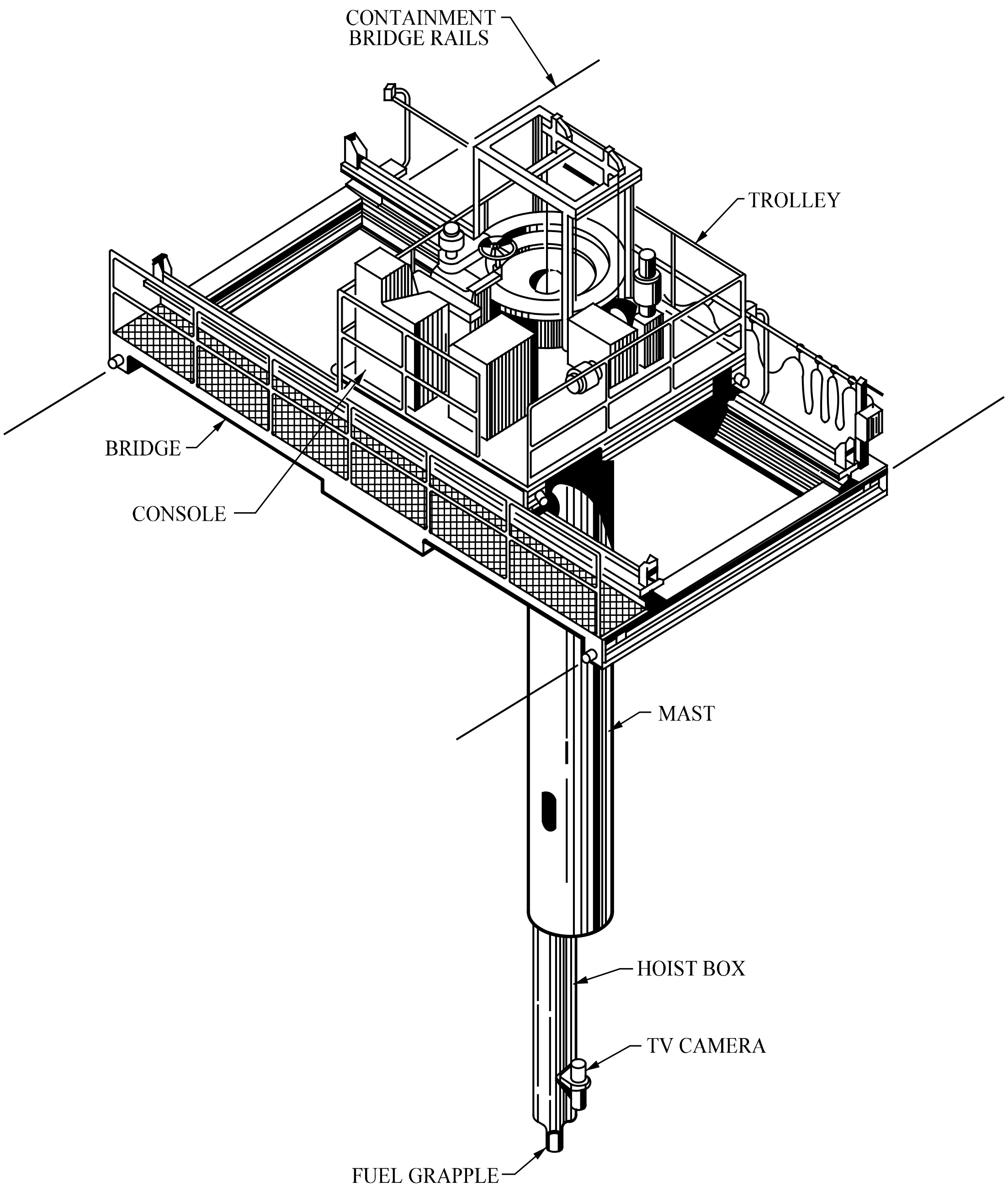


Figure 9.1.4-1 Refueling Machine

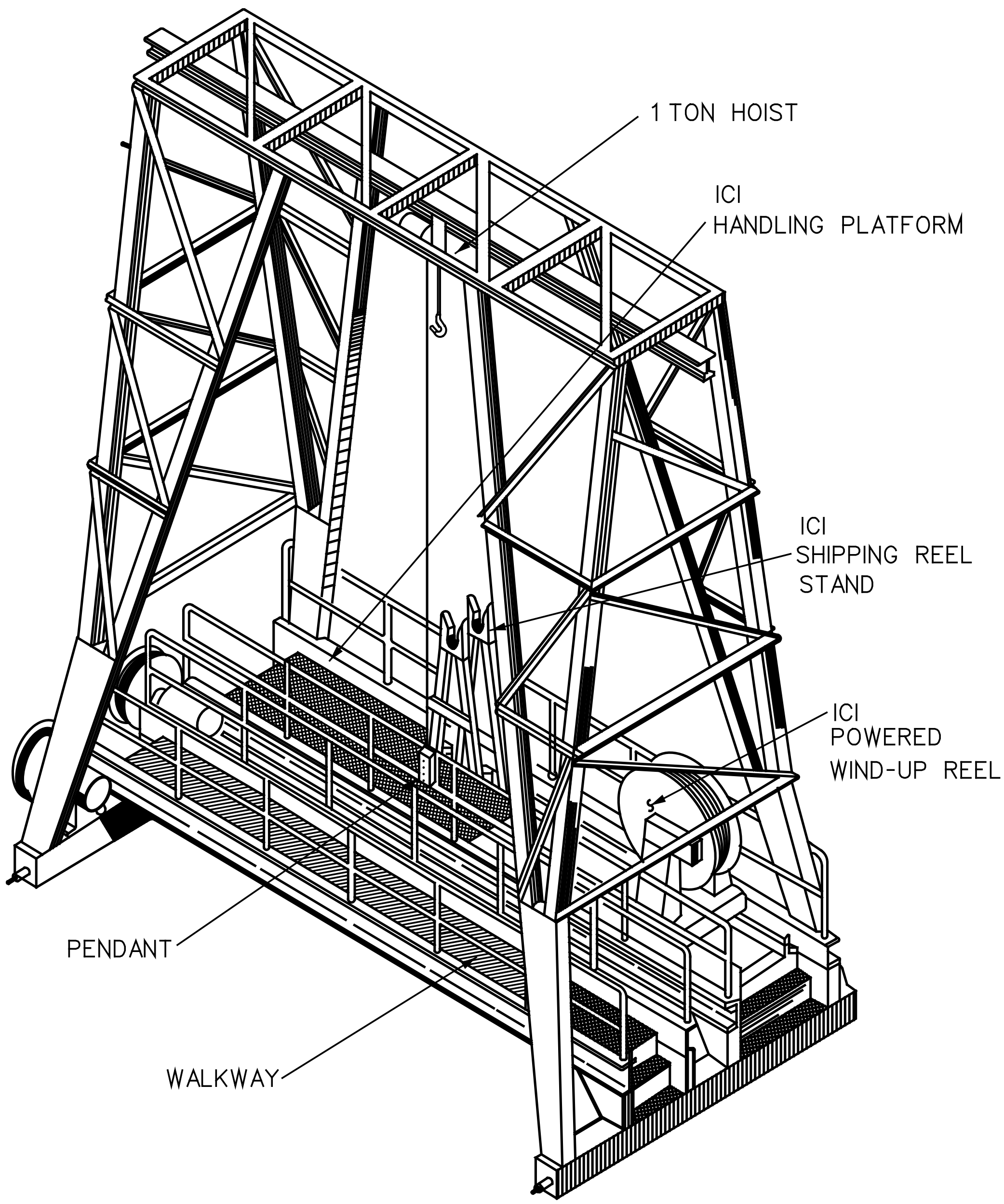


Figure 9.1.4-2 CEA Change Platform

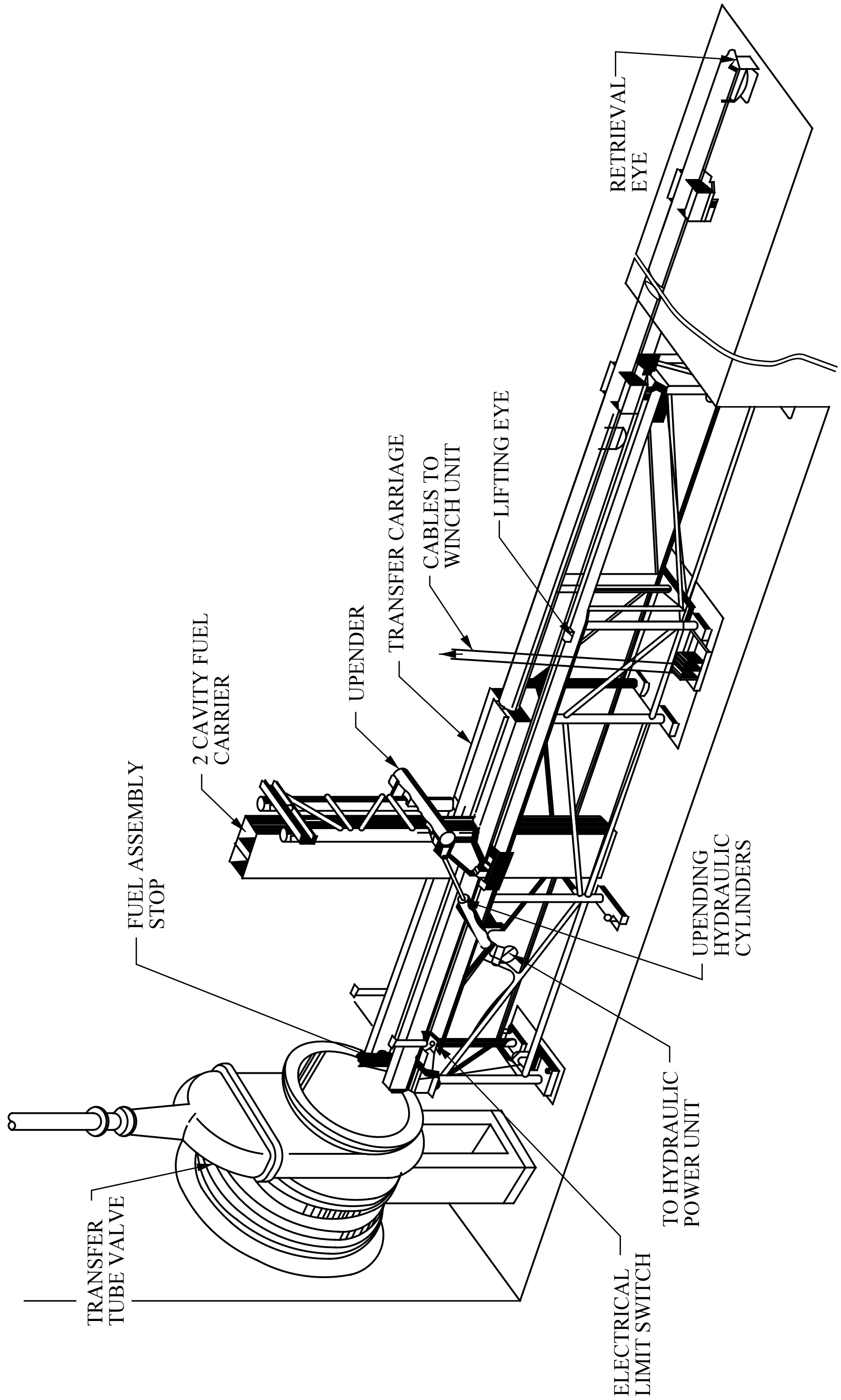


Figure 9.1.4-3A   Fuel Transfer System Carriage and Upender (Fuel Handling Area)

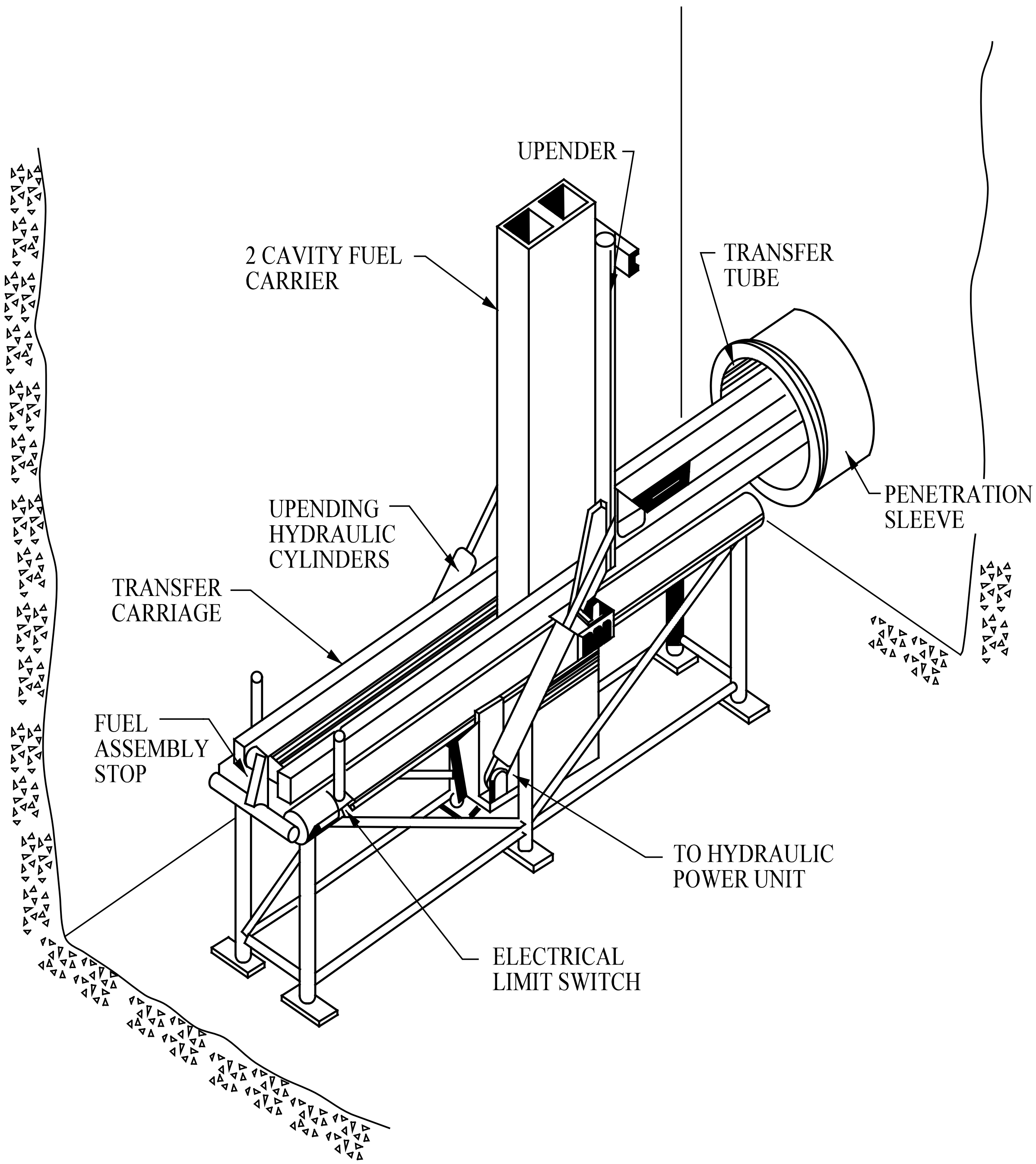


Figure 9.1.4-3B Fuel Transfer System Carriage and Upender (Reactor Containment Building)

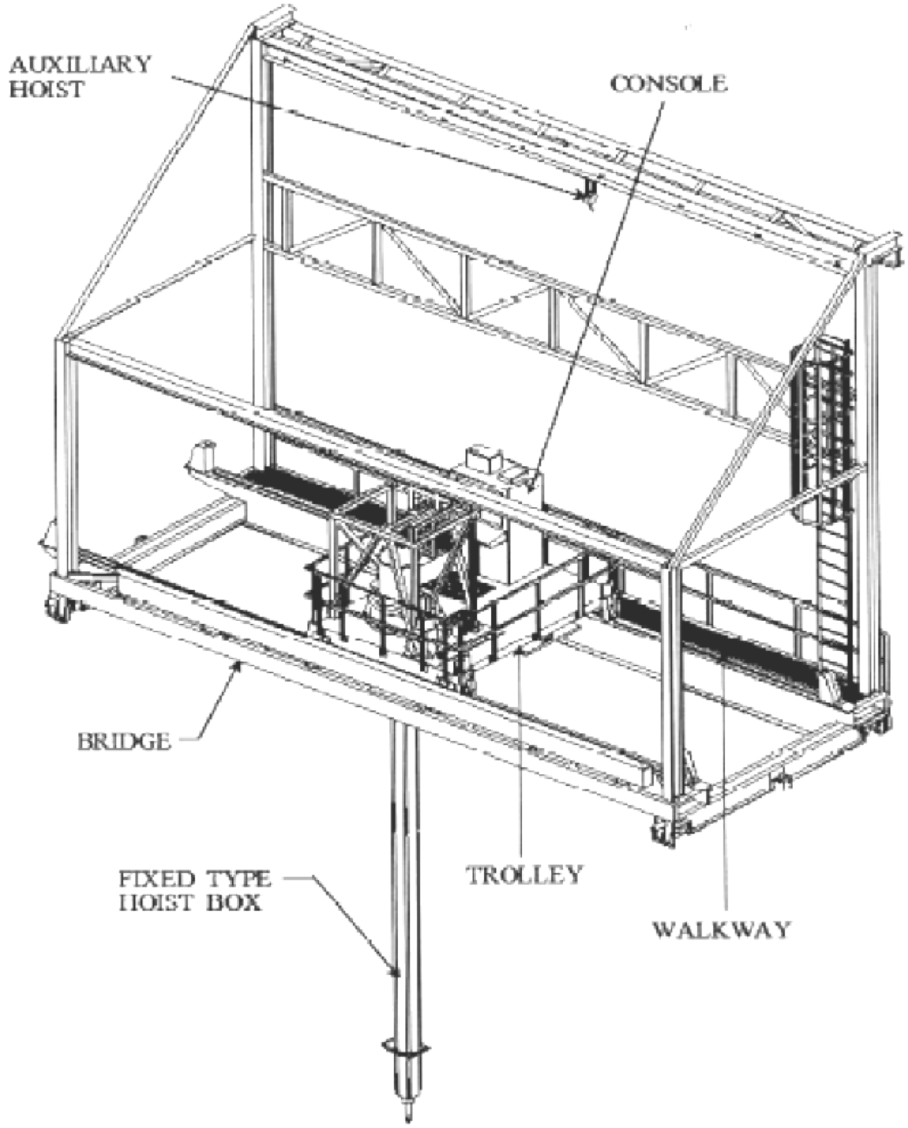


Figure 9.1.4-4 Spent Fuel Handling Machine

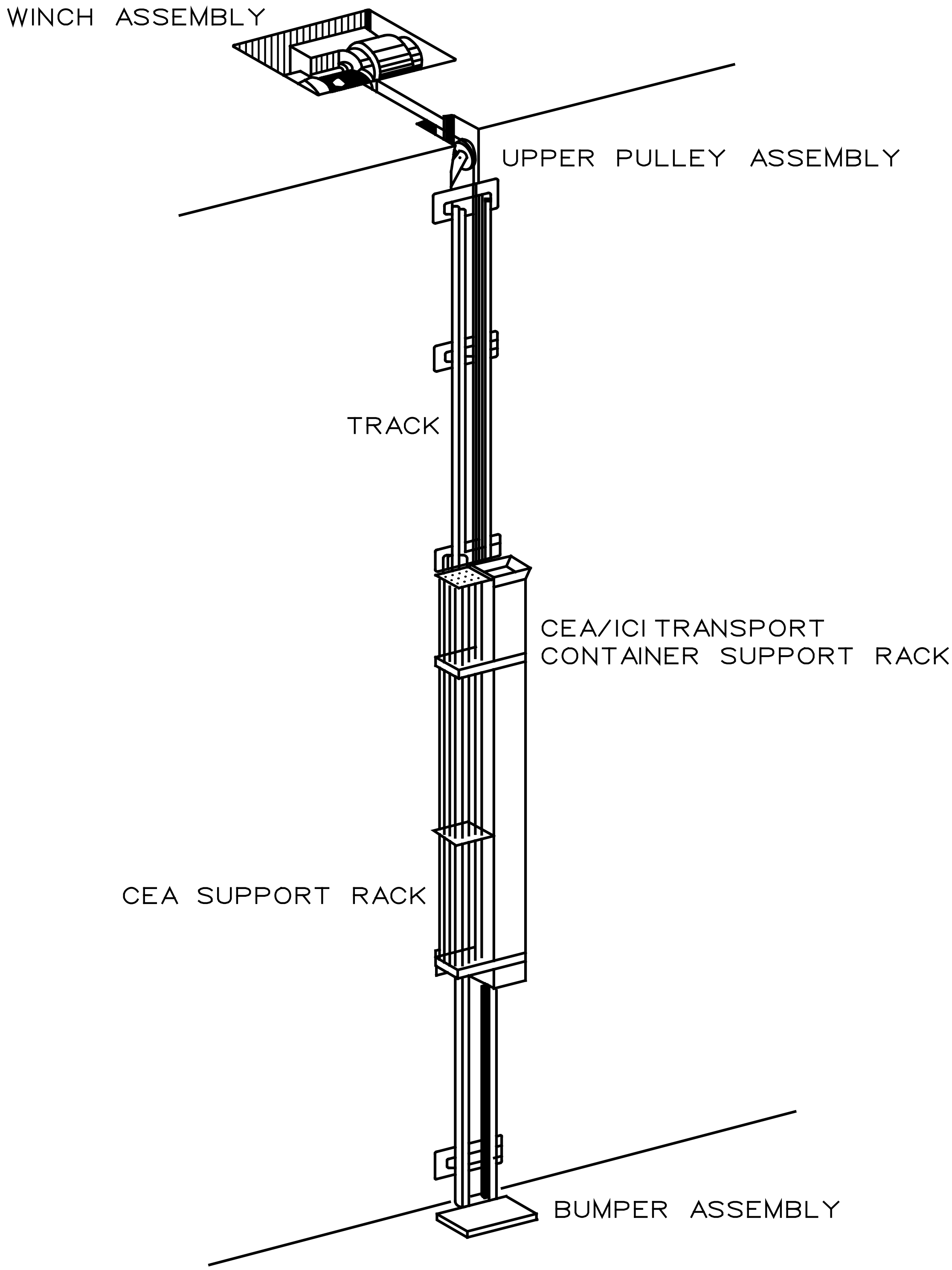


Figure 9.1.4-5 CEA Elevator

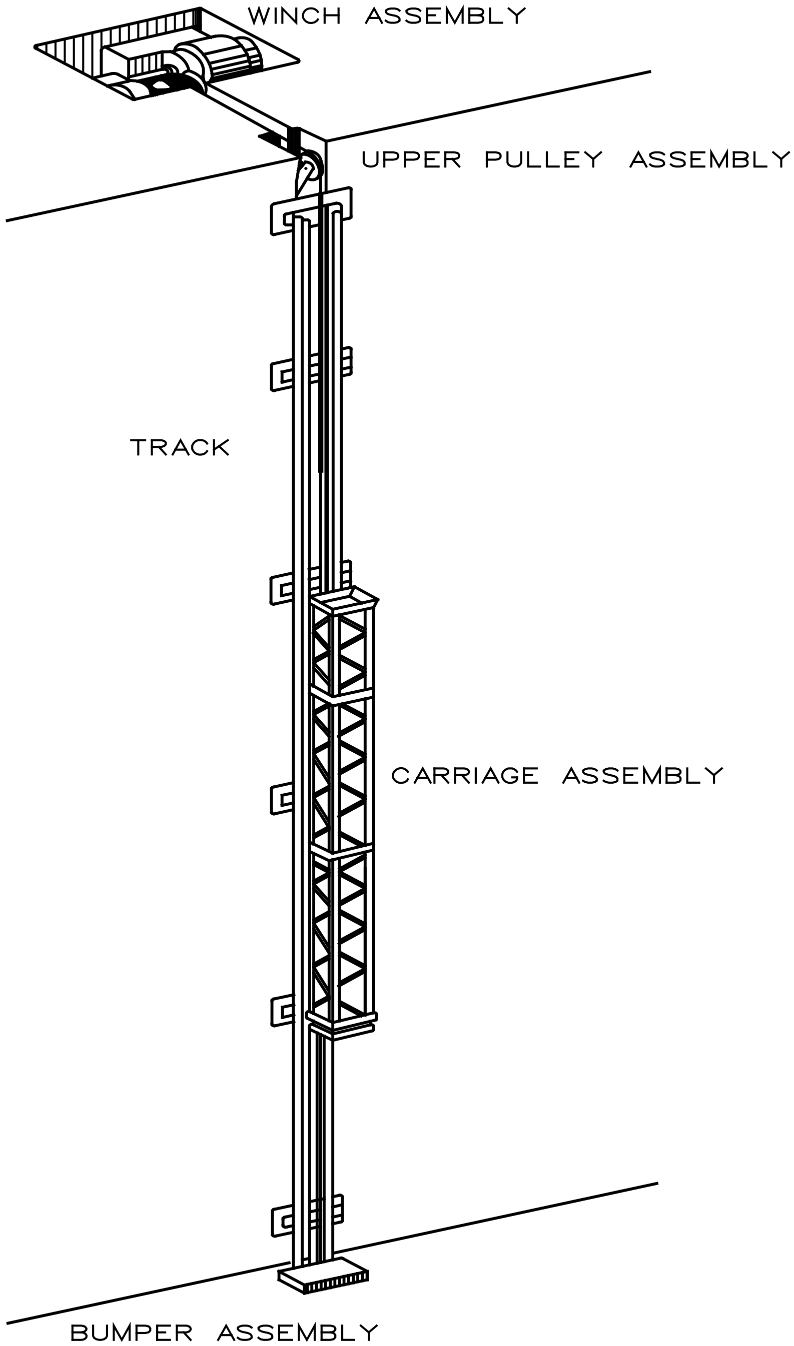


Figure 9.1.4-6 New Fuel Elevator

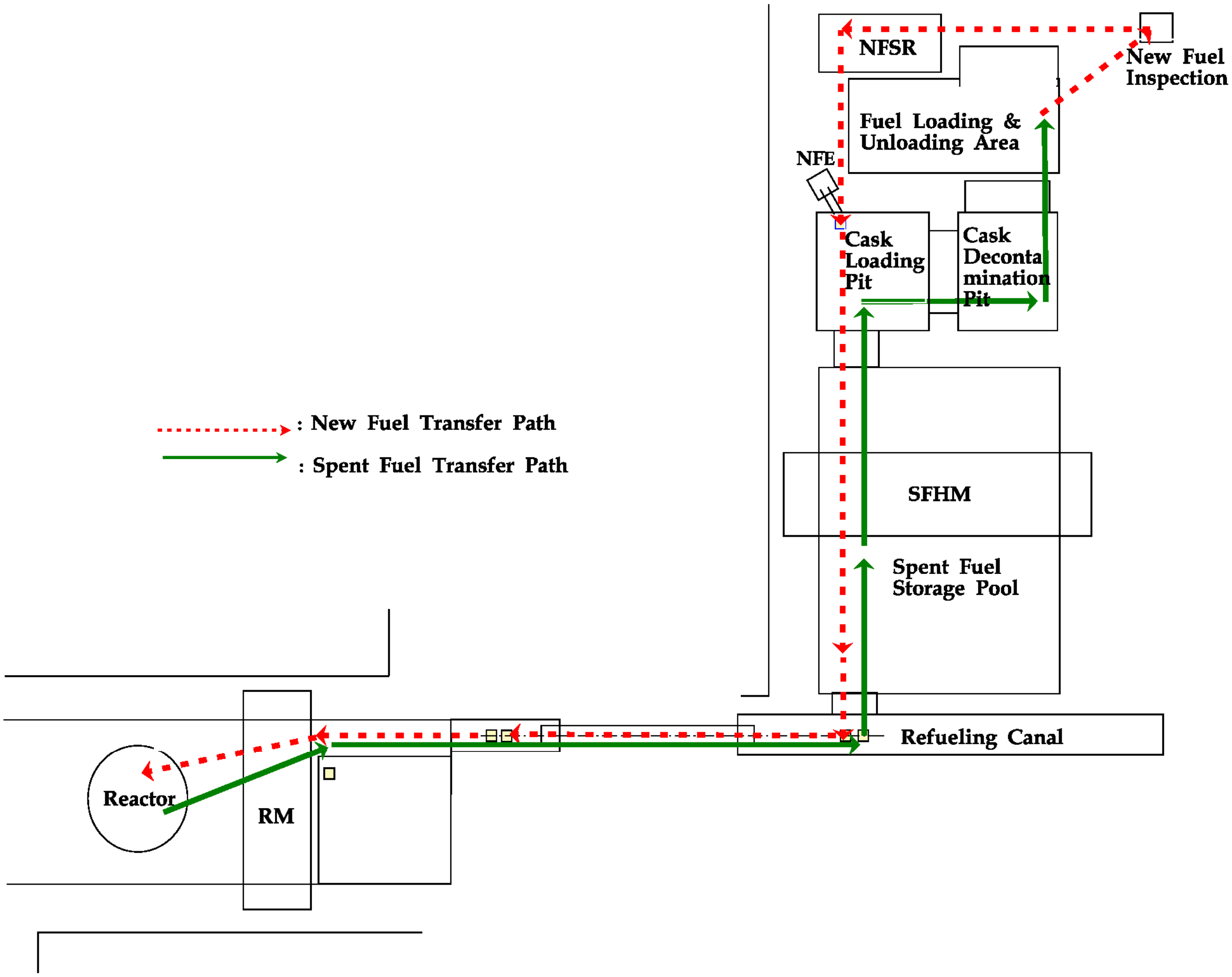


Figure 9.1.4-7 Fuel Movement Path

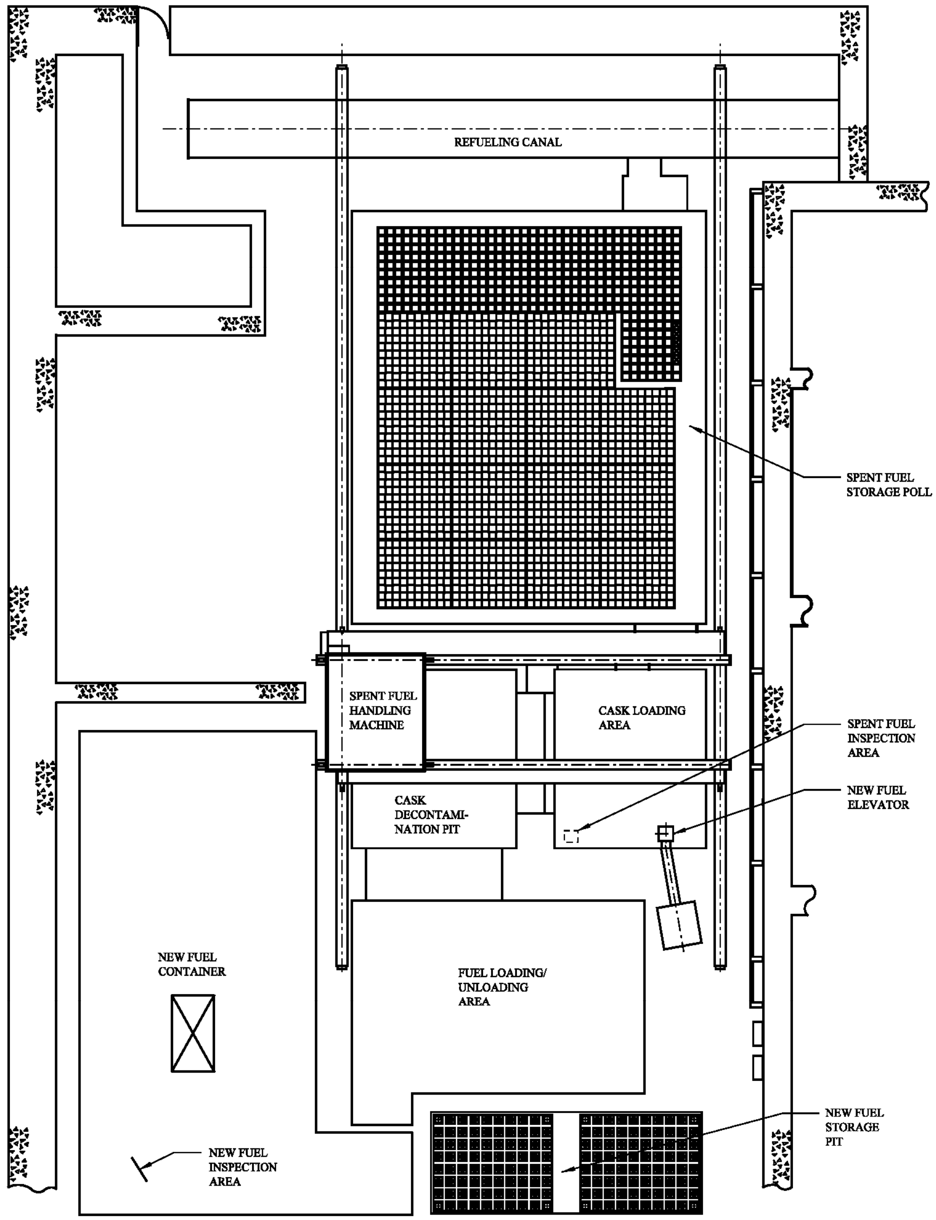


Figure 9.1.4-8 Fuel Building Layout (Related fuel handling)

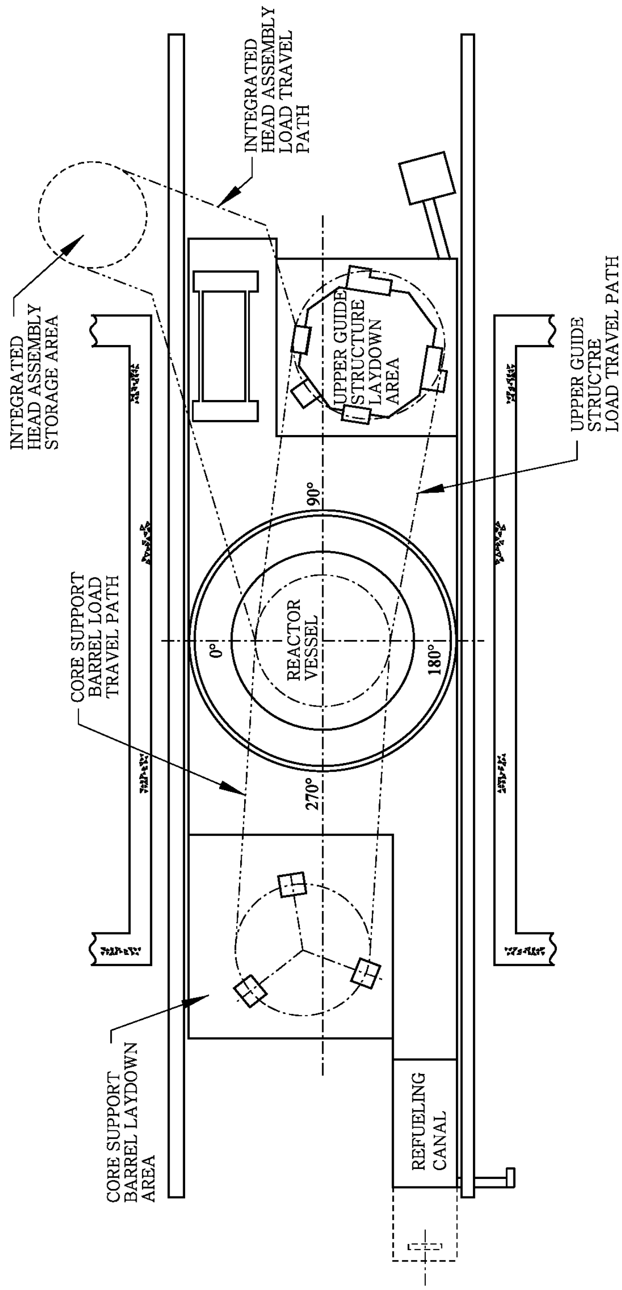


Figure 9.1.4-9 Containment Building Layout (Related fuel handling)

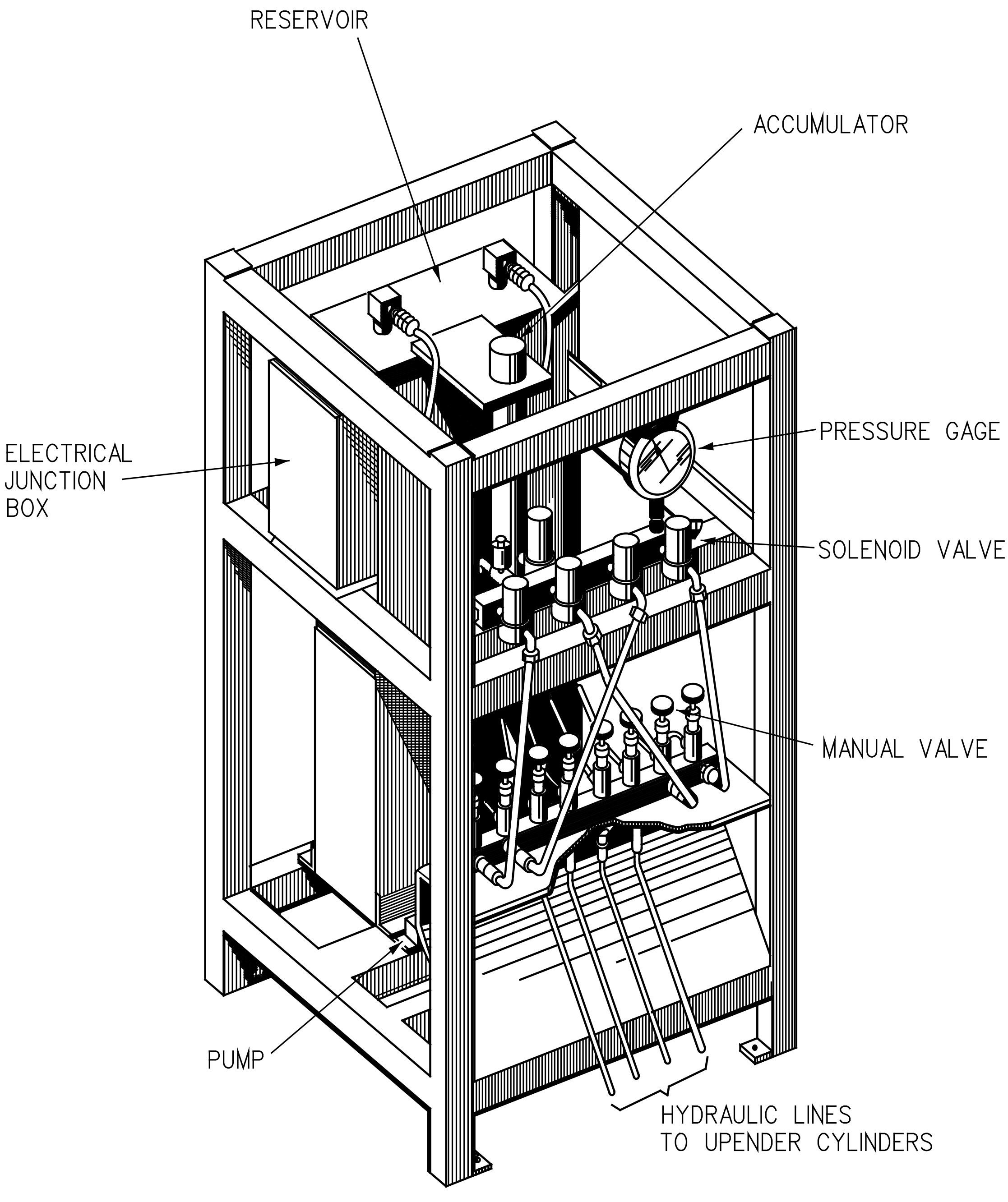


Figure 9.1.4-10 Hydraulic Power Unit

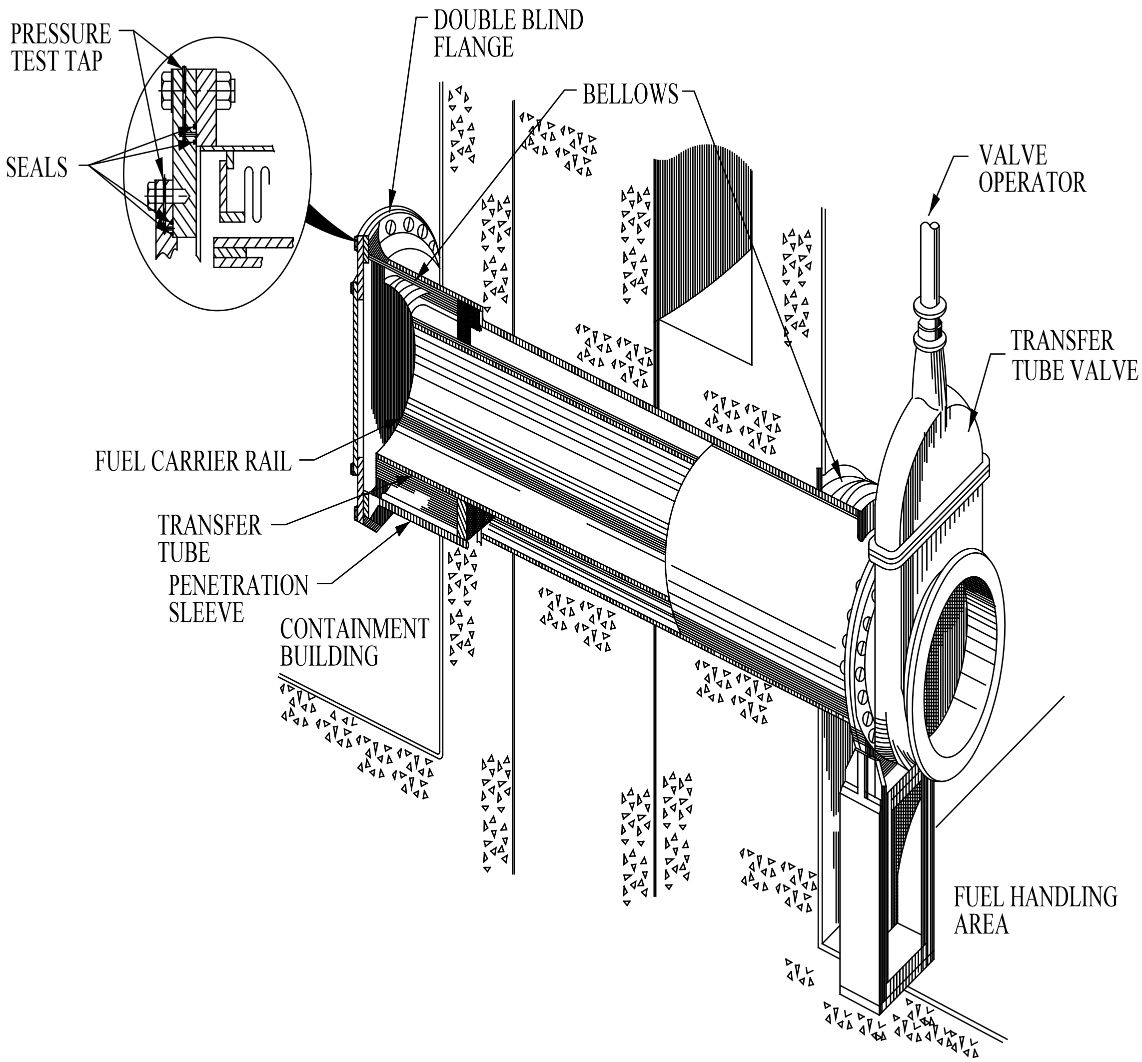
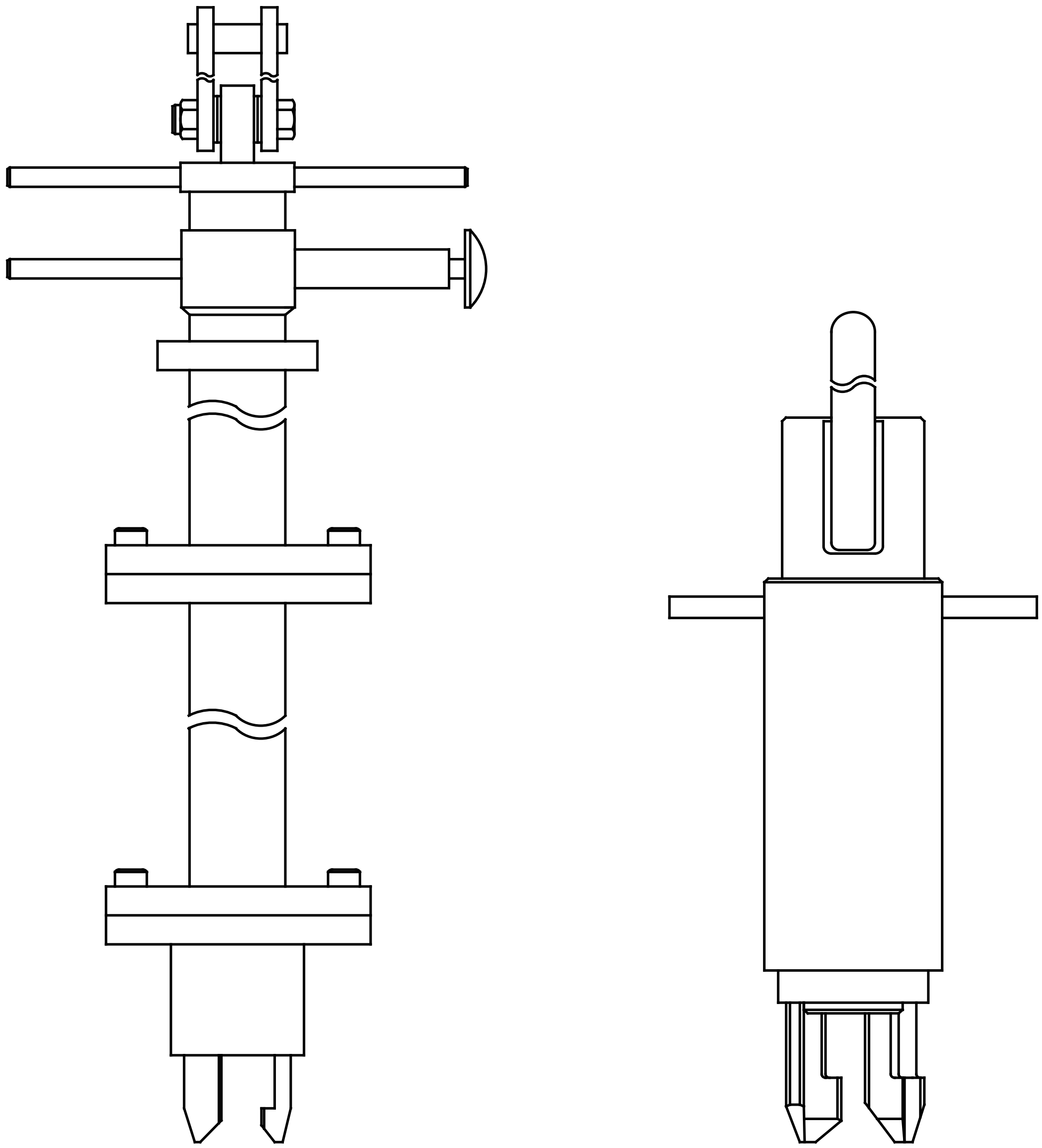


Figure 9.1.4-11   Fuel Transfer Tube Assembly



SPENT FUEL HANDLING TOOL

NEW FUEL HANDLING TOOL

Figure 9.1.4-12 Fuel Handling Tools

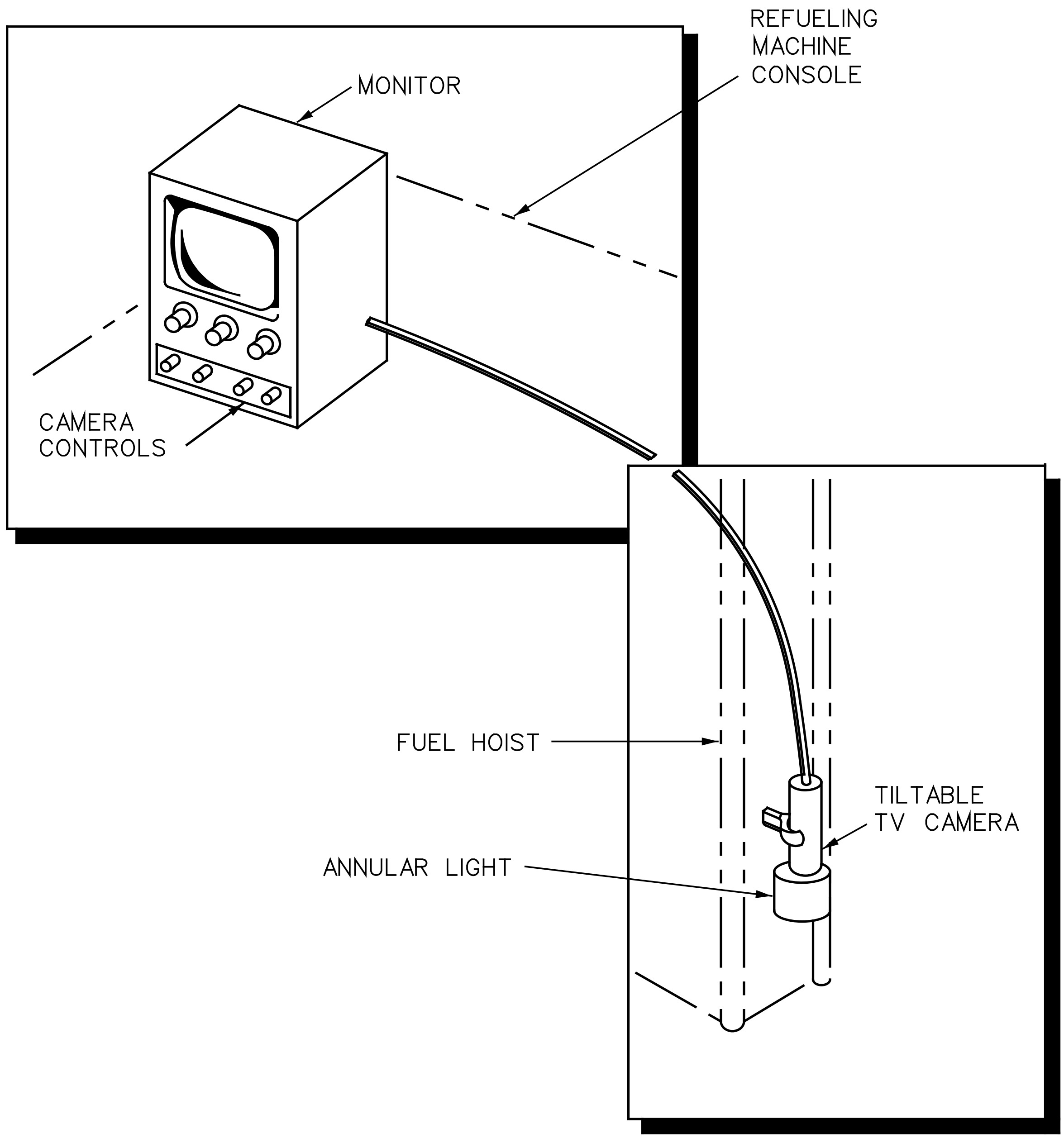


Figure 9.1.4-13 Underwater TV System

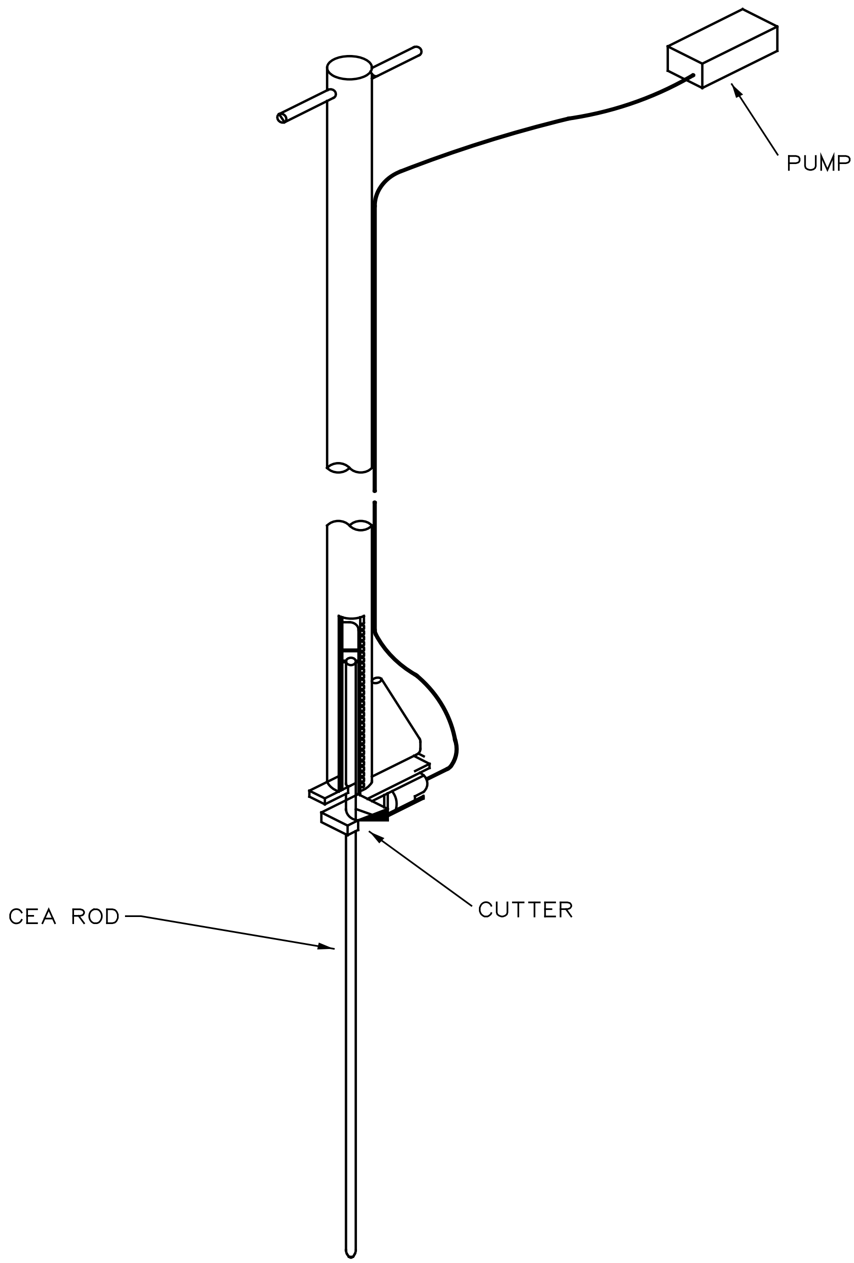


Figure 9.1.4-14 CEA Cutter

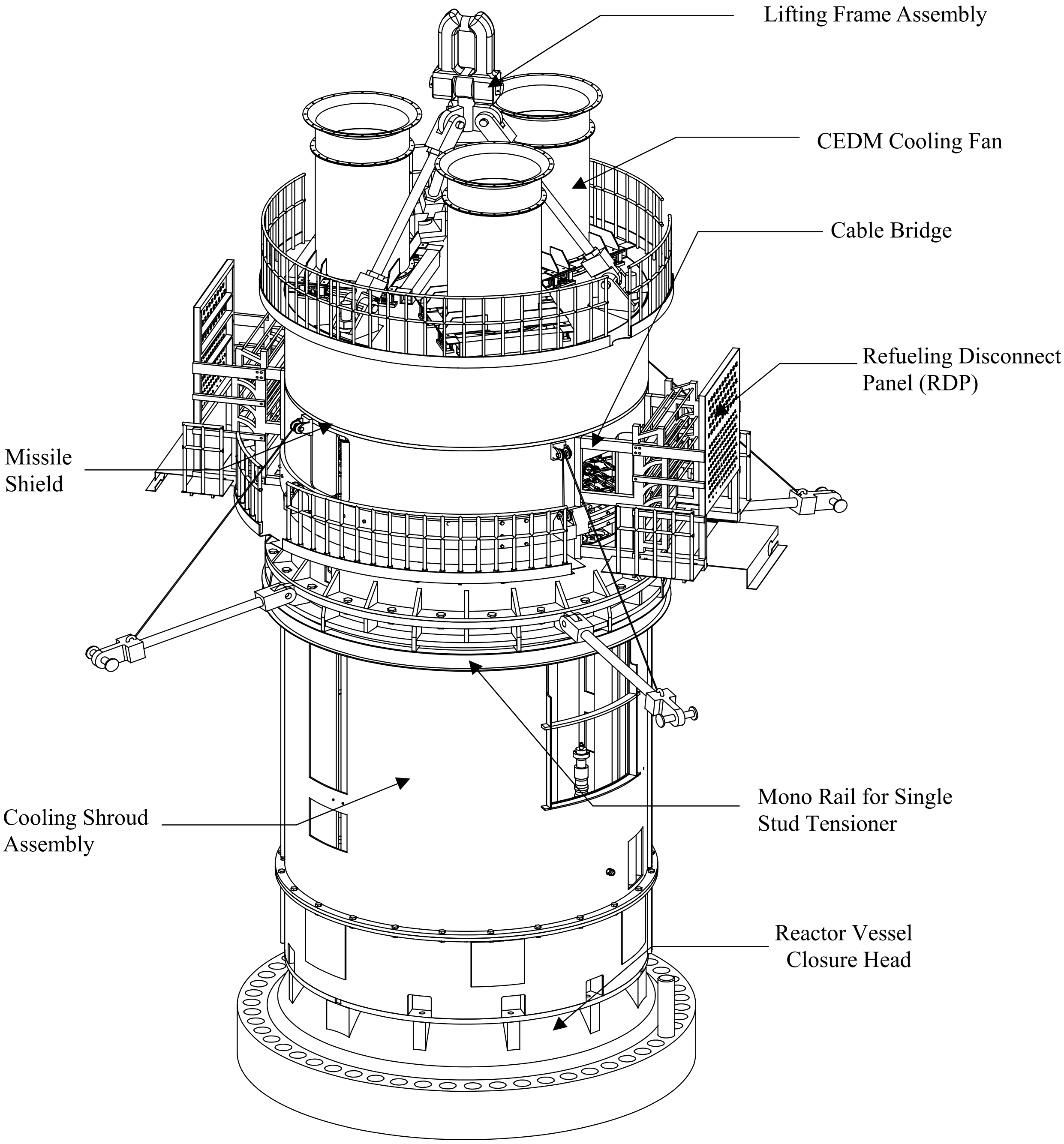


Figure 9.1.5-1 Integrated Head Assembly

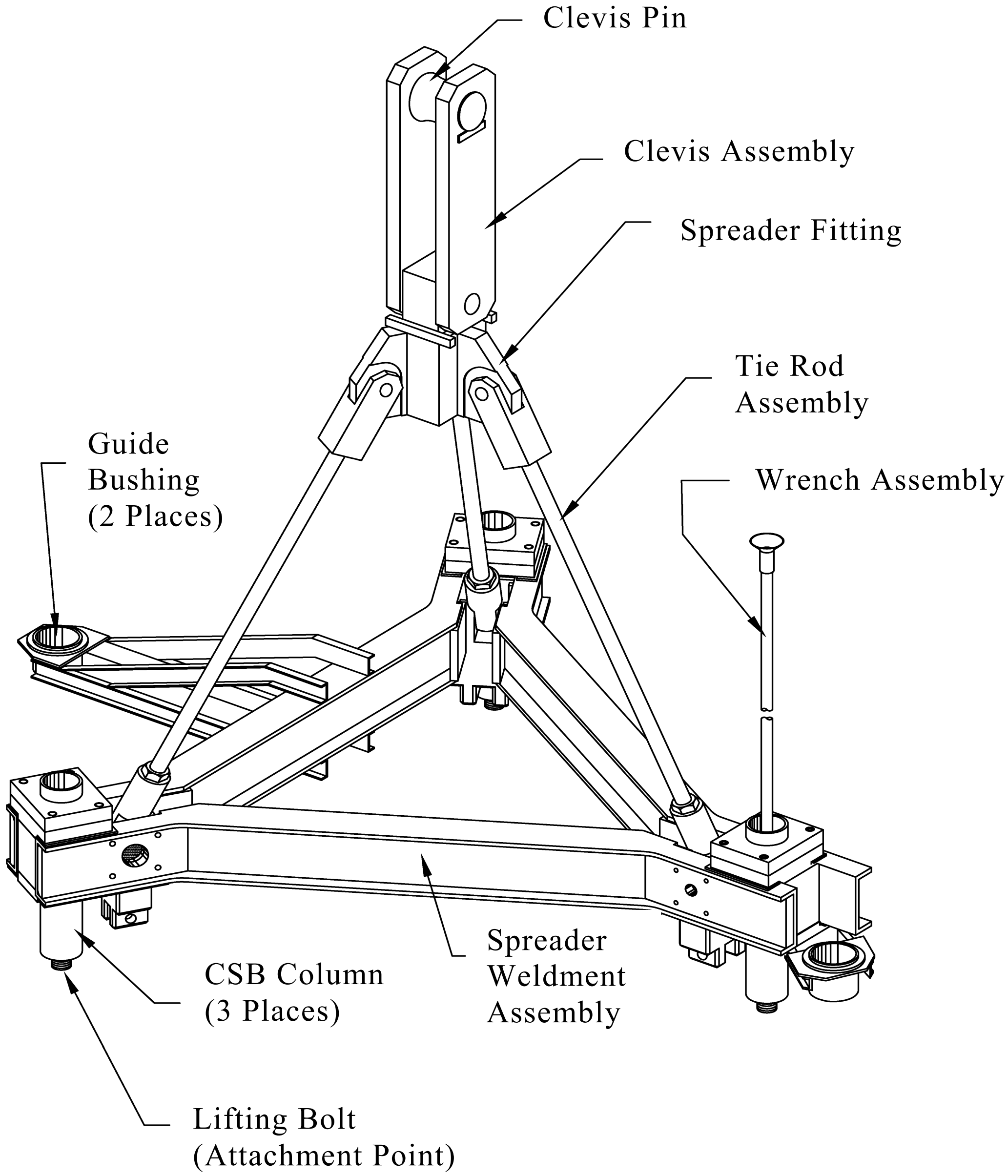


Figure 9.1.5-2 Core Support Barrel Lift Rig Assembly

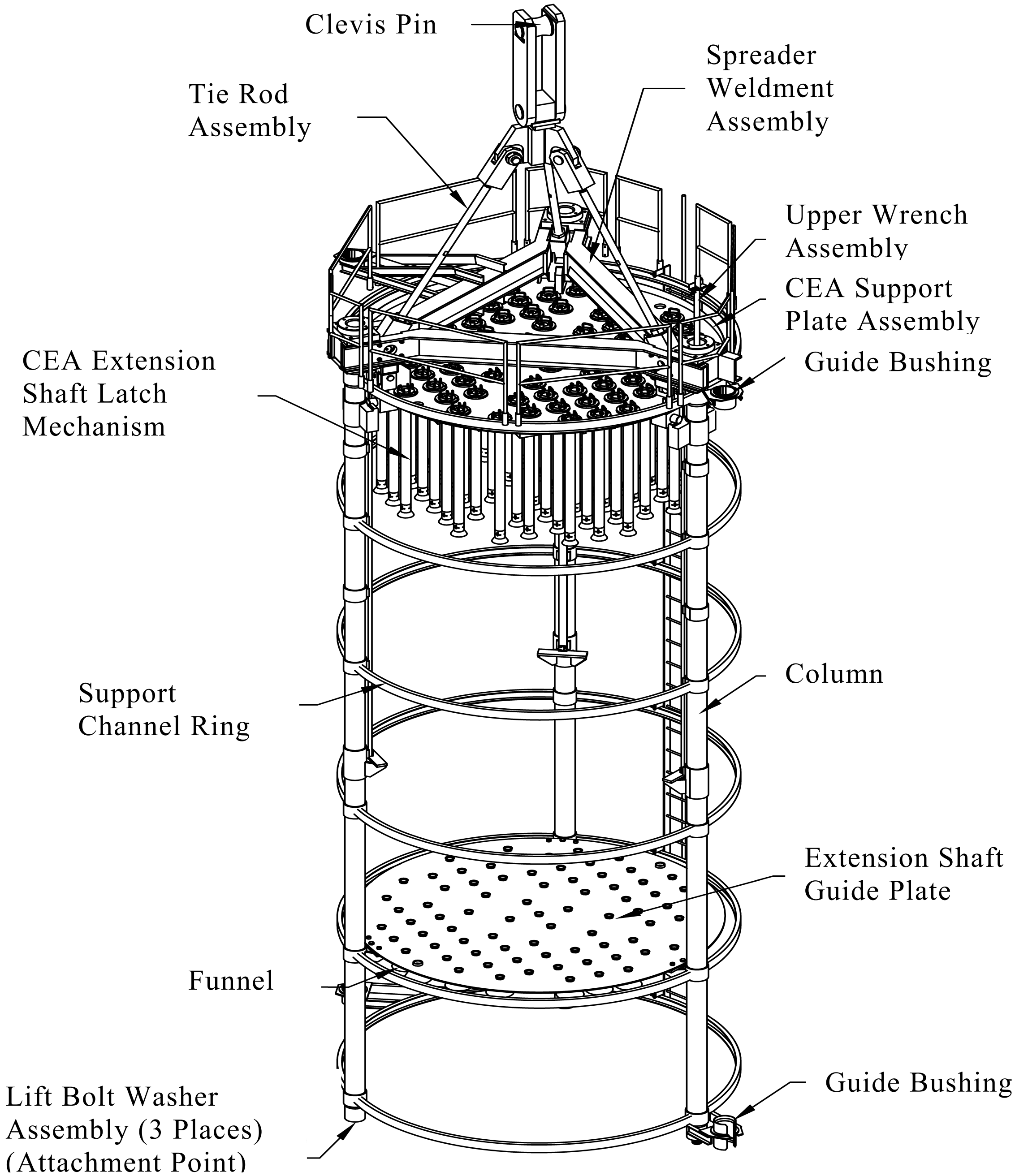


Figure 9.1.5-3 Upper Guide Structure Lift Rig Assembly

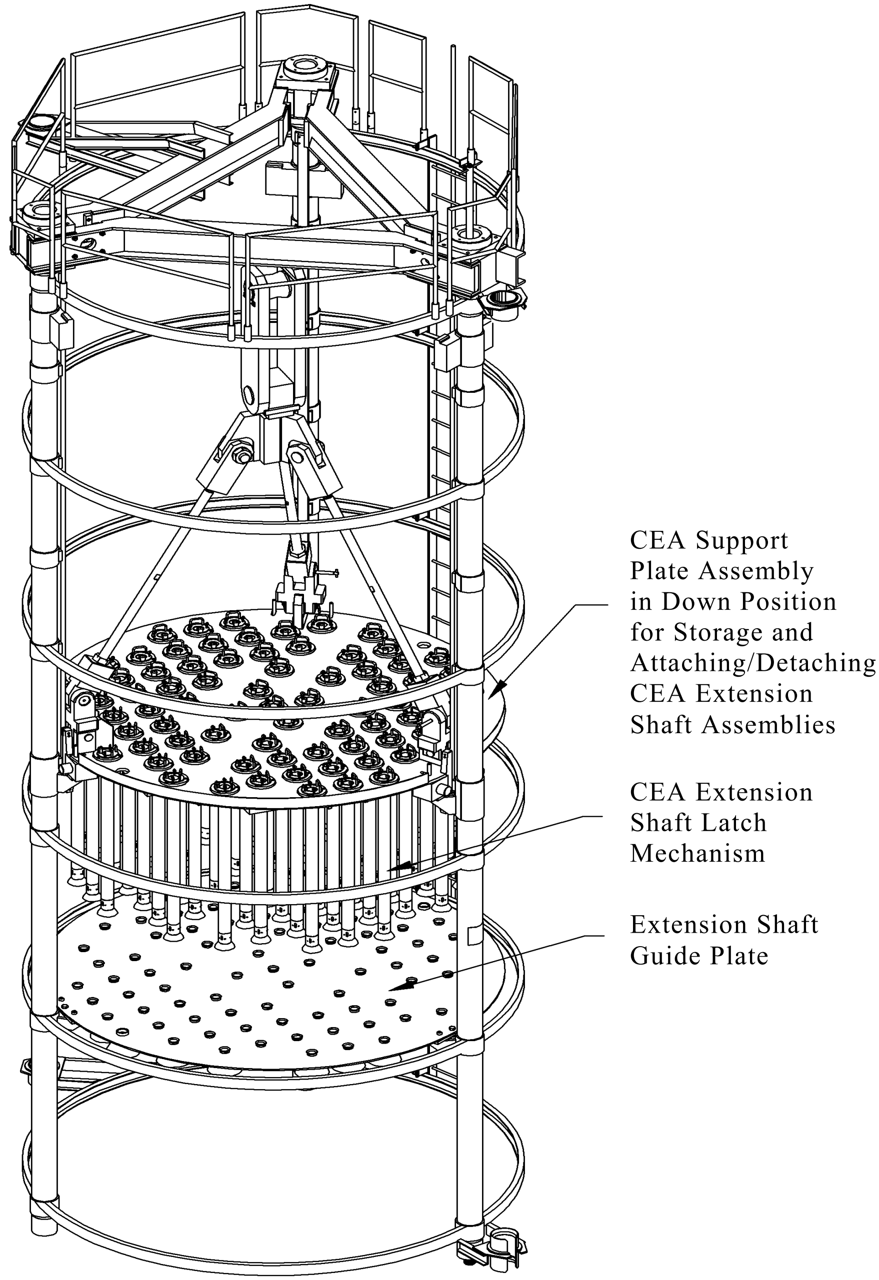


Figure 9.1.5-4 Upper Guide Structure Lift Rig Assembly Storage Configuration

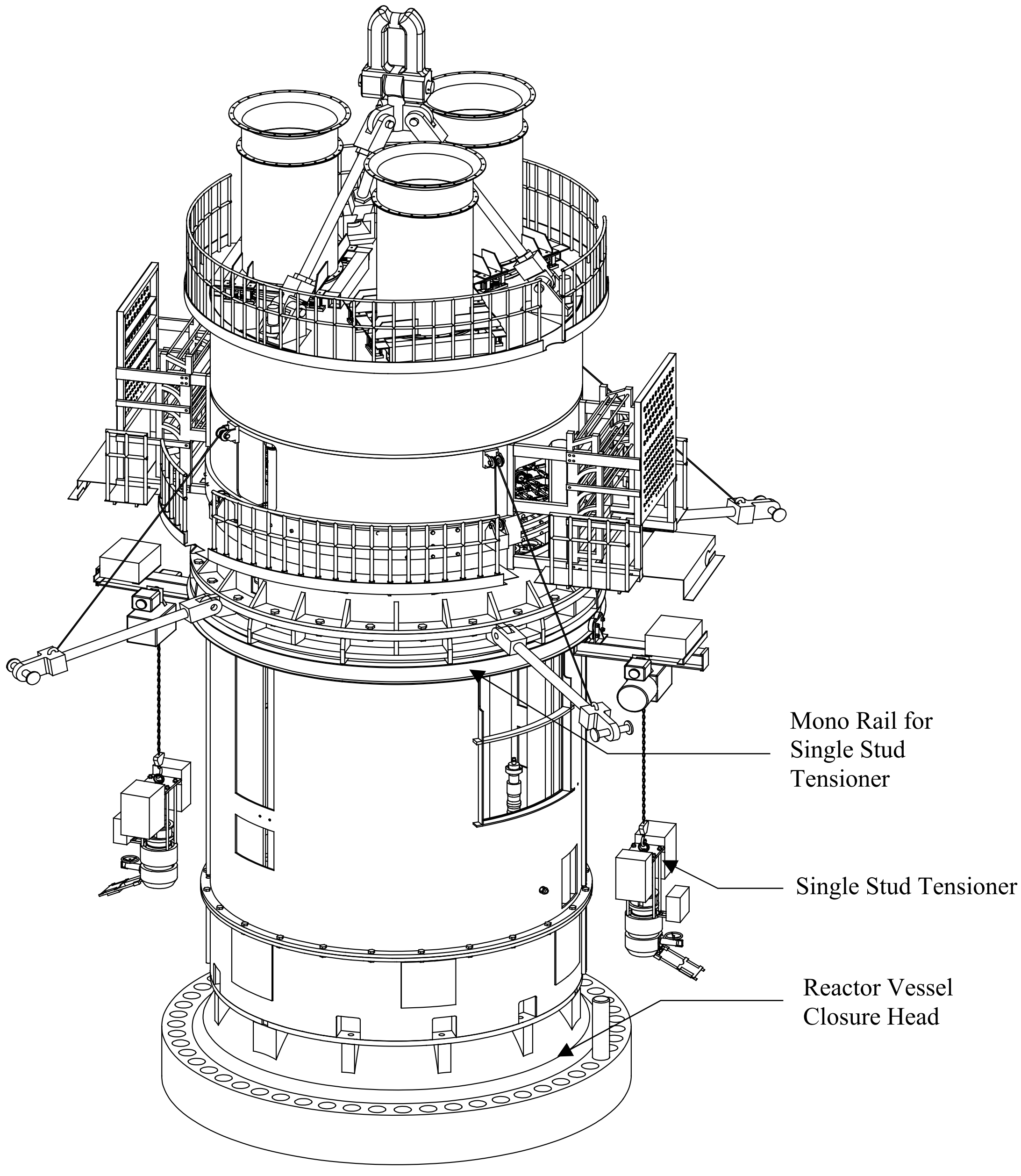


Figure 9.1.5-5 Single Stud Tensioner in the Integrated Head Assembly

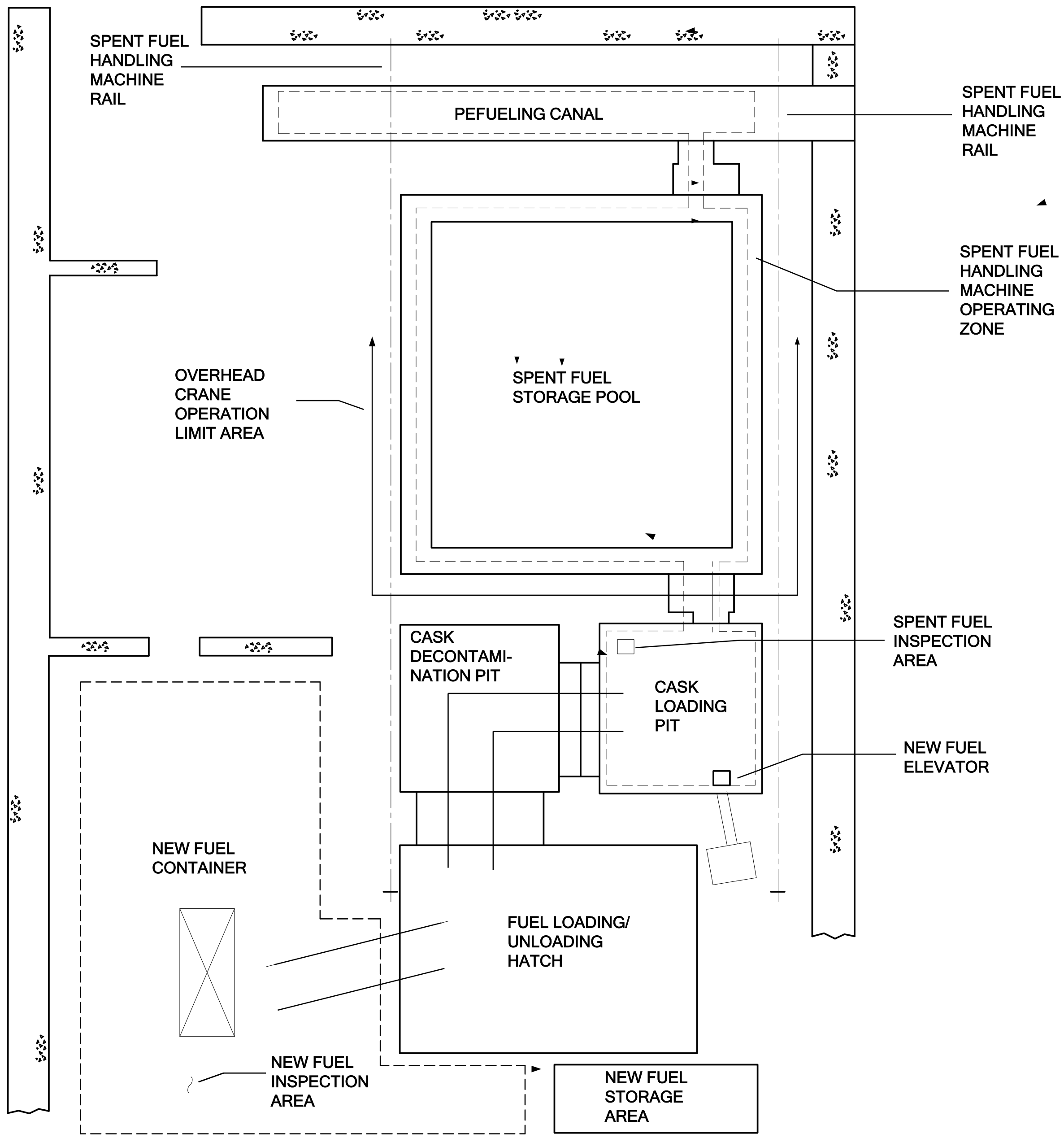


Figure 9.1.5-6 Fuel Handling Area Safe Load Handling Paths

9.2 Water Systems

9.2.1 Essential Service Water System

The essential service water system (ESWS) is an open system that takes suction from the ultimate heat sink (UHS) and provides cooling water to component cooling water (CCW) heat exchangers to remove heat released by plant systems, structures, and components. The ESWS returns the heated water to the UHS. The ESWS cools the removed essential and nonessential heat loads from the component cooling water system (CCWS).

9.2.1.1 Design Bases

The ESWS is designed in accordance with the requirements of GDC 2, 4, 5, 44, 45, and 46.

9.2.1.1.1 Safety Design Bases

Safety design bases applicable to the ESWS are as follows:

a. The ESWS, in conjunction with the CCWS and the UHS, is capable of removing heat loads from the essential heat exchangers and transfer to the UHS to provide reasonable assurance of a safe shutdown and cooling following a postulated accident coincident with a loss of offsite power (LOOP).

b. The ESWS is designed with the capability to isolate nonessential portions of the system.

c. The ESWS supplies cooling water at 31.1 °C (89.8 °F) or less during normal operation and at 33.2 °C (91.8 °F) or less during the design basis accident to the CCW heat exchangers, pursuant to the requirements of GDC 44.

d. A single failure of any component in the ESWS does not impair the ability of the ESWS to meet its functional requirement of mitigating the consequences of an accident pursuant to GDC 44.

e. Environmental occurrences do not impair the ability of the ESWS to meet its functional requirements.

f. The ESWS is designed to minimize the effects of long-term corrosion and organic buildup.

g. The ESWS is designed in accordance with ASME Section III (Reference 12), safety Class 3, requirements and to seismic Category I requirements to withstand the effects of an SSE in accordance with NRC RG 1.29 (Reference 15).

h. Components of the ESWS are capable of being fully tested during normal plant operation. In addition, parts and components are accessible for inspection. The system is designed for periodic inservice testing and inspection to provide reasonable assurance of the integrity and capability of the system in accordance with GDC 45, ASME Section XI (Reference 14) and GDC 46.

i. The system is designed to detect leakage of radioactive material into the system and control leakage out of the system.

j. All essential components of the ESWS are fully protected from floods, fire, tornadoes, hurricanes, tsunami, internal and external missiles, pipe breaks and whip, jet impingement, and interaction with nonseismic systems in the vicinity.

k. The system is designed to minimize the potential for water hammer by providing means for adequate filling and high-point venting. The system is designed considering the adverse conditions that can occur such as freezing and thermal overpressurization.

l. The ESW pumps are designed to have sufficient net positive suction head (NPSH) to remain functional at the lowest probable water level of the UHS in accordance with NRC RG 1.27 (Reference 7) to meet the 30 days water supply requirements without makeup.

m. The ESWS consists of two separate, redundant safety-related divisions. The components and piping in each division are not shared with the other division.

The ESWS does not share structure, systems, or components important to safety with other nuclear plant units in accordance with GDC 5.

9.2.1.1.2 Power Generation Design Bases

Power generation design bases pertinent to the ESWS are as follows:

a. The ESWS, in conjunction with the CCWS and shutdown cooling system (SCS), is designed to cool the reactor coolant from 176.7 °C (350 °F) to 60 °C (140 °F) through the shutdown cooling (SC) heat exchangers and the CCW heat exchangers.

b. The ESWS, in conjunction with the CCWS, is designed to supply CCW at a temperature below 43.3 °C (110 °F) to all components required to operate during a normal shutdown.

c. The ESWS, in conjunction with the CCWS, is designed to supply CCW at a temperature below 35 °C (95 °F) to all components required to operate during normal plant operation.

9.2.1.2 System Description

9.2.1.2.1 General Description

The flow diagram of the ESWS is shown in Figure 9.2.1-1. The ESWS consists of two independent, redundant, once-through, safety-related divisions. Each division cools one of two divisions of the CCWS, which cools 100 percent of the safety-related loads. This arrangement provides reasonable assurance that failures and postulated events in one division do not affect the safety-related functions of the other division during accident conditions, such as a LOCA or safe shutdown with LOOP, or in a postulated single active component failure. The ESWS operates at a lower pressure than the CCWS to avoid contamination of the CCWS with UHS.

The maximum operation supply temperature of the ESW is 33.2 °C (91.8 °F). It is believed to eliminate CCW HX heat load sufficiently under all operating conditions. Table 9.2.5-3 provides information on heat loads and water flow balance for various

operating modes. The ESWS design heat loads are based on the maximum safe shutdown heat loads with only one operable ESWS division. The other division is assumed to be failed due to a single active component failure. Even in these conditions, the ESW flow rate and maximum supply temperature are maintained at 75,708 L/min (20,000 gpm) and 33.2 °C (91.8 °F), respectively.

Each division of the ESWS consists of two pumps, three CCW heat exchangers, three debris filters, and associated piping, valves, controls and instrumentation. The ESW pumps are located in the ESW intake structure at 81 ft. The ESW pumps take suction from the UHS basin, circulate cooling water through the CCW heat exchangers, and return cooling water back to the UHS. [[The ESWS blowdown line is installed at the ESW pump discharge common pipe to remove impurities concentrated in the UHS. The ESWS is designed with the capability to isolate nonessential portions of the system. The ESW blowdown operation is terminated by the engineered safety features actuation signal (ESFAS), ESW pump stop signal, or UHS basin low-level signal. An ESW blowdown bypass line is provided to bypass the ESW blowdown flow during the ESW blowdown isolation valve maintenance.]]

[[The ESW flow of 75,708 L/min (20,000 gpm) including ESW blowdown is maintained during normal and accident operating conditions. During shutdown and refueling condition, the ESW flow of 104,477 L/min (27,600 gpm) including ESW blowdown is maintained.]] Provisions are made to provide reasonable assurance of a continuous flow of cooling water under normal and accident conditions. Manual valves V1005 through V1016 are installed for the isolation/initiation of ESW flow to the CCW heat exchangers. These valves are manually locked open or closed. Each ESWS discharge header is connected to the UHS at the same division.

The CCWS serves as an intermediate barrier between the reactor coolant system (RCS) and the ESWS. Thus, no radioactive contamination leaks directly from RCS to the ESWS. Each division has a sump for collection of leakage from sources within the room. The sump is equipped with level instrumentation for leak detection purposes. Radiation monitors are provided in each discharge line of the CCW heat exchanger cold side (ESW) to detect any radioactive leakage from the CCWS to the ESWS. These monitors are indicated and alarmed to alert the operator in the MCR. Prior to any radiation leakage being detected in the ESWS, radiation alarms in the CCWS side alerts the operators of contamination in the CCWS. The affected CCWS division is immediately isolated

followed by the isolation of the aligned ESWS to prevent possible contamination of the UHS and the environment.

The ESWS together with the UHS is designed to minimize the potential for water hammer by implementing the features described in NUREG-0927 (Reference 10). Vents are installed at high points, and drains are installed at low points in the ESWS. Vents are located to provide reasonable assurance that the piping is filled with water to reduce the potential for water hammer after pump starts. When a division is restarted after shutdown of the division, one pump in the division is initially energized to fill the system with water. Because the system is initially empty, the pump discharge valve is throttled to prevent the pump from the runout condition and water hammer. In addition, pump discharge valve opening/closing times are selected to minimize water hammer effects when a pump is switched to standby pump operation in the same division or when a standby pump starts due to operating pump trip or control signal.

The ESW pipe layout also minimizes water hammer. To prevent the void formation in the pipe and to minimize water hammer, ESW piping continuously goes up from the pump discharge to the UHS. The COL applicant is to develop procedures for system filing, venting, and operational procedures to minimize the potential for water hammer; to analyze the system for water hammer impacts; to design the piping system to withstand potential water hammer forces; and to analyze inadvertent water hammer events in accordance with NUREG-0927 in the ESWS (COL 9.2(1)). The COL applicant is to develop the layout of the site-specific portion of the system to minimize the potential for water hammer in the ESWS (COL 9.2(2)).

Low pressure signal of ESW pump discharge header is interlocked to enable the automatic start of the standby ESW pump. A low pressure signal of ESW pump discharge header caused by failure or tripping of ESW operating pump is alarmed in the MCR. When the low pressure alarm of ESW pump discharge header is annunciated, the standby ESW pump automatically initiates to provide reasonable assurance that heat is removed continuously.

UHS water chemistry management to minimize the degradation of ESWS is described in Subsection 9.2.5.

9.2.1.2.2 Component Description

Table 9.2.1-1 lists component design parameters. Each component is also described in the following sections.

9.2.1.2.2.1 ESW Pumps

Four identical ESW pumps, two per division, are provided. Manual start and stop actuations of the ESW pumps are provided from the MCR to override automatic actuation. Each pump provides 100 percent of the required flow for post-loss-of-coolant-accident (LOCA) conditions. During normal plant operation, one pump per division operates. The second pump in the respective division automatically starts on a low pump discharge pressure signal. This indicates a failure of the operating pump.

The pumps are of the vertical turbine type and are installed in the ESWS intake structure. The pump motors are powered from its associated division of the Class 1E ac power distribution system. In the event of loss of offsite power (LOOP), the pumps are stopped and restarted in accordance with the emergency diesel generator (EDG) load sequencing.

The capacity of the ESW pumps is based on the following operating mode requirements:

Normal power operation	One pump in each division
Normal shutdown	Four pumps in both divisions
Safe shutdown	One pump in a single division
Post-LOCA	One pump in a single division

During normal power operation, the standby pumps may also be in service during hot summer weather as heat load or temperature of basin water in the UHS increases.

Each ESW pump is designed to provide 75,708 L/min (20,000 gpm) flow at the required total dynamic head (TDH).

The ESW pumps are provided with at least 7 percent margin in head at the pump design point. The pump head continuously rises as flow decreases from the design point to shutoff.

The available NPSH is based on the lowest probable water level in the UHS basin and the basin water design temperature at the end of 30 days accident mitigation without makeup in accordance with NRC RG 1.26 (Reference 11). The COL applicant is to (1) determine required pump design head, using pressure drop from the certified design portion of the plant and adding site-specific head requirements, (2) determine pump shutoff head to establish system design pressure, which does not exceed standard plant system design pressure, and (3) evaluate potential for vortex formation at the pump suction based on the most limiting applicable conditions in the ESWS (COL 9.2(3)).

9.2.1.2.2.2 Piping, Valves, and Fittings

[[Piping is carbon steel pipe or internally lined carbon steel pipe depending on the ESW chemistry. Cathodic protection is applied to the pipe depending on the ESW chemistry.]] Piping is designed, fabricated, installed, and tested in accordance with the ASME Section III, Class 3, requirements for the safety-related portion. Materials whose adequacy has been proven by a test at compatible operating temperatures with similar water chemistry are used for components and piping in this system.

The piping and components within a division are physically separated from those in the other division. The ESW piping to the CCW heat exchanger structures is routed through a seismic Category I reinforced concrete pipe tunnels buried in the yard. The ESW piping to the UHS structures is routed through a seismic Category I reinforced concrete pipe tunnel. Access manholes are provided for periodic inspection.

Vents are installed at high points, and drains are installed at low points in the ESWS to allow proper filling and venting.

An isolation valve is installed on each CCW heat exchanger and debris filter inlet and outlet line. The ESW pump discharge isolation valves are interlocked with the ESW pumps. The ESW pump discharge isolation valves are preset to a partially open position before pump start to minimize water hammer effects.

Butterfly valves in the ESWS piping are not used to throttle the water flow excessively to avoid potential downstream pipe wall thinning. The valves are sized to be fully open during the various modes of operation. The opening margins of valve are considered to provide reasonable assurance of the design flow during all mode of operation.

9.2.1.2.2.3 Essential Service Water Debris Filters

ESW debris filters are installed at the upstream of each CCW heat exchanger to minimize clogging of CCW heat exchangers. The debris filters are of the automatic backwash type. The differential pressure provides a high-pressure differential signal across the filtering element for the annunciator in the MCR to notify operators that the backwashing operation is required. Backwashing operation is initiated automatically or manually by a pressure differential signal across the filtering element. Water for backwashing debris filters is supplied by corresponding ESW pumps.

Failure of the ESW debris filters or backwash isolation valves does not lead to failure of the associated division because redundant debris filter or a backwash isolation valve is available. The failure modes effects and analysis is shown in Table 9.2.1-2.

During normal operation, the operator may also periodically switch over the debris filter to operate the standby debris filter in the same operating division. Common cause failures from operator errors are not expected when manually switching over the debris filters because the isolation valves are administratively locked on each side of the CCW heat exchangers.

The debris filters are designed not to degrade the CCW heat exchanger capability by minimizing the inflow of debris or foreign substances. [[The filtering element perforations size is 2.5 mm (0.1 in), which is considered to prevent the potential clogging of the cooling tower nozzles.]]

The COL applicant is to determine the design details of backwashing line, vent line, and their discharge locations in the ESWS (COL 9.2(4)).

9.2.1.2.2.4 CCW Heat Exchangers

Six plate-type CCW heat exchangers are provided, three per division, to handle the essential and nonessential cooling requirements. CCW heat exchangers are described in Subsection 9.2.2.2.2.1.

A chemical cleaning connection line is provided for each CCW heat exchangers to enable ESW side chemical cleaning of CCW heat exchangers with the cleaning in place (CIP) unit.

9.2.1.2.2.5 Electric Power Supply

Each division of safety-related equipment receives power from its associated division of the Class 1E ac power distribution system during normal operation. In the event of a LOOP, the ac power distribution system is supplied by the two divisions of EDGs. Each division of EDGs is capable of supplying one division of the Class 1E ac power distribution system for the operation of the necessary safety equipment of one division. Division I safety-related components are connected to Class 1E buses 1A or 1C and Division II safety-related components are connected to Class 1E buses 1B or 1D.

9.2.1.2.3 System Operation and Controls

The ESWS consists of two 100 percent capacity redundant divisions. Each division supplies cooling water to the CCW heat exchangers in the corresponding CCW division.

Each division has a 100 percent heat dissipation capacity to accomplish a safe shutdown. Cooling water for the ESWS is supplied from the UHS as described in Subsection 9.2.5. The heated UHS water through the CCW heat exchangers is discharged to the UHS for heat rejection.

Upon low ESW pump discharge pressure, the standby ESW pump in the same division starts automatically.

The following sections describe the various modes of operation.

9.2.1.2.3.1 Normal Power Operation

During normal power operation, one ESW pump and two CCW heat exchangers per division are in service. The ESW is supplied to the CCW heat exchangers that are in service and receiving heat loads from the CCWS.

9.2.1.2.3.2 Normal Shutdown Operation

Four ESW pumps and six CCW heat exchangers in both divisions are in service during normal shutdown in which the reactor coolant is cooled to 60 °C (140 °F) in 24 hours after reactor shutdown.

9.2.1.2.3.3 Refueling Operation

Four ESW pumps and six CCW heat exchangers in both divisions are in service during refueling. The RCS is at a refueling temperature of 48.89 °C (120 °F) within 96 hours after reactor shutdown.

9.2.1.2.3.4 Emergency Operation

One ESW pump and two CCW heat exchangers in a division operate with a single failure of the other division during emergency operating conditions such as a LOCA or a safe shutdown with a LOOP.

9.2.1.2.3.5 Loss of Offsite Power

A LOOP results in the shutdown and restarting of the ESW pumps in accordance with the EDG load sequencing. EDG load sequencing is addressed in Subsection 8.3.1.

9.2.1.2.4 Design Features for Minimization of Contamination

The ESWS is designed with features that meet the requirements of 10 CFR 20.1406 (Reference 8) and NRC RG 4.21 (Reference 9). The basic principles of NRC RG 4.21, and the methods of control suggested in the regulations are delineated into four design objectives and two operational objectives that are addressed in Subsection 12.3.1.10.

The ESWS consists of essential service water pumps and essential service water debris filters that are located away from any radiological areas. With the exception of the CCW heat exchangers, the ESWS is designed not to be in contact with potentially radiologically contaminated components. Additionally, the CCW heat exchangers are plate type and constructed of titanium material, which minimizes pinhole leaks. The heat exchanger seals are designed to leak toward the outside of the heat exchangers where leakage is collected in the building sump. A radiation monitor is provided at the outlet of the CCW heat exchangers to detect any radioactive leakage from the CCWS to the ESWS. The monitor is indicated and alarmed in the MCR. Based on this evaluation, the ESWS design is in compliance with the requirements of NRC RG 4.21.

The ESWS shares common design features with the CCWS. The CCWS design features for minimization of contamination are described in Subsection 9.2.2.2.2.8.

9.2.1.3 Safety Evaluation

The ESWS in designed to satisfy the safety design bases of Subsection 9.2.1.1.1, as follows:

a. The ESWS has the capability to dissipate the heat loads for safe shutdown. LOOP results in the shutdown and restarting of the ESWS pumps in accordance with the EDG load sequencing. The EDG load capacity and sequencing times are compatible with ESWS requirements. Thus, the safe shutdown operation is supported by the ESWS.

b. Nonessential portions of the system such as the ESW debris filter backwash discharge piping, ESW blowdown discharge piping to plant discharge, and drain and vent piping after the isolation valves are non-safety-related. The nonessential portions have normally closed isolation valves to separate safety-related and non-safety-related portions. ESW blowdown operation is terminated by engineered safety features actuation signal (ESFAS), ESW pump stop signal, or UHS basin low-level signal. ESW blowdown isolation valves are designed to fail closed. Thus, in the event of a failure of a non-safety-related portion of the system, there is no effect on the operation of the ESWS.

c. The ESWS maintains the CCW supply temperature at or below 43.3 °C (110 °F) for the design basis accident.

d. The ESWS consists of two physically separate, independent, full-capacity divisions, each of which is powered from a separate Class 1E ac power distribution system and separate EDGs. This provides reasonable assurance that a single failure does not impair system safety functions. The failure modes and effects analysis (FMEA) is shown in Table 9.2.1-2.

e. The COL applicant is to provide the evaluation of the ESW pump at the high and low water levels of the UHS. In the event of approaching low UHS water level, the COL applicant is to develop a recovery procedure (COL 9.2(5)).

f. The COL applicant is to provide measures to prevent long-term corrosion and organic fouling that may degrade system performance in the ESWS (COL 9.2(6)).

g. The ESWS is designed as one unit and does not share systems for multi-unit facilities.

h. The ESW pumps are located in seismic Category I structure to protect the pumps against adverse environmental occurrences.

i. The essential portions of the ESWS are designed as seismic Category I. All openings at the operating floor in the ESW intake structure are sealed to prevent water entry and preclude flooding of the ESW pumps and other safety-related equipment within the structure.

j. During normal plant operation, the redundant features of the ESWS allow testing without violation of Technical Specifications in Chapter 16.

k. Components of the ESWS are located so that flooding, fires, tornadoes, hurricanes, tsunami, internal and external missiles, pipe breaks and whip, jet impingements, and interactions with non-seismic sources do not prevent the system from performing its design function, as described in Chapter 3.

l. To prevent damage to components and piping, the system is designed to minimize the potential for water hammer by providing adequate water filling and high-point venting.

m. The COL applicant is to develop procedures for system filling, venting, and operational procedures to minimize the potential for water hammer; to analyze the system for water hammer impacts; to design the piping system to withstand potential water hammer forces; and to analyze inadvertent water hammer events in accordance with NUREG-0927 in the ESWS.

n. The COL applicant is to evaluate freeze protection in the ESWS if required (COL 9.2(7)).

9.2.1.4 Inspection and Testing Requirements

During fabrication of the ESW components, tests and inspections are performed and documented in accordance with code requirements to provide reasonable assurance of high-quality fabrication. As necessary, performance tests of components are performed at the vendor's facility. The ESWS is designed and installed to permit inservice inspection and tests in accordance with ASME Section XI.

Periodic performance verification of the ESWS component performance such as the heat exchangers cooled by the ESW is conducted to detect any degradation in performance caused by fouling. Heat exchangers are monitored according to a test program. The test program is based on the requirements of GL 89-13 (Reference 16). Acceptance criteria for performance verification are established to allow for degradation and maintain acceptable heat exchanger performance for all modes of plant operation.

The COL applicant is to conduct periodic inspections, monitoring, maintenance, performance testing, functional testing, and verification of the function of the ESWS pipes and components such as the heat transfer capability of the CCW heat exchangers based on GL 89-13 and GL 89-13 Supplement 1 (Reference 17) (COL 9.2(8)).

9.2.1.4.1 Preoperational Testing and Inspection

Prior to initial plant startup, a comprehensive performance test as detailed in Section 14.2 is performed to verify the design performance of the system and individual components.

9.2.1.4.2 Inservice Testing and Inspection

a. System-level tests

   After the plant is brought into operation, periodic tests and inspections of the ESW components and subsystems are performed to provide reasonable assurance of proper operation. Scheduled tests and inspections are necessary to verify system operability. A complete schedule of tests and inspections of the ESWS is detailed in the Technical Specifications in Chapter 16.

b. Component testing

   In addition to the system-level tests, tests to verify proper operation of the ESW components are also conducted. These tests supplement the system-level tests by verifying acceptable performance of each active component in the ESWS.

   Pumps and valves are tested in accordance with ASME Section XI. Various flow rate testing up to and including the design point of the ESW pumps can be performed.

9.2.1.5 Instrumentation Requirements

The ESW instrumentation facilitates automatic operation, remote control, and continuous indications of system parameters, i.e., ESW temperature and flow, both locally and in the MCR.

Process indications and alarms are provided to enable the operator to evaluate the ESWS performance and detect malfunctions. ESW pump discharge pressure is monitored and alarms for abnormally low pressure due to a pump failure or a pipe break. The ESW discharge temperature from the CCW heat exchangers is monitored.

9.2.1.5.1 Pressure

Local pressure indication is provided for the ESW pump discharge pressure and ESW debris filters differential pressure. Pressure test points are provided for the CCW heat exchanger inlet and outlet pressures.

Indications of the ESW pump discharge pressure are provided in the MCR. ESW pump low discharge pressure, ESW pump motor air filters high differential pressure, and ESW debris filter high differential pressure are alarmed in the MCR. The respective standby ESW pump in each division automatically starts on a low ESW pump discharge pressure.

9.2.1.5.2 Temperature

MCR and local indications are provided for the CCW heat exchanger outlet temperatures.

9.2.1.5.3 Flow

MCR indication and alarm are provided for the ESW pump discharge common header flow.

9.2.1.5.4 Current

ESW pump motor currents are indicated in the MCR.

9.2.1.5.5 ESWS Operational Logic

The ESWS operational logic, the associated initiation and actuation controls, and instrumentation are summarized as follows:

a. Both divisions and all four ESW pumps are automatically operated by any single or any combination of the following signals or operations:

   1) Manual start by operator in the MCR

   2) Low ESW pump discharge pressure

b. Manual start and stop actuation from the MCR override the automatic mode. Manual start and stop controls are provided for each ESWS division to permit the removal of a division from operation after automatic operation actuation, if that division is not required.

c. The only components that are manually actuated by the MCR operator are the ESW pumps and the ESW pump discharge isolation valves. The other isolation valves except the check valves are either locked open or locked closed depending on plant status and requirements.

d. The ESW pumps operate in the following manner during emergency conditions:

    1) Following an engineered safety features actuation signal (ESFAS), the operating ESW pumps remain running using normal power.

    2) In the event of LOOP or LOOP coincident with a DBA, the ESW pumps stop running and restart in accordance with the EDG load sequencing. If the ESW pump chosen by the sequencer fails to start, the sequencer starts the other pump immediately.

    3) Manual control of the ESW pumps remains functional during emergency conditions.

9.2.1.5.6 Radiation Monitor

Radiation monitors are located downstream of the CCW heat exchanger and the radiation level signal is displayed locally and in the MCR. When the radiation level exceeds the setpoint, an alarm is transmitted both locally and to the MCR.

9.2.2 Component Cooling Water System

The component cooling water system (CCWS) is a closed-loop cooling water system that removes heat from the plant’s essential and nonessential components that are connected to the CCWS. Heat transferred from these components to the CCWS is transferred to the

essential service water system (ESWS) through the CCW heat exchangers and then rejected to the ultimate heat sink (UHS).

9.2.2.1 Design Bases

The CCWS is designed in accordance with the requirements of GDC 2, 4, 5, 44, 45, and 46.

9.2.2.1.1 Safety Design Bases

Safety design bases applicable to the CCWS are as follows:

a. The CCWS, in conjunction with the ESWS, is capable of removing heat from the essential components to provide reasonable assurance of a safe shutdown and cooling following a postulated accident coincident with a loss of offsite power (LOOP).

b. The CCWS, in conjunction with the ESWS, is capable of maintaining the temperature at the outlet of the CCW heat exchanger between 18.3 °C (65 °F) and 43.3 °C (110 °F) during a design basis accident with a LOOP pursuant to the requirements of GDC 44.

c. A single failure of any component in the CCWS does not impair the ability of the CCWS to meet its functional requirements of mitigating the consequences of an accident pursuant to GDC 44.

d. The CCWS is designed to isolate nonessential portions of the system during a design basis accident.

e. Adverse environmental occurrences do not impair the ability of the CCWS to meet its functional requirements.

f. The CCWS is designed to detect and control leakage into the CCWS and loss of CCW.

g. The essential CCWS piping and components are designed in accordance with ASME Section III, Class 3 requirements. Containment isolation valves and containment penetration piping are designed in accordance with ASME Section III (Reference 12), Class 2 requirements.

h. The CCWS is designed to seismic Category I requirements to withstand the effects of a safe shutdown earthquake (SSE) in accordance with NRC RG 1.29 (Reference 15).

i. There is no flow degradation to safety components even if the nonessential headers fail to be isolated when required.

j. CCWS components are capable of being fully tested during normal plant operation. In addition, parts and components are accessible for inspection. The system is designed for periodic inservice testing and inspection to provide reasonable assurance of the integrity and capability of the system in accordance with ASME Section XI (Reference 14) and GDC 45.

k. All essential CCWS components are fully protected from floods, fire, tornadoes, hurricanes, internal and external missiles, pipe breaks and whip, jet impingements, and interactions with non-seismic systems in the vicinity.

l. The system is designed to minimize the potential for water hammer.

9.2.2.1.2 Power Generation Design Bases

Power generation design bases pertinent to the CCWS are as follows:

a. The CCWS, in conjunction with the shutdown cooling system (SCS) and the ESWS, is designed to cool the reactor coolant from 176.7 °C (350 °F) to 60.0 °C (140 °F) through the SC heat exchangers and the CCW heat exchangers using both divisions.

b. The CCWS, in conjunction with the ESWS, is designed to provide CCW at a temperature that does not exceed 43.3 °C (110 °F) to all components that operate during normal shutdown.

c. The CCWS is designed to provide cooling water to the RCPs, letdown heat exchanger, mini-flow heat exchanger, sample cooler racks, compound building chiller condensers, and other nonessential components.

d. The CCWS is designed to accommodate a thermal expansion caused by the CCWS temperature changes.

e. The CCWS, in conjunction with the ESWS, is designed to provide CCW at a temperature of 35 °C (95 °F) or less during normal operating modes except normal shutdown cooling operation.

f. The CCWS is designed to provide protection against ESW leakages into the CCWS.

g. The CCWS is designed to detect radiological leakages into the system and control the release of radiological contamination into the environment via the UHS.

h. The CCWS is designed to minimize the effects of long-term corrosion.

9.2.2.2 System Description

9.2.2.2.1 General Description

The CCWS consists of two safety-related divisions that are separate, independent, redundant, and closed-loop. Either division of the CCWS is capable of supporting 100 percent of the cooling requirements of a safe shutdown following a postulated accident coincident with LOOP. Each CCWS division includes three CCW heat exchangers, a CCW surge tank, two CCW pumps, a CCW chemical addition tank, and CCW radiation monitor, piping, valves, controls, and instrumentations. The flow diagram of the CCWS is provided in Figure 9.2.2-1.

Heat is removed from the CCWS by the ESWS in the CCW heat exchangers. The CCWS operates at a higher pressure than the ESWS thus preventing the leakage of ESW into the CCWS in the event of a CCW heat exchanger plate leak. The CCWS provides cooling water to the essential and nonessential components listed in Subsection 9.2.2.2.2. CCW cooling loops serving essential components are safety Class 3. CCW cooling loops serving nonessential components are a non-nuclear safety class. Containment isolation valves (CIVs) and penetration piping are designed in accordance with safety Class 2 requirements.

The nonessential headers are isolated automatically on a safety injection actuation signal (SIAS) or a low-low surge tank level signal. If these headers fail to be isolated, the standby CCW pump in the respective division automatically stars on a low pump discharge pressure signal. This provides reasonable assurance that there is no flow degradation to the essential components. The CCW headers supplying the RCPs are isolated by a low-low surge tank level signal.

Makeup water is normally supplied by the makeup demineralizer system, as described in Subsection 9.2.6. If the makeup demineralizer system is unavailable, a backup seismic Category I makeup water line is provided. This essential safety-related makeup water is supplied from the auxiliary feedwater storage tank (AFWST).

Two CCW surge tanks, one per division, are connected to the CCW pumps suction piping. The surge tanks are located at the system's high point to facilitate venting and filling. System leakages are compensated with water from the makeup demineralizer system. A seismic Category I makeup water source, which is not used during normal operation, is available to each surge tank from the auxiliary feedwater system (AFWS).

The CCW heat exchanger structures are located close to the ESW intake structure to minimize exposure of the piping to the environment.

The CCWS serves as an intermediate barrier between the RCS and ESWS. A radiation monitor is provided at the outlet of the CCW pumps to detect any radioactive leakage into the CCWS. Leakage is displayed on the monitor and alarmed in the MCR. Grab samples are also used as a means of detecting leakage into the CCWS. In case of a major leak in one of the CCWS divisions, the affected division becomes out of service and the other division is used.

Materials for the wetted surfaces in the CCWS are compatible with the cooling water chemistry. The major portions of the CCWS are constructed of carbon steel. The system water chemistry is controlled for the prevention of long-term corrosion. The system filters are not required since the CCWS is a closed loop that uses the demineralized water with inhibitors.

The corrosion inhibitors from the CCW chemical addition tank are injected into the CCW pump suction and the negatively charged corrosion inhibitors prevent oxidation and hydriding in the CCWS. The cooling water is periodically sampled to monitor the water chemistry. The water from each loop is sampled for a water quality analysis on a scheduled basis and, if required, the pH is adjusted by the addition of chemicals. The makeup lines are stainless steel due to their exposure to the atmosphere. Water quality design specifications applicable to the CCWS are given in Table 9.2.2-1.

Relief valves are provided on the CCW lines of each heat exchanger cooled by the CCW. These relief valves are sized to provide protection against increased pressure due to thermal expansion in the isolated portions of the system or to relieve the maximum credible leakage from higher-pressure sources. The discharge of these relief devices is routed to a suitable location so that personnel and other nuclear safety-related equipment are adequately protected.

A pressure relief valve is provided for each RCP to protect against the potential overpressurization of the CCWS due to an RCP high-pressure cooler tube rupture. The pressure relief is sized to accept the maximum expected in-leakage from an RCP high-pressure seal cooler tube rupture. The pressure relief discharge is piped to the containment drain sump.

Motor operated valves are installed on the CCW supply and return lines to RCPs. These valves can be used to isolate the in-leakage due to an RCP high-pressure seal cooler tube rupture.

9.2.2.2.2 <u>Component Description</u>

Table 9.2.2-4 shows the design parameters of the major components. Each component is described in the following subsections.

9.2.2.2.2.1 CCW Heat Exchangers

Six plate-type CCW heat exchangers, three per division, are provided to handle the essential and nonessential cooling requirements. The heat exchangers are designed to maintain cooling water in the heat exchanger outlet at 35 °C (95 °F) or less during normal power operation and equal to or less than 43.3 °C (110 °F) during normal shutdown or emergency operating modes.

Each operational mode uses a different CCW heat exchanger alignment. The alignments are listed below:

Normal power operation	Two HXs per division
Normal shutdown	All six HXs from both divisions
Safe shutdown	Two HXs in a single division
Post-LOCA	Two HXs in a single division

The frame of the heat exchanger is designed to permit the future installation of 20 percent additional plates at a minimum. by the vendor in the final procurement. The heat exchanger fouling factor for each heat exchanger is based on the manufacturer's standards and system water chemistry.

9.2.2.2.2.2 CCW Pumps

Four identical CCW pumps in both divisions are provided. One pump per division is in service during normal power operation. When the cooling water flow from the operating pump is inadequate, the standby pump in the same division automatically starts on a low pump discharge pressure signal. This signal is an indication of either a failure of the running pump or an insufficient flow. The automatic actuation signal can be overridden by a manual start/stop signal from the MCR.

Each operational mode uses a different pump alignment. The alignments are listed below:

Normal power operation	One pump per division

Normal shutdown	Four pumps from both divisions
Safe shutdown	One pump in a single division
Post-LOCA	One pump in a single division

The pumps are double-suction centrifugal with a horizontally split casing design for easy maintenance. Mechanical seals are provided to minimize leakage. Each CCW pump motor is connected to a separate Class 1E emergency load center. In the event of loss of offsite power, the pump motors are stopped and restarted in accordance with the EDG load sequencing.

The CCW pump design flow includes design margin of approximate 10 percent above the required maximum flow requirement found from Table 9.2.2-3A/B. The CCW pump design head also includes design margin of approximate 10 percent margin at the required maximum pump head.

The minimum available NPSH is the smaller of the following: 25 percent greater or 3.05 m (10 ft) greater than the required NPSH specified by the pump vendor. The available NPSH is calculated with the highest expected operating temperature, maximum flow, and minimum expected CCW surge tank water level during the accident mode.

9.2.2.2.2.3 CCW Surge Tanks

Two CCW surge tanks in both divisions are provided. The CCW surge tanks are installed at a higher elevation than the CCW pumps and connected to the pump suction pipes. The surge tanks perform following functions:

a. Provide reasonable assurance that the CCW pump suction is maintained at positive pressure and filled with water

b. Provide reasonable assurance that adequate NPSH is available to the CCW pumps

c. Provide a means of damping a pressure transient developed in the system due to load changes and pump(s) on/off operation

d. Provide a means of monitoring fluid leakage into or from the system

e. Allow for expansion and contraction of the fluid in the system due to temperature changes

f. Provide a surge volume to accommodate fluid losses from a piping failure in the non-safety-related piping and equipment

g. Facilitate venting and filling of the system

The surge tanks have sufficient capacity to accommodate expected leakage from the system for at least seven days, with no makeup source in post-seismic conditions.

The expected leakage from the system for seven days is calculated to be approximately 50 gallons in accordance with the leakage criteria from ASME QME-1 (Reference 18). The potential leakage portions are the nonessential supply and return headers isolation valves, the RCP coolers supply and return header isolation valves, the pump seal, and the miscellaneous valves.

The surge tank is designed to include a minimum water volume of 630 gallons to accommodate potential system leakage for seven days, with no makeup source in post-seismic conditions. This volume allows the surge tank to accommodate leakage of 3.75 gallons per hour for 7 days in post seismic event with no available makeup.

The makeup to the surge tank is provided automatically based on the tank level or manually. The surge tank is protected from overpressure and vacuum by one pressure relief valve and one vacuum relief valve.

The surge tank is pressurized by the nitrogen gas to minimize air ingress. The elevation of the surge tank and piping arrangement minimize the potential for nitrogen accumulation in places other than the surge tank.

9.2.2.2.2.4 Piping, Valves, and Fittings

CCWS piping is carbon steel and is protected against corrosion by the addition of corrosion inhibitors. The safety-related piping, valves, and fittings are designed and fabricated in accordance with ASME Section III, Class 3 requirements.

Relief valves are provided, as required, for equipment protection. Vents are installed in high points, and drains are installed in low points in the CCWS.

Vents are located to provide reasonable assurance that the piping is filled with water to reduce the water hammer occurrences after pump startups. Also, valve opening/closing times are selected to minimize water hammer effects and to provide reasonable assurance of isolation of a leak before the CCW surge tank empties.

The COL applicant is to develop procedures for water systems filling, venting, keeping the system full, and operation to minimize the potential for water hammer; to analyze the system for water hammer impacts; to design the piping system to withstand potential water hammer forces; and to analyze inadvertent water hammer events in accordance with NUREG-0927 (Reference 10) in the CCWS (COL 9.2(9)).

The following valves are required to perform a specific function in shutting down the reactor or to mitigate the consequences of an accident. The active valves are listed in Table 9.2.2-5.

a. Nonessential supply header isolation valves (CC-143, 144, 145, and 146)

   These MOVs close to terminate CCW flow to the nonessential equipment in the event of an accident. These valves automatically close on the SIAS or CCW surge tank low-low level signal. The valve closure times are selected to prevent the surge tank from being emptied in the event of a break in the non-safety piping. The automatic close signal can be overridden by a manual operation from the MCR to cool the post-accident primary sample cooler rack in division II, if necessary.

b. Nonessential return header isolation valves (CC-147, 148, 149, and 150)

These MOVs are installed to isolate the nonessential return headers in the event of an accident. They automatically close on an SIAS or CCW surge tank low-low level signal. The valve closure times are selected to prevent the surge tank from being emptied in the event of a break in the non-safety piping. The automatic close signal can be overridden by a manual operation from the MCR to cool the post-accident primary sample cooler rack in division II, if necessary.

c. SC heat exchangers 1 and 2 isolation valves (CC-351 and 352)

These MOVs are installed to isolate the CCW flow to the SC heat exchangers. The valves can be manually opened and closed from the MCR. The valves automatically close on an SIAS to provide sufficient flow to the essential components.

d. SFP cooling heat exchangers A and B isolation valves (CC-389 and 390)

These MOVs can be manually opened and closed from the MCR to isolate or reestablish the CCW flow to the SFP cooling heat exchangers.

e. Containment spray heat exchangers 1 and 2 isolation valves (CC-097 and 098)

These MOVs are installed to isolate the CCW flow to the containment spray (CS) heat exchangers. These valves open automatically upon receipt of an SIAS to open flow paths that serve as the bypass lines for excess cooling water during the safety injection operation mode. When a CSAS is received, these valves are also opened automatically to transfer cooling water to the CS heat exchangers. These valves can be manually opened and closed from the MCR.

f. CCW heat exchangers outlet jogging control valves (CC-021, 022, 023, 024, 025, 026, 031, 032, 033, 034, 035, and 036) and bypass valves (CC-027, 028, 037, and 038)

These MOVs regulate the cooling water flow through the CCW heat exchangers. These valves are controlled by jogging function to maintain the cooling water temperature above the minimum design temperature of 18.3 °C (65 °F) when the

ESW temperature is too low. The CCW heat exchanger outlet jogging control valves are opened and bypass valves are closed on an SIAS to maintain component cooling water temperature below 43.3 °C (110 °F) during an accident.

g. CCW pump discharge check valves (CC-1001, 1002, 1003, and 1004)

These check valves prevent reverse flow through the nonoperating pump when one of the pumps does not run or ceases to run.

h. Letdown heat exchanger supply and return line isolation valves (CC-296, 297, 301, and 302)

These MOVs are installed to isolate the CCW flow to/from the letdown heat exchanger. These valves are closed automatically upon receipt of a containment isolation actuation signal (CIAS).

i. Reactor coolant pump cooler isolation valves (CC-231, 249, 250, and 1099)

These valves are installed to isolate the CCW flow to/from the RCP coolers. The MOVs of CC-231, 249, and 250 close automatically on a low-low surge tank level signal. These valves can be manually opened or closed from the MCR.

j. Containment penetration piping bypass check valves (CC-1100, 1685, and 1686)

These check valves are installed to protect the containment penetration piping against overpressure when the piping is isolated.

k. Essential chiller condenser isolation valves (CC-131, 132, 383, and 384)

These MOVs are installed to isolate the CCW flow to the essential chiller condensers. These valves automatically open from starting signal and close from stop signal of the essential chilled water pump. These valves can be manually opened and closed from the MCR.

l. Essential chiller condenser control valves (CC-901, 902, 905, and 906)

These AOVs are installed to control the CCW flow to the essential chiller condensers. These valves are pneumatically modulated by essential chiller condenser pressure controller and fail open on loss of instrument air.

m. EDG heat exchanger isolation valves (CC-181, 182, 191, and 192)

These MOVs are installed to isolate the CCW flow to the EDGs. These valves automatically open on SIAS or EDG starting signal to provide cooling water to the EDGs. These valves can be manually opened and closed from the MCR.

n. CCW surge tank vacuum relief valves (CC-1107 and 1108)

These relief valves are installed to prevent the surge tank from being in a vacuum in the event of a pressure transient such as pump start/stop operation or outsurge due to a pipe break or thermal shrinkage.

o. CCW surge tank relief valves (CC-1111 and 1112)

These relief valves are installed to provide overpressure protection of the CCW surge tank.

p. CCW makeup pump isolation valves (CC-011 and 012)

These MOVs are installed to isolate the CCW makeup flow to the CCW surge tank. These valves automatically open with CCW makeup pump starting on a low CCW surge tank level signal to provide CCW makeup flow from the auxiliary feedwater storage tank and close with CCW makeup pump stop when the high CCW surge tank level is reached.

q. CCW makeup pump discharge check valves (CC-1303, 1304, 1309, and 1310)

These check valves are required to prevent reverse flow through the non-operating pump, when one of the pumps does not run or ceases to run.

r. CCW makeup pump bypass check valves (CC-1325 and 1326)

These check valves are required to prevent reverse flow through the non-operating pump, when one of the pumps does not run or ceases to run.

s. Demineralized water makeup line check valves (CC-1317, 1318, 1319, and 1320)

These check valves are installed to protect the CCWS in the event of a break in the non-safety piping of the makeup demineralizer system.

t. Nitrogen supply line check valves (CC-1109 and 1110)

These check valves are installed to protect the CCWS in the event of a break in the non-safety piping of the nitrogen system.

9.2.2.2.2.5 CCW Makeup Pumps

One horizontal-centrifugal CCW makeup pump per division is provided. The pump supplies makeup water to the surge tank from the AFWST. The pump automatically starts at low level of the surge tank and stops at high level.

9.2.2.2.2.6 CCW Chemical Addition Tank

The CCW chemical addition tanks store corrosion-inhibiting chemicals, which are injected into the CCW pump suction via a manual valve.

9.2.2.2.2.7 CCW Radiation Monitors

One radiation monitor per division is installed in the CCW pumps discharge header to detect inleakage that contains radioactivity.

9.2.2.2.3 Electric Power Supply

Each division of safety-related equipment receives power from its associated division of the Class 1E ac power distribution system with the exception of the CIVs and associated instrumentation and controls (I&C). In the event of a LOOP, the ac power distribution system is supplied by the two divisions of EDGs. Each division of EDGs is capable of

supplying one division of the Class 1E ac power distribution system for the operation of the necessary safety-related equipment of one division. Division I safety-related components are connected to Class 1E buses 1A or 1C, and Division II safety-related components are connected to Class 1E buses 1B or 1D.

The emergency power train designations for the CCW pumps, valves, and controls are given in Table 9.2.2-6. (Note: Each pump start/stop control is done by a different control channel.)

9.2.2.2.4 System Operation and Control

The CCWS consists of two divisions. All safety-related components are redundant and equally distributed on both divisions. One CCWS division is adequate to accomplish all safety-related functions and mitigate consequences of an accident. Each division is connected to its corresponding ESWS division through the CCW heat exchangers. The CCW heat exchangers serve as barriers between the ESWS and CCWS. Heat is transferred from the hot CCW side to the cold ESW side of the CCW heat exchanger and dissipated by the ESWS to the UHS.

At least one CCW pump is in operation per division for all plant operation modes except accident mode. When the cooling water flow becomes inadequate, the standby pump in that division starts automatically on a low pump discharge pressure signal. This signal is indicative of a failure of the running pump, line break, or an increase in cooling water flow demand.

The temperature of the water leaving each CCW heat exchanger is regulated by the jogging control valve located in its discharge pipe. As the temperature of the CCW rises as a result of the increased heat load or higher ESWS water temperature, the CCW heat exchanger bypass valve closes and the CCW heat exchanger outlet jogging control valve opens to allow more CCW to flow through the heat exchanger. The reverse operation is performed when the heat load decreases or the ESWS water is cooler.

Each division of the CCWS supplies cooling water to the following redundant safety-related components:

a. SC heat exchanger (one per division)

b. SC mini-flow heat exchanger (one per division)

c. CS heat exchanger (one per division)

d. CS mini-flow heat exchanger (one per division)

e. EDG coolers (two per division)

f. Essential chiller condensers (two per division)

g. SFP cooling heat exchanger (one per division)

The nonessential components are evenly distributed to both divisions so that the divisional heat load and cooling water demand are similar. The location of the components is used in determining the divisional balance. These components are listed below:

a. RCP motor air cooler (eight in Division I)

b. RCP motor oil cooler (eight in Division I)

c. RCP oil cooler (four in Division I)

d. RCP high-pressure cooler (four in Division I)

e. Letdown heat exchanger (one in Division I)

f. Charging pump mini-flow heat exchanger (one in Division I)

g. Normal primary sample cooler rack (one in Division II)

h. Compound building chiller condenser (three in Division II)

i. Liquid radwaste system (LRS) seal water heat exchanger (one in Division II)

j. Condensate receiver tank vent condenser (one in Division II)

k. Gas stripper (one in Division I)

l. Boric acid concentrator (BAC) (one in Division II)

m. Central chiller condenser (two per division)

n. Radiation monitor heat exchanger (one per division)

o. Gaseous radwaste system (GRS) chiller skid (one in Division II)

p. Secondary sample cooler rack and chillers (one in Division II)

The essential and nonessential heat loads for the CCWS are provided in Tables 9.2.2-3A and 9.2.2-3B.

9.2.2.2.4.1 Normal Power Operation

During normal power operation, one CCW pump and two CCW heat exchangers per division are in operation. When the cooling water demand increases, the additional pump from that division is operated. Cooling flow is supplied to all components except the CS heat exchangers, EDG coolers, and SC heat exchangers. The CCWS temperature is maintained at or below 35 °C (95 °F).

9.2.2.2.4.2 Normal Shutdown Operation

Four CCW pumps and six CCW heat exchangers in both divisions are required to accomplish a normal shutdown. The reactor coolant is cooled from a normal operating temperature to 60.0 °C (140 °F) within 24 hours after reactor shutdown. A normal reactor shutdown cooling is performed in two steps. The reactor coolant is cooled to 176.7 °C (350 °F) through the steam generators and then cooled to 60.0 °C (140 °F) by both divisions of the SCS, CCWS, and ESWS. The cooling water flow path to the SC heat exchangers is manually aligned from the MCR. The CCWS, in conjunction with the ESWS, is designed to provide CCW at or below 43.3 °C (110 °F) during normal shutdown.

During normal shutdown cooling, cooling water is typically supplied to all components except the CS heat exchangers and EDG coolers.

9.2.2.2.4.3 Refueling Operation

Four CCW pumps and six CCW heat exchangers in both divisions are used to cool the RCS to a refueling temperature of 48.9 °C (120 °F) within 96 hours after the reactor shutdown. The CCW temperature is increased up to 43.3 °C (110 °F) at the initiation of the shutdown and then decreased below 35 °C (95 °F) prior to refueling. CCW is supplied to all components except the CS heat exchangers, EDG coolers, and RCP coolers. The heat load of the SC heat exchangers is reactor decay heat.

9.2.2.2.4.4 Emergency Operation

Only one CCW pump and two heat exchangers in a division operate with a single failure in the other division during emergency operating conditions such as a LOCA or a safe shutdown with a LOOP.

A low pump discharge pressure signal is an indication of the failure of a running pump, of a line break, or of an increase in cooling water flow demand. The idle CCW pump automatically starts on this signal, providing reasonable assurance that there is no flow degradation to the essential components.

The following valves close on an SIAS:

a. Nonessential supply and return header isolation valves

b. SC heat exchanger 1 and 2 isolation valves

c. CCW heat exchanger bypass flow isolation valves

The following valves open on SIAS:

a. EDG 1A, 1B, 1C, and 1D supply header isolation valves

b. CS heat exchanger 1 and 2 isolation valves

c. CCW heat exchanger 1A, 1B, 2A, 2B, 3A, and 3B outlet valves

The following CIVs close on CIAS:

a. Letdown heat exchanger supply and return line isolation valves

The following valves open on CSAS:

a. CS heat exchangers 1 and 2 isolation valves

The following valves close on a low-low surge tank level signal:

a. Nonessential supply and return header isolation valves

b. RCP supply and return headers containment isolation valves

9.2.2.2.4.5 Loss of Offsite Power

The CCW pumps stop running upon a LOOP and restart in accordance with the EDG load sequencing. For a DBA without concurrent LOOP, the CCW pump in each division continues operating. However, if a LOOP occurs concurrently with a DBA, the EDG sequencer restarts only the CCW pump that had been operating up until the beginning of the event, within 28 seconds after the load sequencing begins. If this pump fails to operate, the sequencer starts the other CCW pump from that division immediately. After initial loading by the sequencer, the CCW pump that remains on standby is manually started when load capacity of the EDG becomes available through appropriate manual load shedding of the emergency loads.

9.2.2.2.5 Design Features for Minimization of Contamination

The CCWS is designed with features that meet the requirements of 10 CFR 20.1406 (Reference 8) and NRC RG 4.21 (Reference 9). The basic principles of NRC RG 4.21 and the methods of control suggested in the regulations are delineated into four design

objectives and two operational objectives, which are addressed in Subsection 12.3.1.10. The following evaluation summarizes the primary features of the design and the operational objectives of the CCWS.

The CCWS contains demineralized water for cooling functions but can become radioactively contaminated as a result of heat exchanger leakage. In accordance with NRC RG 4.21, the CCWS has been evaluated for leak identification from the SSCs that contain potentially radioactive materials, the areas and pathways where leakage is likely to occur, and the methods of leakage control in the design of the system. The leak identification evaluation indicated that the CCWS is designed to facilitate early leak detection and the prompt assessment and response to manage collected fluids. Thus, unintended contamination to the facility and the environment is minimized and/or prevented by the SSC design, supplemented by operational procedures and programs and inspection and maintenance activities.

<u>Prevention/Minimization of Unintended Contamination</u>

a. The system components, including the CCWS surge tanks, pumps, and associated piping, are fabricated from carbon steel material and are of welded construction for life-cycle planning. The CCWS is injected with a corrosion inhibitor, and the surge tanks are covered with nitrogen gas to minimize the oxidation of steel and formation of corrosion. The CCWS heat exchangers are made of titanium, and pump impellers are made of stainless steel. The system design includes periodic sampling and analysis to maintain water quality and provisions for in-service testing and inspection to maintain system integrity. This design approach minimizes leakage and unintended contamination of the facility and the environment.

b. The CCWS surge tanks, heat exchangers, and pumps are designed with multiple divisions and sufficient capacity to accommodate different modes of operation, including normal and anticipated operational occurrences. The tanks are designed to meet ASME III, Division I, and are equipped with dual-level instruments to facilitate control of the content liquid level, thus minimizing the spread of contamination and waste generation.

Adequate and Early Leak Detection

a. CCWS surge tanks are designed with dual-level instruments to provide reasonable assurance of safe operation and to provide alarms to the operating personnel in the event of overflow or leakage.

b. Two radiation monitors, one for each division, are provided to continuously monitor contamination levels at the discharge of the CCWS pumps and indicate radiation activity in the MCR. In the event that radiation is detected above the pre-determined limit, an alarm is initiated by one of the monitors for operator action. Because the CCWS is segregated into two independent and parallel divisions, each division can be isolated for inspection, mitigation, and maintenance. This design approach provides early leak detection and minimizes the spread of contamination to other components, the facility, and the environment.

Reduction of Cross-Contamination, Decontamination, and Waste Generation

a. SSCs are designed with life-cycle planning through the use of nuclear industry-proven materials that are compatible with the chemical, physical, and radiological environment, thus minimizing waste generation.

b. CCWS surge tanks are located at a high elevation to maintain liquid pressure in order to prevent infiltration and cross-contamination of the CCWS. This location also helps to prevent unintended contamination of the environment because any leaks from the tanks are drained to the local sumps for collection and forwarded to the LWMS for treatment and disposal.

c. The cubicles where the CCWS SSCs are housed are designed with sloped floors, epoxy coating to provide drainage and cleanable surfaces, and local sumps to collect leakages and overflows. Cubicle curbs are also provided to reduce cross-contamination and the spread of contamination to other areas. CCWS heat exchangers are located in a separate structure that is close to the essential service water building in order to minimize radiation exposure to the essential service water piping.

d. Plate-type heat exchangers are used to transfer heat from the component cooling water side to the essential service water side. The heat exchangers are designed with titanium plates to minimize the potential for pinhole leaks between the component cooling water and essential service water. The gaskets between the plates are also designed to direct leakages to the outside of the heat exchangers. Leakages are then collected in the floor drain sumps and routed for treatment and release. This design approach minimizes contamination of clean systems as well as to the facility and the environment.

e. Sampling points are provided to facilitate sampling and analyses to provide reasonable assurance that the water quality is maintained and also to determine the need for the addition of corrosion inhibitor. This design approach minimizes waste generation.

f. Utility connections (e.g., demineralized water, nitrogen) are designed with a minimum of two barriers to prevent the contamination of clean systems.

Decommissioning Planning

a. SSCs are designed for the full service life and are fabricated as individual assemblies for easy removal to the maximum extent possible.

b. The CCWS is designed with minimum embedded or buried piping. Piping between buildings is equipped with piping sleeves with leakage directed back to the auxiliary building for collection. Piping to the component cooling water heat exchanger structures is routed through a seismic Category I reinforced concrete pipe tunnels (one per division) under the yard. The tunnel is coated with epoxy and is designed with a collection sump with a level switch to initiate an alarm signal in the MCR for operator actions in the event liquid is detected. This design approach thus minimizes unintended contamination of the facility and the environment.

Operations and Documentation

a. The CCWS is designed for automated operation with manual initiation for the different modes of operation. CCW surge tanks are designed with dual-level instruments to provide reasonable assurance of safe operation. A high-level signal, indicating in-leakage, or a low-level signal, indicating out-leakage, is transmitted to the MCR for operator action. A low-low level signal isolates the nonessential headers and the RCP headers from the remaining portion of the system, thus minimizing the spread of contamination and waste generation.

b. Adequate space is provided around the equipment to enable prompt assessment and responses as needed.

c. The COL applicant is to provide operational procedures and maintenance programs as related to leak detection and contamination control in the CCWS (COL 9.2(10)). Procedures and maintenance programs are to be completed before fuel is loaded for commissioning.

d. The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations in the CCWS (COL 9.2(11)). Documentation requirements are included as a COL information item.

Site Radiological Environmental Monitoring

a. The CCWS is considered to have a potential low level of contamination through leakage from contaminated systems through heat exchangers. Through monitoring, inservice inspection, and lessons learned from industry experience, the integrity of the CCWS is maintained, resulting in a minimal level of contamination. Leakage from the system to the facility and the environment is captured by the drainage collection provisions. Any residual contamination of the hydrogeology is not likely to be distinguishable from other contamination sources. Hence, contamination characteristics of the CCWS are not monitored in the site-wide program. However, the COL applicant is to include a site-wide radiological environmental monitoring program to monitor environmental contamination in the CCWS (COL 9.2(12)).

9.2.2.3 Safety Evaluations

The CCWS is designed to satisfy the safety design bases of Subsection 9.2.2.1.1, as follows:

a. The CCWS has the capability to dissipate the imposed heat loads within the safe shutdown time frame. Loss of offsite power results in the shutdown and restarting of the CCWS in accordance with the EDG load sequencing.

b. The CCWS flow and heat transfer capabilities maintain the CCW temperature within the design limits of 18.3 °C (65 °F) and 43.3 °C (110 °F) during a design basis accident.

c. The CCWS consists of two physically separate, independent, redundant divisions, each of which is powered from a separate Class 1E ac power distribution system and separate EDGs. This provides reasonable assurance that a single failure does not impair the system's safety function. The FMEA is provided in Table 9.2.2-2.

d. Cooling water flow to the nonessential headers is isolated on an SIAS or a low-low surge tank level signal.

e. Components of the CCWS are installed in buildings and structures that protect against adverse environmental conditions. These buildings and structures are located within the plant protected area.

f. Leakage into the CCWS is detected by the radiation monitors and the surge tank high level alarms in the MCR. Leakage source is identified and isolated from the CCWS.

g. Leakage out of the system is detected by the surge tank low and low-low level alarms in the MCR. The surge tank low level signal starts the CCW makeup pump to makeup flow from the AFWST, and the surge tank low-low level signal isolates the nonessential portions in the relevant division and RCP coolers in Division I.

h. The essential portions of the CCWS are designed as seismic Category I.

i. CCWS components are capable of being fully tested during normal operation because one pump per division is operating at full-flow conditions. Inservice pump tests are performed according to ASME Section XI and compatible with the Technical Specifications in Chapter 16.

j. CCWS components are located so that flooding, fires, tornadoes, hurricanes, internal and external missiles, pipe breaks and whip, jet impingements, and interactions with non-seismic systems from any source would not impair the system's safety capabilities. The two divisions of the CCWS are physically and electrically separated from each other, and are routed to be protected from the above-mentioned sources. The criteria and conditions that are described here are evaluated in the relevant sections of Chapter 3.

k. The system is designed to minimize the potential for water hammer in accordance with the guidance in NUREG-0927.

l. CCWS is designed as one unit and is not shared by multi unit facilities.

m. The system is designed to minimize the effects of long-term corrosion by using demineralized water and corrosion inhibitors.

n. The CCW supply to the RCP coolers is isolated on a low-low surge tank level signal. However, this isolation signal can be overridden by manual operation from the MCR to protect the RCP seal.

o. RCP seal integrity during a station blackout (SBO) is maintained by the auxiliary charging pump of the chemical and volume control system (CVCS) powered from an AAC power source, as described in Subsection 9.3.4.

9.2.2.4 Inspection and Testing Requirements

During fabrication of the CCWS components, tests and inspections are performed and documented in accordance with code requirements to provide reasonable assurance of high-quality fabrication. As necessary, performance tests of components are performed in the

vendor's facility. The CCWS is designed and installed to permit inservice inspections and tests in accordance with ASME Section XI and ASME OM Code.

9.2.2.4.1 Preoperational Testing and Inspection

Prior to initial plant startup, a comprehensive performance test, as detailed in Section 14.2, is performed to verify system and individual component design performance.

9.2.2.4.2 Inservice Testing and Inspection

The CCWS operates during all modes of plant operation. As such, the operability, performance, structural and leak tight integrity of the system is demonstrated by continuous operation.

a. System-level tests

   Periodic tests and inspections on the CCWS are performed to provide reasonable assurance of proper operation. The Technical Specifications in Chapter 16 contain the complete schedule for tests and inspections of the CCWS.

b. Component testing

   In addition to system-level tests, tests of individual components are tested to verify proper operation. These tests supplement the system-level tests by verifying the acceptable performance of each active component in the CCWS. Pumps and valves are tested in accordance with ASME Section XI. The schedule and type of tests and inspections are described in Subsections 3.9.6 and 6.2.4 and Section 6.6. Tests at various flow rates up to and including the design point of the CCW pumps can be performed using the closed system loop.

9.2.2.5 Instrumentation Requirements

Instrumentation and controls are provided to adequately monitor and control the CCWS. Appropriate features provide reasonable assurance of independent operation of I&C channels for the essential equipment. All non-safety-related instrumentation and controls

are designed so that any failure does not cause degradation of any essential equipment function.

The CCWS instrumentation facilitates automatic operation, remote control, and continuous indication of system parameters locally and in the MCR. MCR process indications and alarms are provided to enable the operator to evaluate the CCWS performance and to detect malfunctions.

The major CCW parameter measurements and indication instrumentation are described below.

9.2.2.5.1 Pressure Instrumentation

a. MCR indication

   CCW pump common discharge header pressure in each division is displayed.

b. Controls – CCW pump discharge pressure

   When a low CCW pump discharge pressure signal is actuated, the standby pump in that division automatically starts. This signal is indicative of a failure of the operating pump, line break, or an increase of the required cooling water flow.

9.2.2.5.2 Temperature

a. Main control room indication

   MCR indication is provided for the following process temperature parameters:

   1) CCW heat exchanger outlet header temperature

   2) SC heat exchanger 1 and 2 outlet temperatures

   3) Letdown heat exchanger outlet temperature

4) RCPs 1A, 1B, 2A, and 2B motor oil coolers outlet temperatures

5) RCPs 1A, 1B, 2A, and 2B thermal barrier (e.g., seal cooler, high-pressure cooler) outlet temperatures

b. Controls

1) CCW heat exchanger outlet temperature

CCW heat exchanger outlet jogging control valves and bypass flow isolation valves are modulated to maintain 18.33 °C (65 °F) minimum heat exchanger outlet temperature.

2) Letdown heat exchanger temperature control

Letdown heat exchanger control valve is modulated to control the letdown heat exchanger CVCS outlet temperature.

3) Charging pump mini-flow heat exchanger temperature control

The charging pump mini-flow heat exchanger control valve is modulated to control CVCS heat exchanger outlet temperature.

4) Essential chiller condenser flow control

Essential chiller condenser control valves are modulated to control component cooling water flow through each building chiller condenser side.

5) Central chiller / compound building chiller condenser flow control

Central chiller / compound building chiller condenser control valves are modulated to control CCW flow through the each building chiller condenser side.

c. Alarms

CCW heat exchanger high and low outlet temperatures are alarmed in the MCR.

9.2.2.5.3 Flow

a. Main control room indication

MCR indication is provided for the following process flow parameters:

1) CCW heat exchangers common discharge header flow in each division

2) CCW pumps 1A, 1B, 2A, and 2B outlet flows

3) SFP cooling heat exchangers A and B outlet flows

4) SC heat exchangers 1 and 2 outlet flows

5) Letdown heat exchanger outlet flow

6) RCPs 1A, 1B, 2A, and 2B coolers outlet head flows

7) CS heat exchanger 1 and 2 outlet flows

8) CS mini-flow heat exchanger 1 and 2 outlet flows

9) SC mini-flow heat exchanger 1 and 2 outlet flows

10) Essential chiller condensers 1A, 1B, 2A, and 2B outlet flows

11) EDG coolers 1A, 1B, 1C and 1D outlet flows

12) Charging pump mini-flow heat exchanger outlet flow

b. Alarms

The following low- and high-flows alarm in the MCR:

1) SFP heat exchangers A and B low and high outlet flows

2) SC heat exchangers 1 and 2 low and high outlet flows

3) RCPs 1A, 1B, 2A, and 2B cooler low and high outlet header flows

4) CS heat exchangers 1 and 2 low and high outlet flows

5) EDG coolers 1A, 1B, 1C, and 1D low and high outlet flows

6) Essential chiller condensers 1A, 1B, 2A, and 2B low and high outlet flows

7) Charging pump mini-flow heat exchanger low and high outlet flows

8) CCW pumps 1A, 1B, 2A, and 2B low outlet flows

9) Letdown heat exchanger low and high outlet flows

10) CS mini-flow heat exchanger low and high outlet flows

11) SC mini-flow heat exchanger low and high outlet flows

9.2.2.5.4 Level

a. CCW surge tank level

Level indication is provided in the MCR for CCW surge tanks A and B. High level, demineralized water automatic supply, low-level, and low-low level alarms are provided in the MCR.

A low-low level signal isolates the nonessential headers and the RCP headers from the remaining portion of the system.

b. CCW chemical addition tank level

Local level indications are provided for the CCW chemical addition tanks.

9.2.2.5.5 Radiation Monitors

Radiation monitors are provided downstream of the CCW pumps. An alarm is sounded in the MCR when a pre-determined preset radiation level is detected by one of the monitors. CCW radiation activity is indicated in the MCR.

9.2.2.5.6 Current

CCW pump motor current is indicated in the MCR.

9.2.2.5.7 Interlocks

Makeup demineralized water is automatically supplied to the CCW surge tanks when the tank level drops to a pre-determined low level when the alarm sounds. The inlet valves to the CCW surge tanks are interlocked to the makeup demineralized water auto supply. The surge tank inlet valves close when the respective surge tank reaches a predetermined level. Manual override is provided for these valves.

9.2.2.5.8 Time Delays

The start of the second CCW pump is delayed by 10 seconds when a low discharge pressure signal is actuated on the operating pump.

9.2.3 [Reserved]

This Subsection is reserved in accordance with NRC RG 1.206.

9.2.4 Domestic Water and Sanitary Systems

[[The domestic water and sanitary systems consist of a domestic water system and a sanitary drainage system. The function of the domestic water system is to supply potable water for domestic use in the turbine generator building, compound building, auxiliary building, miscellaneous buildings, and future facilities. The function of sanitary drainage system is to collect and transfer non-radioactive sanitary water for treatment, and discharge during normal operation.]]

9.2.4.1 Design Bases

[[The domestic water and sanitary systems are non safety-related.]]

The systems are designed to meet the following:

a. [[Per the requirements in GDC 60, there are no interconnections between the domestic water and sanitary systems and the systems with the potential to contain radioactive material.]]

b. [[The domestic water system is protected by an air gap, where necessary.]]

c. [[The domestic water quality meets the more stringent requirements of either the U.S. Environmental Protection Agency's "National Primary Drinking Water Regulations," 40 CFR 141 (Reference 1), or all state and local environmental protection standards.]] The COL applicant is to determine all state and local department of health and environmental protection standards to be applied and followed for the domestic water system (COL 9.2 (13)). The COL applicant is to determine the source of domestic water to the site and the necessary required treatment plant (COL 9.2 (14)).

d. [[The distribution of the domestic water by the domestic water system is in compliance with the "Occupational Safety and Health Standard," 29 CFR 1910 (Reference 2).]]

e. [[The domestic water and sanitary systems are designed to supply potable water at a rate of 200 L (53 gal) per person per day. The sanitary system is designed to receive and to treat the sewage for 750 people per day.]] The COL applicant is to confirm the sizing of domestic water tanks and associated pumps, if used (COL 9.2 (15)).

f. [[The sanitary drainage system located at each building collects sanitary water and transfers it to the sanitary water treatment facility.]] The COL applicant is to confirm whether the sanitary waste is sent to an onsite treatment facility or the city sewage system (COL 9.2 (16)).

9.2.4.2 System Description

The domestic water and sanitary systems are shown schematically in Figure 9.2.4-1.

9.2.4.2.1 Domestic Water System

[[Water for drinking and sanitary services is supplied by the domestic water system. Domestic water from the water treatment plant is pumped to the hydropneumatic tank by 2 domestic water pumps. The hydropneumatic tank and distribution headers are kept pressurized by compressed air from the service air system so that water can be provided throughout the plant as needed. The maximum required pressure of the tank is 5.6 kg/cm^2G (80 psig) at the inlet of compound building as the furthermost point from the tank. The hydropneumatic tank is protected from overpressure by the safety relief valve. The domestic water pumps are protected by minimum recirculation piping on the discharge lines.]]

[[No cross-connections exist between the domestic water system and any potentially radioactive system that domestic water is supplied to potentially radiologically contaminated areas, backflow prevention devices are installed.]]

9.2.4.2.2 Sanitary Drainage System

[[The sanitary drainage system collects sanitary wastes and conveys them to the sanitary water treatment facility. The sanitary drainage system consists of vacuum valve pits,

piping, and vacuum station. Each vacuum valve pit consists of vacuum valves, covers, vents, and sensing pipes. The piping networks consist of flexible connectors, division valves and pits, pipes, fitting, and lifts. The vacuum station consists of vacuum pumps, collection tank, sanitary water transfer pumps, instruments, and local control panel.]]

9.2.4.2.3 Component Description

[[Major component data are provided in Table 9.2.4-1.]]

9.2.4.2.3.1 [[Hydropneumatic Tank]]

[[The hydropneumatic tank stores the domestic water for distribution throughout the plant. The capacity of the tank is 25,400 L (6,700 gal). The hydropneumatic tank receives water from the domestic water pumps by actuation of a low-level signal. Service air is supplied to the tank when the tank pressure falls below the maximum pressure during a high level in the tank.]]

9.2.4.2.3.2 [[Domestic Water Pump]]

[[Two 100 percent domestic water pumps are supplied, at 1,325 L/min (350 gpm) each. Domestic water is supplied by gravity to the domestic water pumps. Domestic water from the pump is automatically supplied to the hydropneumatic when tank level drops below the low level setpoint. The pump will continue to run until the water level in the hydropneumatic tank increases to the high water level setpoint.]]

9.2.4.2.4 System Operation

[[Domestic water from the domestic water treatment plant is supplied by gravity to the domestic water pumps. Domestic water is pumped to the hydropneumatic tank, which supplies water to all plant domestic water users including the main shower, toilet facilities, emergency showers, and eye washers. One of the domestic water pumps is automatically operated upon actuation of a low level switch of the hydropneumatic tank. The pump continues to run until the water level increases to the high water level of the hydropneumatic tank. If the operating domestic water pump trips, the standby pump starts automatically.]]

[[The hydropneumatic tank uses air pressure to maintain sufficient domestic water pressure under all plant conditions. Service air is automatically supplied to the tank when the tank pressure is 5 kg/cm^{2}G (71 psig) as low pressure by a control valve. The control valve is automatically closed when the tank pressure is 6.3 kg/cm^{2}G (90 psig) as high pressure. Tank pressure varies with intermediate tank water levels without supplying compressed air to the tank.]]

[[If the hydropneumatic tank is taken out of service, the domestic water supply is manually bypassed around the hydropneumatic tank. The bypass valve is opened manually. The supply pump is manually switched to "START" and operates continuously during this mode of operation. During the manual bypass of the hydropneumatic tank, minimum flow is recirculated to the pump suction.]]

9.2.4.3 Safety Evaluation

The domestic water and sanitary systems do not perform any safety functions, and any malfunction would not have any adverse effect on any safety-related system.

9.2.4.4 Inspection and Testing Requirements

[[The domestic water and sanitary systems are hydrostatically tested and flushed in accordance with ASME B31.1 (Reference 3) and the applicable Plumbing Code.]]

[[Periodic tests of the domestic water quality are conducted.]]

9.2.4.5 Instrumentation Requirements

[[The hydropneumatic tank pressure switch provides alarm signals and control signals for the pressure control valve.]]

[[The hydropneumatic tank level switch provides alarm signals and control signals for the domestic water pumps.]]

[[The flow element and indicator that monitor net flow rates to the domestic water system are provided on the discharge line of the hydropneumatic tank.]]

[[Local instrumentation, controls, and alarms are provided for monitoring and automatic control of the system process and the protection of system components. Pressure, level, and flow indicators are provided at selected points in the system.]]

9.2.5 Ultimate Heat Sink

The function of the ultimate heat sink (UHS) is to dissipate the heat rejected from the essential service water system (ESWS) during all modes of operation including accident conditions. The UHS maximum heat loads for all modes of operation and for LOCA and a safe shutdown with a LOOP are shown on Table 9.2.5-1 and 9.2.5-2. The UHS is safety-related and meets the requirements of NRC RG 1.27 (Reference 7).

9.2.5.1 Design Bases

The UHS is a site-specific system that interfaces with the ESWS. The COL applicant is to provide the UHS-related design information based on the specific site characteristics, including meteorological conditions (COL 9.2(17)).

The UHS is designed to provide maximum, UHS water temperature of 33.2 °C (91.8 °F) to ESWS.

The UHS is designed in accordance with GDC 2, 4, 5, 44, 45, and 46 and in accordance with the SRP 9.2.5, NRC RG 1.27, and ANSI/ANS 5.1 (Reference 19).

The UHS SSCs are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunamis, and seiches without loss of capability to perform its safety functions (GDC 2). The UHS-related structures are designed as seismic Category I based on site-specific and meteorological conditions following NRC RG 1.29 (Reference 15) and to have the capability to withstand the design loadings.

UHS SSCs are designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing and postulated accidents, including a LOCA. They are appropriately protected against dynamic effects, including the effects of external missiles, pipe whip, and discharging fluids, that may result from equipment failure and external events (GDC 4).

UHS SSCs are not shared with other nuclear power units because the UHS is designed for a single nuclear power unit (GDC 5).

The safety function of the UHS is to dissipate the maximum heat load of all modes of operation including that of a LOCA and LOOP under the worst combination of adverse environmental conditions, including freezing. The UHS maximum heat loads for all modes of operation including LOCA and safe shutdown with a LOOP are shown in Tables 9.2.5-1 and 9.2.5-2. The safety function of the UHS is also to supply cooling capacity for at least 30 days (or at least 36 days for cooling pond) in accordance with NRC RG 1.27 without makeup water. The UHS is designed to provide suitable redundancy under LOCA and LOOP assuming a single active failure. The UHS is designed to provide the capability to isolate components, systems, or piping so that safety functions are not compromised (GDC 44).

The UHS is designed to permit appropriate periodic inspection of important components to provide reasonable assurance of the integrity and capability of the system (GDC 45).

The UHS is designed to permit appropriate periodic pressure and functional testing to provide reasonable assurance of (1) the structural and leaktight integrity of its components, (2) the operability, and (3) the performance of the active components, the operability of the system, and the performance of the full operational sequence that brings the system into operation for reactor shutdown and for LOCAs, including operation of applicable portions of the protection system and the transfer between normal and emergency power sources (GDC 46).

9.2.5.2 System Description

The COL applicant is to provide the UHS-related systems, such as blowdown, chemical injection, and makeup water system (COL 9.2(18)).

The COL applicant is to provide the safety-related makeup water source to supply cooling capacity for at least 30 days including the UHS basin capacity to the ESWS during LOCA and/or LOOP (COL 9.2(19)).

The COL applicant is to provide the location and design of the UHS cooling tower basin, the ESW intake structure, and makeup water source (COL 9.2(20)).

The COL applicant is to provide isolation between the UHS and non-safety-related systems (COL 9.2(21)).

9.2.5.2.1 General Description

[[The UHS consists of two independent, redundant, and safety-related divisions. Each division consist of two 100 percent capacity UHS cooling towers, one common UHS cooling tower basin, piping, valves, controls and instrumentation. Each division is designed to remove 100 percent of the design heat load transferred from the ESWS.]] The UHS interfaces with the ESWS, which is described further in Subsection 9.2.1.

The UHS design parameters are listed in Table 9.2.5-3, and the UHS is shown in Figure 9.2.5-1.

The UHS design provides the cooling water inventory for a minimum of 30 days without makeup to mitigate the consequences of a design basis event.

The UHS supplies cooling water to the ESWS at a maximum temperature of 32.1 °C (89.8 °F) under all normal operating modes and a maximum of 33.2 °C (91.8 °F) under accident and safe shutdown conditions to provide assurance of sufficient cooling capacity.

[[The required basin water volume is based on the total evaporation and drift during accident and safe shutdown conditions within a 72 hours (or 3 days) period. The maximum 72-hour cooling water capacity is approximately 5,110 m^3 (1.35 million ga).]]

The UHS provides the source of cooling water to the ESWS and dissipates heat rejected from the ESWS. The cooling water does not contain radioactive materials nor release radioactive contaminants to the environment. Radiation monitors are provided in each ESW division. The radiation monitor design is described in Subsection 9.2.1.2.1.

[[The UHS arrangement provides assurance that failures and postulated events in one division do not affect the safety-related functions of the other division. During normal

operation, at least one division is required to be operable to meet single failure criteria. During accidents and other design basis events, such as a LOCA or safe shutdown with a LOOP, a postulated single active component failure in one division does not prevent the UHS from performing its safety-related functions with the remaining operable division. Instrumentation is also provided independently and not shared between the divisions.]]

[[The water influent into the UHS cooling tower from the ESWS is 71,923 L/min (19,000 gpm) (excluding blowdown) for normal operating conditions except shutdown and refueling conditions. During shutdown and refueling conditions, 100,692 L/min (26,600 gpm) (excluding blowdown) is circulated through the UHS. The water influent into the UHS cooling tower from ESWS is 75,708 L/min (20,000 gpm) during accident and safe shutdown conditions. The ESW blowdown operation is terminated by an engineered safety features actuation signal (ESFAS), ESW pump stop signal, or UHS basin low-level signal.]]

[[To prevent freezing, the UHS cooling tower bypass lines, through which hot water from the ESWS travels directly to the UHS cooling tower basin, are provided. Heaters are also provided.]]

[[The fans in the UHS cooling towers are powered from its associated division of the Class 1E ac power distribution system. In the event of a LOOP, the UHS cooling tower fans are powered by the respective emergency diesel generator.]]

The COL applicant is to provide the design of the ESW intake structure or UHS cooling tower basin so the minimum water level provides adequate NPSH to ESW pumps under accident conditions (COL 9.2(22)).

[[Safety-related makeup water is designed to provide at least 30 (or 36) days cooling capacity to the ESWS by safety-related makeup water pumps during safe shutdown or post-accident conditions.]]

The COL applicant is to provide the non-safety-related makeup water source and capacity for normal operation loss and evaporation in the UHS (COL 9.2(23)).

The COL applicant is to specify the following UHS chemistry for bio-fouling and chemistry control (COL 9.2(24)):

a. A chemical injection system to provide non-corrosive, non-scale forming conditions to limit biological film formation

b. The type of biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor, and silt dispersant, if necessary to maintain system performance, based on site conditions

[[As part of the water chemistry management program for the UHS cooling towers and basins, an ESWS blowdown line is installed at the ESW pump discharge piping.]] The COL applicant is to verify the piping layout of the ESWS and UHS to prevent water hammer and to develop operating procedures to provide reasonable assurance that the ESWS and UHS water pressure are above saturation conditions for all operating modes (COL 9.2(25)). The COL applicant is to develop maintenance and test procedures to monitor debris buildup, and flush out and remove the debris in the UHS (COL 9.2(26)).

9.2.5.2.2 [[Component Description]]

The UHS cooling towers, including all of their safety-related components and piping, are enclosed and supported by a seismic Category I reinforced concrete structure. The UHS cooling tower and UHS makeup water system components are safety-related and designed with Quality Group C requirement.

9.2.5.2.2.1 [[UHS Cooling Towers]]

[[The conceptual design of the UHS is wet type, mechanical draft cooling tower. UHS consists of two 100 percent capacity, independent, and redundant divisions. Each UHS division consists of two 100 percent capacity cooling towers. Each cooling tower consists of three 33⅓ percent capacity cells with fans and motors and associated components such as drift eliminators, film fills, risers, water distribution, and the like. The two UHS cooling towers per division are provided with a single common UHS cooling tower basin. Each UHS cooling tower cell provides 33⅓ percent of the required capacity for a safe shutdown with LOOP under worst-case meteorological conditions.]]

[[The fan motors are powered from the Class 1E ac power buses. On a LOOP, the motors are automatically powered from their respective emergency power source.]]

[[To prevent clogging between the UHS cooling tower and the ESWS, a UHS cooling tower basin screen is provided between the UHS cooling tower internals and the ESW intake structure.]]

[[The accident condition temperature of the UHS cooling tower is based on 27. 2 °C (81 °F) non-coincident ambient wet bulb temperature (0 percent exceedance value). A normal plant condition wet bulb temperature for the UHS cooling tower is 26.1 °C (79 °F) (5 percent exceedance value).]]

The COL applicant is to evaluate the potential wind and recirculation effects of cooling towers based on meteorological conditions (COL 9.2(27)).

[[Each UHS cooling tower basin has a capacity of a minimum 72-hour supply of cooling water to the associated ESW, considering safe shutdown and post-accident conditions without normal makeup water.]]

[[The UHS cooling towers use the basins for structural foundation. The ESW intake structure occupies a corner of the UHS cooling tower basin. The ESW intake basin is deeper than the UHS cooling tower basin. The difference in the depth is to provide reasonable assurance of adequate NPSH to the ESW pumps.]]

[[The UHS design concept described here is depicted in Figure 9.2.5-1. The UHS design parameters are provided in Table 9.2.5-3.]]

9.2.5.2.2.2 [[Piping, Valves, and Fittings]]

The COL applicant is to provide the material specifications for piping, valves, and fittings of the UHS system based on site-specific conditions and meteorological conditions (COL 9.2(28)). [[The safety-related piping, valves, and fittings are designed and fabricated in accordance with ASME Sec. III (Reference 12), Class 3.]]

[[Vents are installed in high points, and drains are installed in low points in the UHS. Vents are located to provide reasonable assurance that the piping is filled with water to reduce the chances of water hammer after pump startups.]]

[[Relief valves (if required) are provided on the UHS system lines. These relief valves are sized to provide protection against increased pressure due to thermal expansions in the isolated portions of the system or to relieve the maximum credible leakage from higher-pressure sources. The discharge of these relief devices is routed to a suitable location so that personnel and other nuclear safety-related equipment are adequately protected.]]

[[Electro-hydraulic operated valves are provided to change the flow path between the UHS cooling tower cells and to bypass the UHS cooling tower, allowing direct entry to the UHS cooling tower basin in case the UHS cooling tower basin temperature is lower than the minimum design temperature in order to prevent freezing.]]

9.2.5.2.2.3 [[UHS Cooing Tower Basin]]

[[The UHS cooling tower basin is designed to provide capacity for the minimum 72-hour cooling water supply to the ESWS, considering the worst meteorological conditions and the maximum heat loads without normal makeup water.]]

[[The UHS cooling tower basin connected to the ESW intake structure maintains an adequate water level for the ESW pump NPSH.]]

The COL applicant is to provide the evaluation of maximum evaporation and other losses based on the site-specific conditions and meteorological conditions in the UHS (COL 9.2(29)).

9.2.5.2.2.4 [[UHS Cooing Tower Basin Screens]]

[[A safety-related basin screen is provided to prevent clogging of the ESWS. The basin screens are located between the UHS cooling tower basin and ESW intake structure. The screen mesh size is selected to prevent flow blockage of the pump inlets and to limit ingestion of bio-fouling, organics, and debris.]]

9.2.5.2.2.5 [[UHS Makeup Water Source]]

[[The safety-related UHS makeup water source, in conjunction with UHS cooling tower basins, is designed to provide the capacity of at least 30 (or 36) days of cooling water supply to the ESWS considering the worst meteorological conditions and the maximum heat loads without normal makeup water.]]

[[During a safe shutdown or post-accident conditions, one of the four UHS makeup water pumps takes suction from the UHS makeup water source and discharges the cooling water to the corresponding operating UHS cooling tower basin.]]

9.2.5.2.2.6 [[UHS Makeup Water Pumps]]

[[There are four identical UHS makeup water pumps (two per division). Only one pump is in operation under safe shutdown or post-accident conditions. The standby pump in the same division automatically starts on a low pump discharge flow or low pump discharge pressure. This signal may be an indication of either a failure of the running pump or an insufficient flow. The automatic actuation signal can be overridden by a manual start/stop signal from the MCR.]]

[[The UHS makeup water pumps are provided with a margin of at least 7 percent in dynamic head at the pump design point. The head continuously increases as the flow decreases from the design flow to shut-off. The minimum available NPSH is the smaller of the following: 25 percent greater or 3.05 m (10 ft) greater than the required NPSH specified by the pump vendor. The available NPSH is calculated with the highest expected operating temperature and flow condition at the minimum water elevation of the seismic Category I makeup water source.]]

The COL applicant is to provide the design and location of the UHS makeup water pumps with consideration of site-specific conditions and meteorological conditions (COL 9.2(30)). The COL applicant is to develop UHS makeup water parameters such as flow capacity, total dynamic head (TDH), available NPSH, and motor horsepower (COL 9.2(31)).

9.2.5.2.3 System Operation

9.2.5.2.3.1 Plant Normal Power Operation

[[The ESW pump takes cooling water from the UHS cooling tower basin and the water heated through the CCW heat exchangers is returned to the UHS cooling tower. During all modes of plant normal operation, one cooling tower in each UHS division operates. Each UHS division consists of two 100 percent capacity cooling towers, with each cooling tower having three 33⅓ percent capacity cells with a fan and motor in each cooling tower cell. One UHS cooling tower with three cells with fans in each division operates, while the other cooling tower in the same division remains in standby condition.]]

[[A portion of ESW discharge flow is discharged as blowdown water to control water quality, and the blowdown rate is determined considering the site water chemistry. The blowdown operation is terminated to prevent loss of cooling water during safe shutdown or post-accident conditions.]]

[[When any of the operating cooling tower fans is tripped due to power failure or other reasons, a fan failure signal is sent to the UHS inlet valve in the respective division. The UHS inlet valve in the flow path of the failed cell is closed automatically by the signal and the other UHS inlet valve in the flow path of the other standby power cell is opened automatically by the signal. After that, the standby cooling tower fan is automatically started.]]

[[The normal makeup water is provided to maintain the UHS cooling tower basin water level and to supplement water loss due to blowdown and evaporation. The UHS cooling tower basin water level is monitored and alarmed in the MCR.]]

[[When the UHS cooling tower basin water level reaches the design minimum water level, the UHS makeup water pump starts to maintain the water level for adequate NPSH of the ESW pumps and to maintain the minimum 72-hour cooling water supply under all operation modes.]]

Chemicals are provided by the chemical injection system to prevent bio-fouling and long-term corrosion. Periodic sampling is provided to monitor water quality.

[[ESW blowdown operation is terminated by ESW pump stop signal or UHS basin low-level signal]]

9.2.5.2.3.2 Plant Startup, Shutdown, and Refueling

The UHS system operation during plant startup/shutdown and refueling operation is the same as that during the plant normal operation, as described in Subsection 9.2.5.2.3.1, except the ESWS flow rates due to the ESW startup/shutdown and refueling operation as described in Subsection 9.2.1.2. [[ESW blowdown operation is terminated by the ESW pump stop signal or UHS basin low-level signal.]]

9.2.5.2.3.3 Plant Abnormal/Accident Condition

The UHS system operation during the plant abnormal/accident conditions is the same as that during the plant normal operation except for the following cases. [[The UHS makeup water pumps remain in the standby condition to provide makeup water from the seismic Category I makeup water source to the UHS cooling tower basins when normal makeup water is unavailable at the UHS cooling tower basin low water level. The ESW blowdown operation is terminated by ESFAS signal to maintain 72 hours of makeup water capacity of the UHS basin.]]

a. [[In the event of a LOOP, each UHS system division is automatically powered from the emergency diesel generator of the respective component and starts in accordance with each ESF load sequencing logic.]]

b. [[In the event of a LOCA, one UHS cooling tower in one of the two divisions is operated for safe shutdown and mitigation of the post-accident conditions.]]

9.2.5.3 Safety Evaluation

The UHS is designed to dissipate the heat rejected from the ESW under normal and accident conditions assuming a single active failure. [[The UHS consists of two independent, redundant, safety-related divisions and does not share components between divisions. The UHS is designed for a single nuclear power unit and is not shared between

units.]] The COL applicant is to provide the detailed evaluation for UHS capacity with consideration of site-specific conditions and meteorological data (COL 9.2(32)).

The heat loads for LOCA and safe shutdown conditions with a LOOP for up to 36 days are provided in Table 9.2.5-2. The minimum required UHS cooling water inventory is based on the heat loads for LOCA and safe shutdown conditions to maintain the ESW supply water temperature and to meet the ESW pump NPSH requirements in accordance with NRC RG 1.27.

The UHS provides cooling capacity for at least 30 days (or at least 36 days for cooling pond) in accordance with NRC RG 1.27 without makeup water assuming the worst meteorological data. Each UHS basin provides a minimum 72-hour (3-day) capacity. The COL applicant is to provide the seismic Category I makeup water source with the remaining 27 day capacity to meet the required 30-day cooling capacity in the UHS (COL 9.2(33)).

The UHS is capable of withstanding the effect of the design loading and natural phenomena such as the safe shutdown earthquake (SSE), tornadoes, tornado missiles, hurricanes, and the probable maximum flood (PMF) considering Sections 3.3, 3.4, 3.5, 3.7, and 3.8. Site-specific UHS design features to address limiting hydrology-related events are addressed as required by DCD Section 2.4. The UHS is designed as seismic Category I structure meeting design acceptance following NRC RG 1.27.

The UHS is designed to prevent long-term fouling and mitigate short-term clogging anticipated at the site that may degrade system performance. The UHS basin screen is provided to prevent debris from entering the ESWS and located in water passage between the UHS cooling tower basin and ESW intake structure. The COL applicant is to provide chemicals and blowdown to prevent bio-fouling and long-term corrosion, considering site water quality in the UHS (COL 9.2(34)). Chemicals will include biocide, algaecide, pH adjuster, corrosion inhibitor, and silt dispersant.

[[Failure modes and effects analysis (FMEA) of the UHS is described in Table 9.2.5-3. FMEA is to provide reasonable assurance that redundancy of the UHS system function exists in case of single failure.]]

9.2.5.4 Inspection and Testing Requirements

The COL applicant is to provide the inspection and testing of the UHS to demonstrate that fouling and degradation mechanisms applicable to the site are effectively managed to maintain acceptable heat sink performance and integrity (COL 9.2(35)).

9.2.5.4.1 Preoperational Testing and Inspection

[[Preoperational testing of the UHS is performed as described in Section 14.2 to verify that the system is installed in accordance with plans and specifications. The system is hydrostatically tested and functionally tested to verify proper installation and operation of the valves and the UHS makeup water pump starting occur on the appropriate signals. The UHS makeup water pumps are tested to verify performance.]]

9.2.5.4.2 In-Service Testing and Inspection

[[During normal operation, periodic inspections and tests are performed to verify operability or, alternatively, placed in normal operation in place of the division that has been operating. Descriptions of the testing and inspection programs for pumps and valves are provided in the Subsection 3.9.6 and Section 6.6.]]

9.2.5.5 Instrumentation Requirements

The COL applicant is to provide the alarms, instrumentation, and controls required for the safety-related functions of the UHS (COL 9.2(36)).

[[Alarms, indications, and controls are provided in the main control room (MCR).]]

9.2.5.5.1 System Monitoring

a. [[UHS cooling tower basin water level]]

b. [[UHS cooling tower water temperature]]

c. [[UHS makeup water pump discharge pressure]]

d. [[UHS makeup water pump discharge flow]]

9.2.5.5.2 System Alarms

a. [[UHS cooling tower water level high/low]]

b. [[UHS cooling tower water temperature high/low]]

c. [[UHS makeup water pump discharge pressure low]]

d. [[UHS makeup water pump discharge flow low]]

9.2.6 Condensate Storage Facilities

The condensate storage facilities consist of two systems:

a. Makeup demineralizer system

b. Condensate storage and transfer system

The makeup demineralizer water treatment package is not within the scope of this DCD. The makeup demineralizer system consists of a 100 percent demineralized water storage tank (DWST), two 100 percent demineralized water transfer pumps, and two 100 percent membrane oxygen removal subsystems (MORS), associated piping, and valves from fresh water storage tanks up to connections of each usage point.

The condensate storage and transfer system consists of two 50 percent capacity condensate storage tanks (CSTs), associated piping, and valves from CSTs up to connections of the condenser hotwell and other systems.

9.2.6.1 Design Bases

The demineralized water system is designed to provide the demineralized water to:

a. Component cooling water (CCW) surge tank

b. Chilled water system makeup

c. Diesel generator (D/G) engine cooling water makeup

d. Auxiliary feedwater storage tank (AFWST)

e. Turbine generator building closed cooling water surge tank

f. Miscellaneous other systems makeup

g. CST and reactor makeup water tank (RMWT) through the MORS

The condensate storage and transfer system is designed to:

a. Provide demineralized water for initial fill of the condensate and feedwater systems

b. Provide makeup condensate by the hotwell level control system

c. Maintain proper feedwater inventory in the secondary system during startup, shutdown, hot standby, and normal operation

d. Maintain water purity and restrict oxygen content

The condensate storage facilities handle non-radioactive fluid. Therefore, NRC RG 4.21 (Reference 9) and GDC 60 are not applicable for the condensate storage facilities.

9.2.6.2 System Description

9.2.6.2.1 Makeup Demineralizer System

The demineralized water system (see Figure 9.2.6-1) supplies filtered and demineralized water to the AFWST for makeup and to other systems for various services during all modes of normal operation including startup, power operation, hot shutdown, cold shutdown, and refueling. This system provides the demineralized and degasified water to the CST and

RMWT through MORS. The water from the DWST is pumped by demineralized water transfer pumps to the MORS. The MORS reduces the oxygen concentration of the demineralized water. The makeup demineralized water meets the chemistry requirements of Table 9.2.6-2.

The demineralized water system except for the DWST is located on the ground floor of the water treatment building in the yard. The DWST is located in the yard. The source to demineralizer water is supplied from the fresh water tanks in the fire protection program described in Subsection 9.5.1, through a series of demineralizers to the DWST.

All system components meet design code requirements consistent with the component quality group and seismic design classification, as described in Section 3.2. All demineralized water system components are non-safety related except for the containment isolation valves and associated piping, and designed in accordance with NRC RG 1.26 (Reference 11), Quality Group D. Containment isolation valves and associated piping are seismic Category I. Non-safety-related related components and piping located in safety-related areas are seismic Category II. The others including DWST are seismic Category III. Design parameters of the DWST and demineralized water transfer pumps are shown in Table 9.2.6-1.

9.2.6.2.2 Condensate Storage and Transfer System

The condensate storage and transfer system (see Figure 9.2.6-1) provides a readily available source of deaerated condensate for makeup to the condenser. The condensate storage and transfer system provides condensate by means of gravity to the following equipment:

a. Condenser hotwell

b. Auxiliary feedwater pump suction as alternate non-safety backup supply

c. Miscellaneous condensate makeup demands

All system components meet design code requirements consistent with the component quality group and seismic design classification, as described in Section 3.2. All condensate storage and transfer system components including the CST and piping are non-

safety-related and designed in accordance with NRC RG 1.26, Quality Group D. System components including the CST are non-seismic. The CSTs are pressurized by the nitrogen system to minimize air ingress. Design parameters of the CST are shown in Table 9.2.6-1.

9.2.6.3 Safety Evaluation

The makeup demineralizer system does not perform any safety function except for containment isolation portion. Also, the condensate storage and transfer system has no safety function. Therefore, no safety evaluation is required.

9.2.6.4 Inspection and Testing Requirements

Prior to startup, all piping is flushed and hydrostatically tested in accordance with ASME B31.1. System operability is verified by placing the system into operation prior to fuel loading in accordance with the test procedure guidelines of the condensate storage facilities.

9.2.6.5 Instrumentation Requirements

The demineralized water storage tank level indication and alarm are provided in the MCR and RSR. Flow into the demineralized water storage tank is controlled by automatic actuation of the isolation valve at the inlet of the demineralized water storage tank.

The demineralized water transfer pumps are equipped with locally mounted pressure indicators and a pressure switch at the common discharge line. The demineralized water transfer pump status is indicated in the MCR and RSR. Demineralized water is manually or automatically provided by one or both of the demineralized water transfer pumps.

CST pressure is indicated locally and in the MCR and RSR. CST high- and low-pressure alarms are provided in the MCR and RSR. The CST maintains 0.14 kg/cm^2G (2 psig) nitrogen gas in the space above water to control oxygen levels in the condensate. The CST is protected from overpressure and vacuum by one pressure relief valve and two vacuum relief valves.

The water level in each CST is indicated locally and in the MCR and RSR. The CST high and low water level alarms are provided in the MCR and RSR. Makeup water flow from

the makeup demineralizer system into the CST is automatically controlled by the isolation valve at the inlet of the CST. At low tank level, the isolation valve opens and at high level, it closes.

The CST inlet flow rate and flow quantity, for checking CST inlet flow from the demineralized water storage tank, are indicated locally and in the MCR and RSR.

9.2.7 Chilled Water System

The chilled water system consists of the essential chilled water system (ECWS) and the plant chilled water system (PCWS). The ECWS provides chilled water for safety-related heating, ventilation, air conditioning (HVAC) systems, and the PCWS provides chilled water for non-safety related HVAC systems.

9.2.7.1 Design Bases

9.2.7.1.1 Essential Chilled Water System

The ECWS design bases are as follows:

a. The ECWS provides an adequate quantity of chilled water at 5.6 °C (42 °F) to safety-related cooling coils of air handling units (AHUs) and cubicle coolers during all plant operating modes including normal, abnormal, and accident conditions (GDC 44).

b. The ECWS consists of two independent divisions to meet the single failure criterion. A single failure of any active component or a LOOP does not result in a loss of ECWS to safety-related HVAC systems. Two 100 percent capacity chillers and pumps per division are provided. One chiller and one pump operate continuously while the other chiller and pump are kept in standby per division (GDC 44).

c. The electrical equipment in each division is powered from an independent Class 1E power source.

d. Safety-related components of this system are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods (GDC 2).

e. Safety-related components of this system are designed to protect against adverse environmental conditions and dynamic effects such as internal missiles, pipe breaks and whip, and jet impingement (GDC 4).

f. ECWS equipment and components are designed in accordance with safety Class 3 and seismic Category I requirements. The system pressure boundary is designed in accordance with ASME Section III (Reference 12).

g. The ECWS is designed to meet seismic Category I requirements to remain functional during and following an SSE.

h. The ECWS is designed to minimize the potential for water hammer and to accommodate thermal expansion.

i. The ECWS is designed to minimize the effects of long-term corrosion.

j. The ECWS components are capable of being fully tested during normal plant operation. The essential components are accessible for inspection. The system is designed for periodic inservice testing and inspection to provide reasonable assurance of integrity and capability according to 10 CFR 50 Appendix A, GDCs 45 and 46.

9.2.7.1.2 Plant Chilled Water System

The PCWS design bases are as follows:

a. The PCWS provides adequate quantity of chilled water at 5.6 °C (42 °F) to the non-safety related AHU cooling coils and cubicle coolers during normal operation or LOOP. During a LOOP, non-safety related components of the central chilled water subsystem in the PCWS are powered from the permanent non-safety (PNS) bus backed by the AAC source.

b. Pressure vessels, components, and piping are designed in accordance with ASME Section VIII (Reference 13) and ASME B31.1 (Reference 3).

c. The PCWS is not required to meet safety design basis requirements except for the containment isolation function.

d. Safety-related containment isolation valves (CIVs) are provided in each chilled water supply line and return line at the point of containment penetrations to provide containment isolation. CIVs are powered from a Class 1E source. During a DBA or LOOP, these isolation valves are closed upon receipt of an engineered safety feature actuation signal – containment isolation actuation signal (ESFAS-CIAS).

e. The plant chilled water piping components within the seismic Category I buildings including the containment are designed in accordance with seismic Category II criteria to preclude damage to safety-related systems during an SSE.

f. The containment isolation valves and the piping between containment isolation valves of PCWS are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods (GDC 2).

g. The containment isolation valves and the piping between containment isolation valves of PCWS are designed to permit the appropriate periodic inspection, pressure, and functional tests to provide reasonable assurance of the integrity and capability of the system according to 10 CFR 50 Appendix A, GDC 45 and 46.

9.2.7.2 System Description

The chilled water system consists of the ECWS and PCWS. The chilled water system configurations are shown in Figures 9.2.7-1 and 9.2.7-2.

9.2.7.2.1 Essential Chilled Water System

The ECWS provides chilled water for cooling to all safety-related HVAC equipment cooling coils.

The ECWS consists of two independent, redundant, closed loop safety-related divisions. The divisions are separated both mechanically and electrically.

Each division consists of two chillers, two chilled water pumps, a chilled water makeup pump, a compression tank, an air separator, a chemical additive tank, piping, valves, and instrumentation and controls. Cooling water for each chiller condenser is supplied from the component cooling water system (CCWS). The design data for major components are listed in Table 9.2.7-1. The makeup demineralizer system is the normal source of makeup water to ECWS. In case of a loss of demineralized water, the ECW makeup water is supplied from the auxiliary feedwater storage tank (AFWST) by the ECW makeup pump.

The ECWS is powered from different Class 1E sources and the respective EDG. During an SBO, the safety-related components of the system are powered from an AAC source. The ECWS is unavailable for 10 minutes until the alternate ac generator restores power after an SBO occurs. The design requirements to cope with an SBO event are addressed in Subsection 8.4.2.2.

One compression tank per division is connected to the suction side of the ECW pumps. The makeup to the compression tank is provided either automatically based on the tank level or manually. A relief valve protects the tank against overpressurization due to excessive in-leakages.

The ECWS is initially filled with demineralized water from the makeup demineralized system. All system valves and high point vent valves are open during system filling. The compression tank is maintained at the proper water level, and vent valves are closed at the completion of system filling.

The chiller/pump is manually started either in the MCR or RSR or local control panel (LCP). The chiller is also able to be started and stopped from the chiller control panel. The chillers and associated pumps are interlocked such that only one pair in the two pairs of chiller and pump per division can operate at a time.

Vents are installed in high points, and drains are installed in low points in the ECWS. Vents are located to provide assurance that the piping remains filled with water to minimize the chances of water hammer after pump startups. In addition, valve opening and closing times are selected to minimize water hammer effects.

The COL applicant is to develop procedures for water system filling, venting, keeping the system full, and operation to minimize the potential for water hammer; to analyze the system for water hammer impacts; to design the piping system to withstand potential water hammer forces; and to analyze inadvertent water hammer events in accordance with NUREG-0927 (COL 9.2(37)).

Corrosion inhibitors are injected from the chemical addition tank to the chilled water pump suction via a manual valve to prevent oxidation in the ECWS. The chilled water is periodically sampled to monitor the water chemistry.

The ECWS heat load and flow requirement for plant normal and abnormal operating conditions are shown in Table 9.2.7-2.

9.2.7.2.2 Plant Chilled Water System

The PCWS provides chilled water for cooling to all non-safety related HVAC equipment cooling coils and process equipment in the auxiliary building, turbine generator building, and compound building.

The PCWS consists of the following subsystems:

a. Central chilled water subsystem

b. Compound building chilled water subsystem

The central chilled water subsystem consists of four chillers, two chilled water pumps, an air separator, a compression tank, a chemical additive tank, associated piping, valves, and instrumentation and controls. Cooling water for each chiller condenser is supplied from the CCWS. Three chillers and one pump in this subsystem operate to provide chilled water to the non-safety related cooling coils of reactor containment fan coolers (RCFCs), AHUs, and cubicle coolers located in the reactor containment building, auxiliary building, and turbine generator building.

The compound building chilled water subsystem consists of three chillers, two chilled water pumps, an air separator, a compression tank, a chemical additive tank, associated

piping, valves, and instrumentation and controls. Cooling water for each chiller condenser is supplied from the CCWS. Two chillers and one pump in this subsystem operate to provide chilled water to the non-safety related AHU cooling coils and cubicle coolers in the compound building and the shellsides of waste gas dryers in the gaseous radwaste system in the compound building when required.

Compression tank pressure relief valves are provided in compression tanks to protect the system from overpressure. The relief valves are discharged to the non-radioactive equipment drain system. The chiller pressure relief valves are provided to protect chillers and piped to outside of the building to protect personnel from the effect of refrigerant exposure. The chiller rooms are equipped with refrigerant leak detectors that are capable of actuating an alarm in the MCR and RSR to meet ASHRAE 15 requirements for the refrigerating machinery room.

The chilled water system starts with the chilled water pump operation. A chilled water pump in each chilled water subsystem starts manually by the operator. When the chilled water flows are established, the chillers in each chilled water subsystem are started manually by the operator. The evaporator inlet isolation valves and the condenser water flow isolation valves are opened automatically upon chiller start signal. The chilled water system controls the chilled water supply temperature to be maintained within the design temperature range. The compression tanks maintain required minimum pressure in the system and accommodate the liquid volume expansion and contraction resulting from system temperature change.

During LOOP, non-safety related components of the central chilled water subsystem in the PCWS are powered from the PNS bus backed by the AAC source. Cooling water for each chiller condenser is supplied from the CCWS.

Redundant CIVs are provided in each supply and return line at the containment penetrations. The CIVs are powered from the Class 1E source and can be operated from the MCR or RSR. These valves are automatically closed by a containment isolation actuation signal (CIAS).

9.2.7.2.3 Component Description

Table 9.2.7-1 shows the design parameters of the major components. Each component is described below.

Essential Chiller

The essential chillers are provided to supply chilled water to cooling coils of safety-related HVAC equipment during all plant operating conditions. The essential chiller is a centrifugal type with a water-cooled condenser. The chiller is designed in accordance with the requirement of ASME Section III, Class 3. Each chiller conforms to the requirements of AHRI 550/590 (Reference 4), ASHRAE 15 (Reference 5), and ASME AG-1. The chillers are designed to use environmental-friendly refrigerant.

The chiller's relief valves are piped to the outside of the building to protect station personnel from the effect of refrigerant exposure, according to the requirements of ASHRAE 15. The chiller rooms are equipped with refrigerant-leak detectors that are capable of actuating an alarm in the MCR and RSR to meet ASHRAE 15 requirements for the refrigerating machinery room.

The intake for the exhaust duct of chiller room ventilation system is located as close to the floor as practicable to effectively purge the potential leaking refrigerant vapor.

For personnel protection, provision for leak detection and annunciation is also included.

Essential Chilled Water Pump

The essential chilled water pump is provided to circulate the chilled water from chillers to the cooling coils of safety-related HVAC equipment during all plant operating conditions. The pump is selected to overcome the system pressure at the design operating conditions. The pump is a horizontal, centrifugal type with single-speed electric motor drive. The essential chilled water pump is designed in accordance with the requirements of ASME Section III, Class 3. The pumps are provided with a margin of at least 10 percent in the head at the pump design point. The pumps have sufficient available NPSH as a result of the static pressure pressurized by the essential chilled water compression tank. The

available NPSH is a minimum of 25 percent greater than the required NPSH specified by the pump vendor. The available NPSH is calculated with the highest expected operating temperature, maximum flow, and minimum expected compression tank water level.

Essential Chilled Water Compression Tank

The essential chilled water compression tank is provided to accommodate the thermal expansion and contraction of the chilled water and potential leakage from the ECWS. The compression tank is connected to the suction of the essential chilled water pumps to prevent pump cavitation. The compression tank is also provided to maintain a minimum pressure in the ECWS because it prevents in-leakage of air into the water. The tank is compressed by nitrogen gas.

The compression tank contains sufficient water volume to provide reasonable assurance of reliable system operation without normal makeup for at least 7 days. The tank capacity includes the water volume due to thermal expansion and contraction and minor system leakage such as pump seal and valve seat leaks for 7 days.

The compression tank is designed in accordance with the requirements of the ASME Section III, Class 3.

Air Separator

The air separator is provided to release air from water continuously. The air separator is a tangential flow type and is designed in accordance with the requirements of ASME Section III, Class 3.

Chemical Additive Tank

The chemical additive tank is provided to manually feed the corrosion inhibitors to the system, as required. The tank is designed as non-safety related and seismic Category II. The tank is a horizontal cylinder type and is designed in accordance with the requirements of ASME Section VIII. Manual valves are provided to isolate between the chemical additive tank and the ECWS piping. The isolation valves are normally locked closed.

Piping

Carbon steel piping for safety related portion is designed, fabricated, installed, and tested in accordance with the requirements of ASME Section III, Class 3. Piping is arranged to permit access for inspection.

Valves

a. ECW compression tank pressure relief valve

Compression tank pressure relief valves are provided in the compression tank to protect the system from overpressure. The valves are discharged to the non-radioactive equipment drain system.

b. Check valves

The nitrogen supply line and makeup demineralized water supply line check valves are designed to maintain ECWS pressure integrity in the event of failure of the non-seismic support system.

c. ECW control valves

The air operated three-way control valves are supplied on return lines from each cooling coil of the safety-related AHUs. These valves control the heat removal capacity by modulating the flow rate of chilled water through the AHU cooling coils in response to a temperature control signal. The three-way control valves fail open upon a loss of control signal or electric power.

9.2.7.3 Safety Evaluation

9.2.7.3.1 Essential Chilled Water System

The ECWS is designed to remove heat load from all cooling coils of safety-related HVAC systems during all plant operating conditions. The chiller condensers are supplied with cooling water from CCWS.

The ECWS consists of two physically separated, independent, redundant divisions that are powered from a Class 1E source and the respective EDGs to provide reasonable assurance that a single failure does not impair the safety function of the system. The ECWS FMEA is shown in Table 9.2.7-3.

Components of the ECWS are located in a missile-protected structure that is designed to withstand the effects of natural phenomena such as tornadoes, hurricanes, and floods. The casings of the chiller compressors and pumps are designed to withstand penetration by internally generated missiles.

The ECWS is classified as safety Class 3 and seismic Category I. The pressure boundary is designed in accordance with ASME Section III and maintains the integrity of the system pressure boundary under all plant operating modes.

All safety-related components are physically separated and protected so that the damage to one system does not cause damage to the other system. The components are not subjected to pipe break effects such as pipe whip or jet impingement, and interaction with non-seismic systems in the vicinity. They are designed as seismic Category I equipment and remain functional following an SSE.

The system is designed to minimize the potential for water hammer.

The system is designed to minimize the effects of long-term corrosion by using demineralized water and corrosion inhibitors.

Initial filling and normal makeup for the ECWS are from the makeup demineralizer system. In case of a loss of demineralized water, the ECW makeup pump is used to provide makeup water from the AFWST.

9.2.7.3.2 Plant Chilled Water System

The PCWS does not serve any safety function except for the containment isolation valves and the piping between the containment isolation valves.

The CIVs and piping between CIVs are designed in accordance with ASME Section III, safety Class 2, and seismic Category I. These valves are powered from a Class 1E source.

The PCWS FMEA is shown in the Table 9.2.7-4 and the FMEA shows that a single failure does not impair the safety function of the system.

9.2.7.4 Inspection and Testing Requirements

9.2.7.4.1 Essential Chilled Water System

Equipment is factory inspected and tested in accordance with the applicable equipment specifications and codes. System piping and equipment installation is inspected during various construction stages. Construction tests are performed on mechanical components, and the system is balanced for the design water flows and system operating pressures.

Controls, interlocks, and safety devices on each system are checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation. A final integrated acceptance test is conducted with equipment and controls operational to verify the system performance.

The chillers, chilled water pumps, and system piping are hydrostatically tested in accordance with ASME Section III.

Preoperational testing of the ECWS is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

Test and inspection programs and inservice test programs for safety-related portions of the system components are addressed in Subsection 3.9.6 and Section 6.6.

9.2.7.4.2 Plant Chilled Water System

Equipment is factory inspected and tested in accordance with the applicable equipment specifications and codes. System piping and equipment installation is inspected during

various construction stages. Construction tests are performed on mechanical components, and the system is balanced for the design water flows and system operating pressures.

Controls, interlocks, and safety devices on each system are checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation. A final integrated acceptance test is conducted with equipment and controls in operation to verify system performance.

The chillers, chilled water pumps, and system piping are hydrostatically tested in accordance with ASME Section VIII and ASME B31.1.

Preoperational testing of the PCWS is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

The testing of containment isolation valves to verify operability and the ability to meet closing requirements is described in Subsection 6.2.4. The inservice inspection of Class 2 components is described in Section 6.6.

9.2.7.5 Instrumentation Requirements

Local temperature and pressure indicators are provided at the selected points in the system. The compression tank water level is indicated locally, and the level alarms are provided in the MCR and RSR. The discharge pressures of both ECWS and PCWS are locally indicated at the discharge of the pumps in addition to the inlet and outlet of the evaporators. Makeup water flow to the compression tank is initiated automatically by a compression tank water low-level signal and continues until the normal level is re-established.

9.2.7.5.1 Essential Chilled Water System

The following controls and instrumentation are supplied for the ECWS:

a. Each chiller unit is provided with built-in protection devices against freezing, high refrigerant pressure, low refrigerant pressure, high refrigerant temperature, motor overload, loss of lubrication oil, and motor high temperature.

b. If chilled water flow through an operating chiller is lost, the chiller and chilled water pumps are automatically shut down by interlock signals from the flow switch in the chilled water line. An alarm is also annunciated locally and in the MCR and RSR.

c. If the cooling water pressure at the inlet of any operating chiller is lost, the chiller is automatically shut down by interlock signals.

d. The chilled water temperature leaving the chillers is controlled to a design value of 5.6 °C (42 °F).

e. The manual start and stop actuation of the essential chilled water pump and essential chiller is provided in the MCR and RSR to override automatic actuation when required by plant operations.

9.2.7.5.2 Plant Chilled Water System

The following controls and instrumentation are supplied for the PCWS:

a. Each chiller unit is provided with built-in protection devices against freezing, high refrigerant pressure, low refrigerant pressure, high refrigerant temperature, motor overload, loss of lubrication oil, and motor high temperature.

b. If chilled water flow through an operating chiller is lost, the chiller and chilled water pumps are automatically shut down by interlock signals from the flow switch in the chilled water line. An alarm is also annunciated locally and in the MCR and RSR.

c. If the cooling water pressure at the inlet of any operating chiller is lost, the chiller is automatically shut down by interlock signals.

d. The chilled water temperature leaving the chillers is controlled to a nominal design value of 5.6 °C (42 °F).

e. The manual start and stop actuation of the central chilled water pump and central chiller is provided in the MCR and RSR to override automatic actuation when required by plant operations.

9.2.8 Turbine Generator Building Closed Cooling Water System

The turbine generator building closed cooling water (TGBCCW) system provides cooling water for the removal of heat from turbine generator building equipment and non-safety related equipment. The heat is dissipated to the turbine generator building open cooling water system (TGBOCWS). Refer to Subsection 9.2.9 for the description of the TGBOCWS.

9.2.8.1 Design Bases

The TGBCCW system meets the following design bases:

a. The TGBCCW system provides a continuous supply of cooling water to the turbine generator building during normal plant operation.

b. The TGBCCW system rejects heat from the equipment to the TGBOCWS through TGBCCW heat exchangers.

c. Demineralized water with corrosion inhibitors is used for cooling water.

d. The cooler cold side of the equipment is protected from overpressure by the thermal relief valve.

e. The TGBCCW system supplies cooling water to the independent closed loop cooling system that allows operation of one air compressor when the TGBCCW system is not available.

9.2.8.2 System Description

9.2.8.2.1 General Description

The TGBCCW system consists of three 50 percent heat exchangers, two 100 percent pumps, one surge tank, one chemical addition tank, associated piping, valves, instrumentation and controls that are located in the turbine generator building. The TGBCCW system is a closed loop system. A flow diagram of the TGBCCW system is shown in Figure 9.2.8-1, and major system components are described in Table 9.2.8-1.

The TGBCCW system provides the plant cooling capability for all plant operation modes with one pump and two heat exchangers in service. The heated water is returned through the return header and is pumped through the TGBCCW heat exchangers, where the heat is dissipated to the TGBOCWS.

Cooling water from the heat exchanger is distributed to the various equipment coolers through the individual lines branched off from a single discharge header. The discharge isolation valves of the heat exchangers have jogging operation provisions to control the cooling water temperature in conjunction with the heat exchanger bypass line.

The TGBCCW flow to the main turbine lube oil coolers, generator hydrogen coolers, and feedwater pump turbine lube oil coolers is regulated by automatic control valves located in the associated cooler outlet lines. Air-operated control valves are modulated in response to temperature signals from the temperature indicating controllers for the fluid being cooled. The flow of cooling water to all other coolers is regulated manually by individual throttling valves located at each cooler outlet. Thermal relief valve is installed at the outlet of each cooler.

The surge tank provides a reservoir to compensate leakage from the system, the expansion and contraction of the cooling fluid with changes in system temperature and a constant suction head source of the TGBCCW pumps. The surge tank is connected to the suction of the pumps.

Makeup water to the surge tank is provided from the demineralized water makeup system and is automatically controlled by the surge tank water level. The surge tank is pressurized by the nitrogen system to prevent oxygen from entering the system.

A corrosion inhibitor is periodically added to the TGBCCW system via the chemical addition tank to control the pH of the system and for corrosion inhibition.

9.2.8.2.2 System Operation

During start-up, the TGBCCW system is initially filled with demineralized water and the surge tank is pressurized by the nitrogen system. The TGBCCW system is placed in operation by manually starting one pump in MCR or RSR. The standby pump is placed in the automatic mode. The required cooling water flow for the manually controlled coolers is sustained by throttling outlet valves for each cooler.

During normal operation, one TGBCCW pump and two heat exchangers are normally in operation with one pump and one heat exchanger on standby. The standby pump automatically starts whenever the pump discharge header pressure falls below a preselected value. The redundant TGBCCW heat exchanger is placed in service manually.

During winter or when the TGBOCW temperature is low, the cooling water temperature is controlled by the use of a TGBCCW heat exchanger bypass line. Then the bypassed water in high temperature is mixed with the cooled water from the heat exchanger at its outlet.

The TGBCCW system is shut down after the TGBOCWS is shut down to prevent contamination of the TGBCCW from TGBOCW leaking through the failed plate or gasket of the TGBCCW heat exchanger. The TGBCCW system is shut down by manually stopping the operating TGBCCW pump(s) in the MCR and RSR. During TGBCCW system shutdown mode, all coolers and components rejecting heat to the TGBCCW system are out of service.

The CLCS is normally isolated and manually operated to provide cooling water during the TGBCCW system malfunction or outage for maintenance. Before the TGBCCW system is shut down, the CLCS is tied to the operating air compressor by opening manual isolation valves.

9.2.8.2.3 Design Features for Minimization of Contamination

The APR1400 is designed with specific features to meet the requirements of 10 CFR 20.1406 and NRC RG 4.21. The basic principles of NRC RG 4.21, and the methods of control suggested in the regulations, are specifically delineated into four design objectives and two operational objectives discussed in Subsection 12.3.1.10.

The TGBCCW system consists of heat exchangers, pumps, a surge tank, a chemical addition tank, piping, valves, and instrumentation to supply continuous cooling water for dissipating the heat from the turbine building equipment coolers and rejecting the heat to the TGBOCWS. The TGBOCWS then discharges the heat to the CW cooling towers.

The TGBCCW heat exchangers supply continuous cooling water to the turbine generator building equipment (generator hydrogen cooler, ISO phase bus duct cooler, generator stator water cooler, feedwater pump turbine lube oil coolers, etc.), which are not normally expected to contain radioactive fluid. However, the TGBCCW system components can become contaminated through leakage of contaminated condensate or feedwater through the equipment coolers. The TGBCCW heat exchangers are plate type and constructed of titanium material, which minimizes pinhole leaks. The heat exchanger seals are designed to leak outside the heat exchangers where the leakage is collected in the turbine generator building drain system. Based on this evaluation, the TGBCCW system is in compliance with the NRC RG 4.21 requirements for the prevention of cross-contamination and the minimization of waste generation.

9.2.8.3 Safety Evaluation

The TGBCCW performs no safety function. Therefore, no safety evaluation is required.

9.2.8.4 Inspection and Testing Requirements

Preoperational test is carried out as described in Section 14.2 to demonstrate the system performance, structural integrity, and leak-tightness of the system components.

9.2.8.5 Instrumentation Requirements

Local temperature and pressure indicators are provided at the equipment cooler outlet. Pressure indicators are provided on the TGBCCW heat exchanger inlet and outlet, and the TGBCCW water temperature in the MCR and RSR.

When the pressure at the TGBCCW pump discharge is low, an alarm is provided in the MCR. The water level in the surge tank is indicated locally and in the MCR. An alarm also is provided on the high or low water level in the surge tank in the MCR.

Makeup water flow to the surge tank is initiated automatically by surge tank water level low signal and is continued until the normal level is re-established.

The TGBCCW heat exchangers water outlet header temperature is indicated in the MCR and RSR.

9.2.9 Turbine Generator Building Open Cooling Water System

The turbine generator building open cooling water system (TGBOCWS) supplies cooling water to remove heat from the turbine generator building closed cooling water (TGBCCW) heat exchangers.

9.2.9.1 Design Bases

The TGBOCWS meets the following design bases:

a. The TGBOCWS supplies sufficient cooling water to the TGBCCW heat exchangers during all modes of plant operation.

b. Upon isolation or loss of one of two operating TGBCCW heat exchangers or strainer, the remaining standby heat exchanger or strainer is capable of heat removal.

c. The cooling water is branched off from the discharge header of the circulating water (CW) pump and is returned back to the CW discharge conduit, after cooling

the TGBCCW heat exchangers. The TGBOCWS then discharges the heat to the CW cooling towers.

9.2.9.2 System Description

9.2.9.2.1 General Description

The cooling water of TGBOCWS is branched off from the circulating water (CW) pumps header. The heated cooling water after passing the TGBCCW heat exchangers is discharged to the heat sink via the CW system.

The system consists of redundant strainers, valves, associated piping, and instrumentation and controls, which are located in the turbine generator building. A flow diagram is shown in Figure 9.2.9-1.

The system performs its cooling function with two 50 percent TGBCCW heat exchangers and one 100 percent strainer. Each heat exchanger is provided with flushing connections at both the inlet and outlet of the heat exchanger for the flushing of the heat exchangers.

In the prevention of TGBCCW system contamination by TGBOCWS, the design operating pressure of the TGBOCWS is lower than the design operating pressures of the TGBCCW system.

To minimize the potential for water hammer, the operating pressure at all location in the system remains higher than the saturated condition at the operating temperature.

9.2.9.2.2 System Operation

The TGBOCWS startup operation is followed by TGBCCW system startup.

The TGBOCWS supplies cooling water to the TGBCCW heat exchangers. Cooling water flows through the strainer to remove coarse particles prior to the TGBCCW heat exchangers. Cooling water passes through the cold side of two of the three 50 percent TGBCCW heat exchangers. The remaining heat exchanger in standby is isolated.

The TGBOCWS provides sufficient cooling capability for all plant operating modes with the CW system operating. Cooling water supply to the standby TGBCCW heat exchanger is accomplished from the MCR and RSR by using remote controlled motor operated butterfly valves.

The TGBOCWS is shut down by stopping all the CW pumps or by closing the inlet and outlet valves of all the TGBCCW heat exchangers' cold side.

When the cold side of a TGBCCW heat exchanger is isolated, the side is vented, drained, flushed with raw water, and drained again to prevent biological growth and fouling in the heat exchanger.

The shutdown of the TGBOCWS precedes the shutdown of the TGBCCW system to prevent contamination of the TGBCCW system from leakage through a failed plate or gasket in the TGBCCW heat exchanger.

9.2.9.2.3 Design Features for Minimization of Contamination

The TGBOCWS is designed with specific features to meet the requirements of 10 CFR 20.1406 and NRC RG 4.21. The basic principles of NRC RG 4.21, and the methods of control suggested in the regulations, are specifically delineated into four design objectives and two operational objectives discussed in Subsection 12.3.1.10.

The TGBOCWS consists of piping, valves, and instrumentation to supply cooling water to the TGBCCW heat exchangers. The cooling water is supplied from the CW system header and is returned back to the CW discharge conduit, after cooling the TGBCCW heat exchangers. The TGBOCWS is designed not to be in contact with radiologically-contaminated components. The only interface with a potentially contaminated system for the TGBOCWS is with the TGBCCW heat exchangers. The TGBCCW system supplies continuous cooling water to the turbine generator building equipment (e.g., generator hydrogen cooler, ISO phase bus duct cooler, generator stator water cooler, feedwater pump turbine lube oil coolers), which is not normally expected to contain radioactive fluid. Also, the TGBCCW heat exchangers are plate type and constructed of titanium material, which minimizes pinhole leaks. The heat exchanger seals are designed to leak outside the heat exchangers where the leakage is collected in the turbine generator building drain system. Based on this evaluation, the TGBOCWS is in compliance with the NRC RG 4.21

requirements for the prevention of cross-contamination and minimization of waste generation.

Further description for the NRC RG 4.21 compliance features of the CW system is presented in Subsection 10.4.5.2.6.

9.2.9.3 Safety Evaluation

The TGBOCWS has no safety-related function and therefore requires no safety evaluation.

9.2.9.4 Inspection and Testing Requirements

Preoperational testing is performed as described in Section 14.2 to demonstrate the system performance, structural integrity, and leak-tightness of the system components.

9.2.9.5 Instrumentation Requirements

A pressure transmitter located at the branch line from the CW header of the CW system provides indication in the MCR and RSR. A flow element with flow indicating transmitter, located at the downstream of TGBCCW heat exchanger outlet common line, provides indication in the MCR and RSR. A local pressure indicator is provided on each TGBCCW heat exchanger inlet and outlet line to determine if the heat exchanger is clogged. A local temperature indicator is provided at the branch line from the CW header and each TGBCCW heat exchanger outlet line to monitor the heat exchanger performance. A local differential pressure indicator across the strainer is provided. Position value and position status for TGBCCW heat exchanger discharge valves is indicated in the MCR and RSR.

9.2.10 Combined License Information

Information for the following items is required to be provided in support of the combined license application (COLA):

COL 9.2(1) The COL applicant is to develop procedures for system filing, venting, and operational procedures to minimize the potential for water hammer; to analyze the system for water hammer impacts; to design the piping system

to withstand potential water hammer forces; and to analyze inadvertent water hammer events in accordance with NUREG-0927 in the ESWS.

COL 9.2(2) The COL applicant is to develop layout of the site-specific portion of the system to minimize the water hammer potential in the ESWS.

COL 9.2(3) The COL applicant is to (1) to determine required pump design head, using pressure drop from the certified design portion of the plant and adding site-specific head requirements, (2) determine pump shutoff head to establish system design pressure, which is not to exceed standard plant system design pressure, and (3) evaluate potential for vortex formation based on the most limiting applicable conditions in the ESWS.

COL 9.2(4) The COL applicant is to determine the design details of the backwashing line and vent line and their discharge locations in the ESWS.

COL 9.2(5) The COL applicant is to provide measures to prevent long-term corrosion and organic fouling that may degrade system performance in the ESWS.

COL 9.2(6) The COL applicant is to provide the evaluation of the ESW pump at the high and low water levels of the UHS. In the event of approaching low UHS water level, the COL applicant is to develop a recovery procedure.

COL 9.2(7) The COL applicant is to evaluate the need and design and install freeze protection in the ESWS if required.

COL 9.2(8) The COL applicant is to conduct periodic inspection, monitoring, maintenance, performance and functional testing, of the ESWS and UHS piping and components, including the heat transfer capability of the CCW heat exchangers based on GL 89-13 and GL 89-13 supplement 1.

COL 9.2(9) The COL applicant is to develop procedures for water systems filling, venting, keeping the system full, and operation to minimize the potential for water hammer; to analyze the system for water hammer impacts; to design the piping system to withstand potential water hammer forces; and

to analyze inadvertent water hammer events in accordance with NUREG-0927 in the CCWS.

COL 9.2(10) The COL applicant is to provide operational procedures and maintenance programs as related to leak detection and contamination control.

COL 9.2(11) The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.

COL 9.2(12) The COL applicant is to include a site-wide radiological environmental monitoring program to monitor environmental contamination.

COL 9.2(13) The COL applicant is to determine all state and local departments of health and environmental protection standards to be applied and followed for the domestic water system.

COL 9.2(14) The COL applicant is to determine the source of domestic water to the site and the necessary required treatment plant.

COL 9.2(15) The COL applicant is to confirm the sizing of domestic water tanks and associated pumps, if used.

COL 9.2(16) The COL applicant is to confirm whether the sanitary waste is sent to an onsite treatment facility or the city sewage system.

COL 9.2(17) The COL applicant is to provide the UHS-related design information based on the site characteristics, including meteorological conditions.

COL 9.2(18) The COL applicant is to provide the operational procedures and maintenance program as related to leak detection and contamination control.

COL 9.2(19) The COL applicant is to maintain the complete documentation of system design, construction, design modifications, field changes, and operations.

COL 9.2(20) The COL applicant is to provide the UHS-related systems such as blowdown, chemical injection, and makeup water system.

COL 9.2(21) The COL applicant is to provide the safety-related makeup water source to supply cooling capacity for at least 30 days including the UHS basin capacity to the ESWS during LOCA and/or LOOP.

COL 9.2(22) The COL applicant is to provide the location and design of the UHS cooling tower basin, the ESW pump house, and makeup water source.

COL 9.2(23) The COL applicant is to provide isolation between the UHS and the non-safety related systems.

COL 9.2(24) The COL applicant is to provide the design of ESW intake structure or UHS cooling tower basin so the minimum water level will provide adequate NPSH to ESW pumps under accident conditions.

COL 9.2(25) The COL applicant is to provide the non-safety related makeup water source and capacity for normal operation loss and evaporation in the UHS.

COL 9.2(26) The COL applicant is to specify the following UHS chemistry requirements for bio-fouling and chemistry control:

a. A chemical injection system to provide non-corrosive, non-scale-forming conditions to limit biological film formation

b. The type of biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor, and silt dispersant, if necessary to maintain system performance based on site conditions.

COL 9.2(27) The COL applicant is to verify the piping layout of the ESWS and UHS to prevent water hammer and develop operating procedures to provide reasonable assurance that the ESWS and UHS water pressure are above saturation conditions for all operating modes.

COL 9.2(28) The COL applicant is to develop maintenance and testing procedures to monitor debris buildup and flush out and to remove the debris in the UHS.

COL 9.2(29) The COL applicant is to evaluate the potential wind and recirculation effects of cooling towers based on meteorological condition.

COL 9.2(30) The COL applicant is to provide the material specifications for piping, valves, and fittings of the UHS system based on site-specific conditions and meteorological conditions.

COL 9.2(31) The COL applicant is to provide the evaluation of maximum evaporation and other losses based on the site-specific conditions and meteorological conditions in the UHS.

COL 9.2(32) The COL applicant is to provide the design and location of the UHS makeup water pump with consideration of site-specific conditions and meteorological conditions.

COL 9.2(33) The COL applicant is to develop UHS makeup water pump parameters such as flow capacity, total dynamic head (TDH), and available NPSH.

COL 9.2(34) The COL applicant is to provide the detailed evaluation for UHS capability with consideration of site-specific conditions and meteorological data in the UHS.

COL 9.2(35) The COL applicant is to provide the seismic Category I makeup water source with the remaining 27-day capacity to meet the required 30-day cooling capacity in the UHS.

COL 9.2(36) The COL applicant is to provide chemical and blowdown to prevent bio-fouling and long-term corrosion, considering site water quality in the UHS.

COL 9.2(37) The COL applicant is to develop the following procedures the water system: filling, venting, keeping tit full, and opering it to minimize the potential for water hammer. The COL applicant is also to analyze the

system for water hammer impacts, design the piping system to withstand potential water hammer forces and analyze inadvertent water hammer events in accordance with NUREG-0927 in the ECWS.

COL 9.2(38) The COL applicant is to provide the alarms, instrumentation, and controls required for the safety-related functions of the UHS.

9.2.11 References

1. 40 CFR 141, "National Primary Drinking Water Regulations," NRC Regulations Title 40, Code of Federal Regulations.

2. 29 CFR 1910, "Occupational Safety and Health Standard," NRC Regulations Title 29, Code of Federal Regulations.

3. ASME B31.1-2010, "Power Piping."

4. AHRI 550/590-2003, "Performance Rating of Water-Chilling Packages Using the Vapor Compression Cycle."

5. ASHRAE 15-2010, "Safety Standard for Refrigeration Systems."

6. ASME AG-1-2009, "Code on Nuclear Air and Gas Treatment."

7. NRC RG 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 2, January 1976.

8. 10 CFR 20.1406, "Radiological Criteria for Unrestricted Use."

9. NRC RG 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," July 2013.

10. NUREG-0927, "Evaluation of Water Hammer Occurrences in Nuclear Power Plants," Revision 1, March 1984.

11. NRC RG 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," Revision 4, March 2007.

12. ASME Boiler and Pressure Vessel Code, Section III, “Rules for Construction of Nuclear Power Plant Components,” 2007 Edition with 2008 Addenda.

13. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, “Rules for Construction of Pressure Vessels,” 2010 Edition.

14. ASME Boiler and Pressure Vessel Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” 2007 Edition with 2008 Addenda.

15. NRC RG 1.29, “Seismic Design Classification,” Rev.4, March 2007.

16. Generic Letter 89-13, “Service Water System Problems Affecting Safety-Related Equipment,” July 1989.

17. Generic Letter 89-13, “Service Water System Problems Affecting Safety-Related Equipment,” Supplement 1, April 1990.

18. ASME Code, QME-1, “Qualification of Active Mechanical Equipment Used in Nuclear Facilities,” 2007 Edition.

19. ANSI/ANS 5.1-1979, “Decay Heat Power in Light Water Reactors,” 1979.

Table 9.2.1-1

Essential Service Water System Component Design Parameter

Essential Service Water Pumps	
Quantity	4 (2 per division)
Design Code	ASME, Section III, Class 3
Type	Turbine, Vertical Wet Pit
Design Flow	75,708 L/min (20,000 gpm)
Design Pressure	10.55 kg/cm^2 G(150 psig)
Design Temperature	60 °C (140 °F)
Material of Construction	Stainless steel
Safe Class	3
Electrical Class	Class 1E
Essential Service Water Debris Filters	
Quantity	6 (3 per division)
Design Pressure	10.55kg/cm^2 G(150 psig)
Design Temperature	60 °C (140 °F)
Retention Size	0.25 cm (0.098 in)
Material of Construction	Stainless steel
Safe Class	3
Electrical Class	Class 1E
ESW Pump Discharge Isolation Valves	
Quantity	4 (2 per division)
Design Flow	75,708 L/min (20,000 gpm)
Design Pressure	10.55 kg/cm^2 G(150 psig)
Design Temperature	60 °C (140 °F)
Material of Construction	Stainless steel
Safe Class	3
Electrical Class	Class 1E

Table 9.2.1-2

Essential Service Water System Failure Modes and Effects Analysis

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
ESW Pumps PP01A, PP01B, PP02A, PP02B	One pump inoperable/ mechanical or electrical failure	None; a redundant pump is available.	Motor status and flow indication in the MCR	Two redundant divisions are provided.
ESW debris filters and backwash isolation valves FT01A, FT01B, FT02A, FT02B, FT03A, FT03B, V3101, V3103	One debris filter or one backwash isolation valve is inoperable in a mechanical or electrical failure	None; a redundant debris filter and backwash isolation valve are available.	Debris filters differential pressure is alarmed in MCR	Two redundant divisions are provided, and debris filters and valves are operated manually.
Check valve in pump discharge V1001, V1002, V1003, V1004	Check valve stays closed/mechanical failure	None; a redundant division is available.	Flow and pressure indication in MCR	Two redundant divisions are provided.

Table 9.2.2-1

CCWS Water Quality Specifications

Parameter	Range
pH	8.5 ~ 10.5
Chloride	0 ~ 10 ppm
Fluoride	0 ~ 10 ppm
Sulfate	0 ~ 10 ppm
Total dissolved solids	≤ 0.5 ppm
Corrosion inhibitors (sodium nitrite/borate)	500~1,000 ppm NO_2^-
Benzotriazole or tolyltriazole (ferrous/copper systems only)	5 ~ 30 ppm
Radioactivity	Not detectable

Table 9.2.2-2

Component Cooling Water System Failure Modes and Effect Analysis

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
CCW pump CC-PP01A CC-PP01B CC-PP01C CC-PP01D	One pump inoperable/ mechanical or electrical failure	Loss of flow in one division None; two pumps are available per division.	Motor status and flow indication in the MCR	The idle CCW pump in the respective loop automatically starts on a low pump discharge pressure signal. Redundant loop/division is provided. One operable loop is capable of providing 100 % of required heat duty under accident conditions.
CCW makeup pump CC-PP03A CC-PP03B	One pump inoperable/ mechanical or electrical failure	Loss of makeup flow to one division None; redundant division is available.	Surge tank level low alarm in the MCR	Low-low signal of the surge tank closes the cooling water supply to nonessential. Redundant division is provided.
Nonessential supply header isolation valve CC-0143 CC-0144 CC-0145 CC-0146	Valve fails to close/ mechanical or electrical failure	None; two isolation valves are provided in series.	Valve position and/or flow indication in the MCR	Two isolation valves are provided in series.
Nonessential return header isolation valve CC-0147 CC-0148 CC-0149 CC-0150	Valve fails to close/ mechanical or electrical failure	None; two isolation valves are provided in series.	Valve position and/or flow indication in the MCR	Two isolation valves are provided in series.
Containment spray heat exchanger isolation valve CC-097 CC-098	Valve fails to open/ mechanical or electrical failure	None; redundant division (each containment spray heat exchanger is sized to transfer the maximum heat load) is available.	Valve position and/or flow indication in the MCR	Redundant containment spray heat exchanger is sized to transfer the maximum containment spray heat load.
Shutdown cooling heat exchanger isolation valve CC-0351 CC-0352	Valve fails to open/ mechanical or electrical failure	None; redundant division is available.	Valve position and/or flow indication in the MCR	Redundant division is provided.

Table 9.2.2-3A (1 of 7)

Typical Component Cooling Water System Heat Loads and Flow Requirements (International System Unit)

Normal Operation				
Component	Div. I		Div. II	
	Heat load (MW)	Flow (L/min)	Heat load (MW)	Flow (L/min)
Containment Spray Heat Exchangers	-	-	-	-
Shutdown Cooling Heat Exchangers	-	-	-	-
Containment Spray Mini-Flow Heat Exchangers	-	757	-	757
Shutdown Cooling Mini-Flow Heat Exchangers	-	2,006	-	2,006
Essential Chiller Condensers	4.10	10,599	4.10	10,599
Emergency Diesel Generator Coolers A/B	5.83 (4)	9,085 (4)	5.83 (4)	9,085 (4)
Emergency Diesel Generator Coolers C/D	-	-	-	-
Spent Fuel Pool Cooling Heat Exchangers (1)	6.97	13,249	6.97	13,249
Central Chiller Condensers (2)	9.37	24,227	9.37	24,227
Charging Pump Mini-Flow Heat Exchanger	0.56	1,703	-	-
Letdown Heat Exchanger	6.82	5,678	-	-
Gas Stripper	1.76	1,893	-	-
RCP and RCP Motor Coolers (3)	2.29	6,700	-	-
Radiation Monitoring # 104	0.001	76	-	-
Post Accident Primary Sample Cooler Rack	-	-	-	-
Boric Acid Concentrator	-	-	3.35	2,650
Condensate Receiver Tank Vent Condenser	-	-	0.70	795
Radiation Monitoring # 103	-	-	0.001	76
Compound Building Chiller Condensers	-	-	2.17	5,602
LRS Seal Water Heat Exchanger	-	-	0.03	369
Normal Primary Sample Cooler Rack	-	-	0.37	397
GRS Chiller Skid	-	-	0.01	61
Secondary Sample Cooler Rack	-	-	0.85	1,098
Secondary Sample Chiller	-	-	0.03	87
Total	37.70	75,973	33.78	71,058

Table 9.2.2-3A (2 of 7)

Shutdown Operation (3.5 hr after Reactor Shutdown)				
Component	Div. I		Div. II	
	Heat load (MW)	Flow (L/min)	Heat load (MW)	Flow (L/min)
Containment Spray Heat Exchangers	-	-	-	-
Shutdown Cooling Heat Exchangers	47.15	41,640	47.15	41,640
Containment Spray Mini-Flow Heat Exchangers	-	757	-	757
Shutdown Cooling Mini-Flow Heat Exchangers	2.93	2,006	2.93	2,006
Essential Chiller Condensers	4.10	10,599	4.10	10,599
Emergency Diesel Generator Coolers A/B	-	-	-	-
Emergency Diesel Generator Coolers C/D	-	-	-	-
Spent Fuel Pool Cooling Heat Exchangers (1)	6.97	13,249	6.97	13,249
Central Chiller Condensers (2)	9.37	24,227	9.37	24,227
Charging Pump Mini-Flow Heat Exchanger	0.56	1,703	-	-
Letdown Heat Exchanger	6.82	5,678	-	-
Gas Stripper	-	1,893	-	-
RCP and RCP Motor Coolers (3)	2.29	6,700	-	-
Radiation Monitoring # 104	0.001	76	-	-
Post Accident Primary Sample Cooler Rack	-	-	-	-
Boric Acid Concentrator	-	-	-	2,650
Condensate Receiver Tank Vent Condenser	-	-	0.70	795
Radiation Monitoring # 103	-	-	0.001	76
Compound Building Chiller Condensers	-	-	2.17	5,602
LRS Seal Water Heat Exchanger	-	-	0.03	369
Normal Primary Sample Cooler Rack	-	-	0.37	397
GRS Chiller Skid	-	-	0.01	61
Secondary Sample Cooler Rack	-	-	0.85	1,098
Secondary Sample Chiller	-	-	0.03	87
Total	80.20	108,528	74.68	103,612

Table 9.2.2-3A (3 of 7)

Refueling Operation				
Component	Div. I		Div. II	
	Heat load (MW)	Flow (L/min)	Heat load (MW)	Flow (L/min)
Containment Spray Heat Exchangers	-	-	-	-
Shutdown Cooling Heat Exchangers	-	379	-	379
Containment Spray Mini-Flow Heat Exchangers	-	757	-	757
Shutdown Cooling Mini-Flow Heat Exchangers	0.29	2,006	0.29	2,006
Essential Chiller Condensers	4.10	10,599	4.10	10,599
Emergency Diesel Generator Coolers A/B	-	-	-	-
Emergency Diesel Generator Coolers C/D	-	-	-	-
Spent Fuel Pool Cooling Heat Exchangers (1)	17.40	13,249	17.40	13,249
Central Chiller Condensers (2)	9.37	24,227	9.37	24,227
Charging Pump Mini-Flow Heat Exchanger	-	1,703	-	-
Letdown Heat Exchanger	-	5,678	-	-
Gas Stripper	1.76	1,893	-	-
RCP and RCP Motor Coolers (3)	-	6,700	-	-
Radiation Monitoring # 104	0.001	76	-	-
Post Accident Primary Sample Cooler Rack	-	-	-	-
Boric Acid Concentrator	-	-	3.35	2,650
Condensate Receiver Tank Vent Condenser	-	-	-	-
Radiation Monitoring # 103	-	-	0.001	76
Compound Building Chiller Condensers	-	-	2.17	5,602
LRS Seal Water Heat Exchanger	-	-	0.03	369
Normal Primary Sample Cooler Rack	-	-	0.37	397
GRS Chiller Skid	-	-	0.01	61
Secondary Sample Cooler Rack	-	-	0.85	1,098
Secondary Sample Chiller	-	-	0.03	87
Total	32.92	67,267	37.97	61,556

Table 9.2.2-3A (4 of 7)

Design Basis Accident (SIAS)				
Component	Div. I		Div. II	
	Heat load (MW)	Flow (L/min)	Heat load (MW)	Flow (L/min)
Containment Spray Heat Exchangers	-	30,283 (5)	-	30,283 (5)
Shutdown Cooling Heat Exchangers	-	-	-	-
Containment Spray Mini-Flow Heat Exchangers	0.59	757	0.59	757
Shutdown Cooling Mini-Flow Heat Exchangers	-	2,006	-	2,006
Essential Chiller Condensers	4.10	10,599	4.10	10,599
Emergency Diesel Generator Coolers A/B	5.83	9,085	5.83	9,085
Emergency Diesel Generator Coolers C/D	4.72	7,306	4.72	7,306
Spent Fuel Pool Cooling Heat Exchangers (1)	6.97	13,249	6.97	13,249
Central Chiller Condensers (2)	-	-	-	-
Charging Pump Mini-Flow Heat Exchanger	-	-	-	-
Letdown Heat Exchanger	-	-	-	-
Gas Stripper	-	-	-	-
RCP and RCP Motor Coolers (3)	2.29	6,700	-	-
Radiation Monitoring # 104	-	-	-	-
Post Accident Primary Sample Cooler Rack	-	-	0.15	76
Boric Acid Concentrator	-	-	-	-
Condensate Receiver Tank Vent Condenser	-	-	-	-
Radiation Monitoring # 103	-	-	-	-
Compound Building Chiller Condensers	-	-	-	-
LRS Seal Water Heat Exchanger	-	-	-	-
Normal Primary Sample Cooler Rack	-	-	-	-
GRS Chiller Skid	-	-	-	-
Secondary Sample Cooler Rack	-	-	-	-
Secondary Sample Chiller	-	-	-	-
Total	24.49	79,986	22.35	73,361

Table 9.2.2-3A (5 of 7)

Design Basis Accident (CSAS)				
Component	Div. I		Div. II	
	Heat load (MW)	Flow (L/min)	Heat load (MW)	Flow (L/min)
Containment Spray Heat Exchangers	31.57	30,283	31.57	30,283
Shutdown Cooling Heat Exchangers	-	-	-	-
Containment Spray Mini-Flow Heat Exchangers	0.59	757	0.59	757
Shutdown Cooling Mini-Flow Heat Exchangers	-	2,006	-	2,006
Essential Chiller Condensers	4.10	10,599	4.10	10,599
Emergency Diesel Generator Coolers A/B	5.83	9,085	5.83	9,085
Emergency Diesel Generator Coolers C/D	4.72	7,306	4.72	7,306
Spent Fuel Pool Cooling Heat Exchangers (1)	6.97	13,249	6.97	13,249
Central Chiller Condensers (2)	-	-	-	-
Charging Pump Mini-Flow Heat Exchanger	-	-	-	-
Letdown Heat Exchanger	-	-	-	-
Gas Stripper	-	-	-	-
RCP and RCP Motor Coolers (3)	2.29	6,700	-	-
Radiation Monitoring # 104	-	-	-	-
Post Accident Primary Sample Cooler Rack	-	-	0.15	76
Boric Acid Concentrator	-	-	-	-
Condensate Receiver Tank Vent Condenser	-	-	-	-
Radiation Monitoring # 103	-	-	-	-
Compound Building Chiller Condensers	-	-	-	-
LRS Seal Water Heat Exchanger	-	-	-	-
Normal Primary Sample Cooler Rack	-	-	-	-
GRS Chiller Skid	-	-	-	-
Secondary Sample Cooler Rack	-	-	-	-
Secondary Sample Chiller	-	-	-	-
Total	56.07	79,986	53.92	73,361

Table 9.2.2-3A (6 of 7)

Safe Shutdown Operation				
Component	Div. I		Div. II	
	Heat load (MW)	Flow (L/min)	Heat load (MW)	Flow (L/min)
Containment Spray Heat Exchangers	-	-	-	-
Shutdown Cooling Heat Exchangers	80.66	41,640	80.66	41,640
Containment Spray Mini-Flow Heat Exchangers	-	757	-	757
Shutdown Cooling Mini-Flow Heat Exchangers	3.69	2,006	3.69	2,006
Essential Chiller Condensers	4.10	10,599	4.10	10,599
Emergency Diesel Generator Coolers A/B	5.83	9,085	5.83	9,085
Emergency Diesel Generator Coolers C/D	4.72	7,306	4.72	7,306
Spent Fuel Pool Cooling Heat Exchangers (1)	6.97	13,249	6.97	13,249
Central Chiller Condensers (2)	-	-	-	-
Charging Pump Mini-Flow Heat Exchanger	-	-	-	-
Letdown Heat Exchanger	-	-	-	-
Gas Stripper	-	-	-	-
RCP and RCP Motor Coolers(3)	-	-	-	-
Radiation Monitoring # 104	-	-	-	-
Post Accident Primary Sample Cooler Rack	-	-	-	-
Boric Acid Concentrator	-	-	-	-
Condensate Receiver Tank Vent Condenser	-	-	-	-
Radiation Monitoring # 103	-	-	-	-
Compound Building Chiller Condensers	-	-	-	-
LRS Seal Water Heat Exchanger	-	-	-	-
Normal Primary Sample Cooler Rack	-	-	-	-
GRS Chiller Skid	-	-	-	-
Secondary Sample Cooler Rack	-	-	-	-
Secondary Sample Chiller	-	-	-	-
Total	105.96	84,642	105.96	84,642

Table 9.2.2-3A (7 of 7)

(1) One of two spent fuel pool cooling heat exchangers for both divisions operates for all operation.

(2) Three of four central chiller condensers for both divisions operate for all operation except the design basis accident. Data apply to the two central chiller condensers in each division.

(3) Each RCP cooler consists of two RCP motor oil coolers, two RCP motor air coolers, one RCP oil cooler, and one RCP high-pressure cooler. The value listed is a total quantity for 4 RCP coolers.

(4) The listed heat load and flow for the emergency diesel generator in normal operation apply for only test period and the test is performed one by one.

(5) The flow is served as bypass line for overflow of cooling water.

Table 9.2.2-3B (1 of 7)

Typical Component Cooling Water System Heat Loads and Flow Requirements (British Unit)

Normal Operation				
Component	Div. I		Div. II	
	Heat load (MBtu/hr)	Flow (gpm)	Heat load (MBtu/hr)	Flow (gpm)
Containment Spray Heat Exchangers	-	-	-	-
Shutdown Cooling Heat Exchangers	-	-	-	-
Containment Spray Mini-Flow Heat Exchangers	-	200	-	200
Shutdown Cooling Mini-Flow Heat Exchangers	-	530	-	530
Essential Chiller Condensers	14.00	2,800	14.00	2,800
Emergency Diesel Generator Coolers A/B	19.90 (4)	2,400 (4)	19.90 (4)	2,400 (4)
Emergency Diesel Generator Coolers C/D	-	-	-	-
Spent Fuel Pool Cooling Heat Exchangers (1)	23.80	3,500	23.80	3,500
Central Chiller Condensers (2)	32.00	6,400	32.00	6,400
Charging Pump Mini-Flow Heat Exchanger	1.90	450	-	-
Letdown Heat Exchanger	23.30	1,500	-	-
Gas Stripper	6.00	500	-	-
RCP and RCP Motor Coolers (3)	7.83	1,770	-	-
Radiation Monitoring # 104	0.003	20	-	-
Post Accident Primary Sample Cooler Rack	-	-	-	-
Boric Acid Concentrator	-	-	11.43	700
Condensate Receiver Tank Vent Condenser	-	-	2.40	210
Radiation Monitoring # 103	-	-	0.003	20
Compound Building Chiller Condensers	-	-	7.40	1,480
LRS Seal Water Heat Exchanger	-	-	0.10	98
Normal Primary Sample Cooler Rack	-	-	1.25	105
GRS Chiller Skid	-	-	0.04	16
Secondary Sample Cooler Rack	-	-	2.90	290
Secondary Sample Chiller	-	-	0.11	23
Total	128.73	20,070	115.33	18,772

Table 9.2.2-3B (2 of 7)

Shutdown Operation (3.5 hr after Reactor Shutdown)				
Component	Div. I		Div. II	
	Heat load (MBtu/hr)	Flow (gpm)	Heat load (MBtu/hr)	Flow (gpm)
Containment Spray Heat Exchangers	-	-	-	-
Shutdown Cooling Heat Exchangers	161.00	11,000	161.00	11,000
Containment Spray Mini-Flow Heat Exchangers	-	200	-	200
Shutdown Cooling Mini-Flow Heat Exchangers	10.00	530	10.00	530
Essential Chiller Condensers	14.00	2,800	14.00	2,800
Emergency Diesel Generator Coolers A/B	-	-	-	-
Emergency Diesel Generator Coolers C/D	-	-	-	-
Spent Fuel Pool Cooling Heat Exchangers (1)	23.80	3,500	23.80	3,500
Central Chiller Condensers (2)	32.00	6,400	32.00	6,400
Charging Pump Mini-Flow Heat Exchanger	1.90	450	-	-
Letdown Heat Exchanger	23.30	1,500	-	-
Gas Stripper	-	500	-	-
RCP and RCP Motor Coolers (3)	7.83	1,770	-	-
Radiation Monitoring # 104	0.003	20	-	-
Post Accident Primary Sample Cooler Rack	-	-	-	-
Boric Acid Concentrator	-	-	-	700
Condensate Receiver Tank Vent Condenser	-	-	2.40	210
Radiation Monitoring # 103	-	-	0.003	20
Compound Building Chiller Condensers	-	-	7.40	1,480
LRS Seal Water Heat Exchanger	-	-	0.10	98
Normal Primary Sample Cooler Rack	-	-	1.25	105
GRS Chiller Skid	-	-	0.04	16
Secondary Sample Cooler Rack	-	-	2.90	290
Secondary Sample Chiller	-	-	0.11	23
Total	273.83	28,670	255.00	27,372

Table 9.2.2-3B (3 of 7)

Refueling Operation				
Component	Div. I		Div. II	
	Heat load (MBtu/hr)	Flow (gpm)	Heat load (MBtu/hr)	Flow (gpm)
Containment Spray Heat Exchangers	-	-	-	-
Shutdown Cooling Heat Exchangers	-	100	-	100
Containment Spray Mini-Flow Heat Exchangers	-	200	-	200
Shutdown Cooling Mini-Flow Heat Exchangers	1.00	530	1.00	530
Essential Chiller Condensers	14.00	2,800	14.00	2,800
Emergency Diesel Generator Coolers A/B	-	-	-	-
Emergency Diesel Generator Coolers C/D	-	-	-	-
Spent Fuel Pool Cooling Heat Exchangers (1)	59.40	3,500	59.40	3,500
Central Chiller Condensers (2)	32.00	6,400	32.00	6,400
Charging Pump Mini-Flow Heat Exchanger	-	450	-	-
Letdown Heat Exchanger	-	1,500	-	-
Gas Stripper	6.00	500	-	-
RCP and RCP Motor Coolers (3)	-	1,770	-	-
Radiation Monitoring # 104	0.003	20	-	-
Post Accident Primary Sample Cooler Rack	-	-	-	-
Boric Acid Concentrator	-	-	11.43	700
Condensate Receiver Tank Vent Condenser	-	-	-	-
Radiation Monitoring # 103	-	-	0.003	20
Compound Building Chiller Condensers	-	-	7.40	1,480
LRS Seal Water Heat Exchanger	-	-	0.10	98
Normal Primary Sample Cooler Rack	-	-	1.25	105
GRS Chiller Skid	-	-	0.04	16
Secondary Sample Cooler Rack	-	-	2.90	290
Secondary Sample Chiller	-	-	0.11	23
Total	112.40	17,770	129.63	16,262

Table 9.2.2-3B (4 of 7)

Design Basis Accident (SIAS)				
Component	Div. I		Div. II	
	Heat load (MBtu/hr)	Flow (gpm)	Heat load (MBtu/hr)	Flow (gpm)
Containment Spray Heat Exchangers	-	8,000 (5)	-	8,000 (5)
Shutdown Cooling Heat Exchangers	-	-	-	-
Containment Spray Mini-Flow Heat Exchangers	2.00	200	2.00	200
Shutdown Cooling Mini-Flow Heat Exchangers	-	530	-	530
Essential Chiller Condensers	14.00	2,800	14.00	2,800
Emergency Diesel Generator Coolers A/B	19.90	2,400	19.90	2,400
Emergency Diesel Generator Coolers C/D	16.10	1,930	16.10	1,930
Spent Fuel Pool Cooling Heat Exchangers (1)	23.80	3,500	23.80	3,500
Central Chiller Condensers (2)	-	-	-	-
Charging Pump Mini-Flow Heat Exchanger	-	-	-	-
Letdown Heat Exchanger	-	-	-	-
Gas Stripper	-	-	-	-
RCP and RCP Motor Coolers (3)	7.83	1,770	-	-
Radiation Monitoring # 104	-	-	-	-
Post Accident Primary Sample Cooler Rack	-	-	0.50	20
Boric Acid Concentrator	-	-	-	-
Condensate Receiver Tank Vent Condenser	-	-	-	-
Radiation Monitoring # 103	-	-	-	-
Compound Building Chiller Condensers	-	-	-	-
LRS Seal Water Heat Exchanger	-	-	-	-
Normal Primary Sample Cooler Rack	-	-	-	-
GRS Chiller Skid	-	-	-	-
Secondary Sample Cooler Rack	-	-	-	-
Secondary Sample Chiller	-	-	-	-
Total	83.63	21,130	76.30	19,380

Table 9.2.2-3B (5 of 7)

Design Basis Accident (CSAS)				
Component	Div. I		Div. II	
	Heat load (MBtu/hr)	Flow (gpm)	Heat load (MBtu/hr)	Flow (gpm)
Containment Spray Heat Exchangers	107.80	8,000	107.80	8,000
Shutdown Cooling Heat Exchangers	-	-	-	-
Containment Spray Mini-Flow Heat Exchangers	2.00	200	2.00	200
Shutdown Cooling Mini-Flow Heat Exchangers	-	530	-	530
Essential Chiller Condensers	14.00	2,800	14.00	2,800
Emergency Diesel Generator Coolers A/B	19.90	2,400	19.90	2,400
Emergency Diesel Generator Coolers C/D	16.10	1,930	16.10	1,930
Spent Fuel Pool Cooling Heat Exchangers (1)	23.80	3,500	23.80	3,500
Central Chiller Condensers (2)	-	-	-	-
Charging Pump Mini-Flow Heat Exchanger	-	-	-	-
Letdown Heat Exchanger	-	-	-	-
Gas Stripper	-	-	-	-
RCP and RCP Motor Coolers (3)	7.83	1,770	-	-
Radiation Monitoring # 104	-	-	-	-
Post Accident Primary Sample Cooler Rack	-	-	0.50	20
Boric Acid Concentrator	-	-	-	-
Condensate Receiver Tank Vent Condenser	-	-	-	-
Radiation Monitoring # 103	-	-	-	-
Compound Building Chiller Condensers	-	-	-	-
LRS Seal Water Heat Exchanger	-	-	-	-
Normal Primary Sample Cooler Rack	-	-	-	-
GRS Chiller Skid	-	-	-	-
Secondary Sample Cooler Rack	-	-	-	-
Secondary Sample Chiller	-	-	-	-
Total	191.43	21,130	184.10	19,380

Table 9.2.2-3B (6 of 7)

Safe Shutdown Operation				
Component	Div. I		Div. II	
	Heat load (MBtu/hr)	Flow (gpm)	Heat load (MBtu/hr)	Flow (gpm)
Containment Spray Heat Exchangers	-	-	-	-
Shutdown Cooling Heat Exchangers	275.40	11,000	275.40	11,000
Containment Spray Mini-Flow Heat Exchangers	-	200	-	200
Shutdown Cooling Mini-Flow Heat Exchangers	12.60	530	12.60	530
Essential Chiller Condensers	14.00	2,800	14.00	2,800
Emergency Diesel Generator Coolers A/B	19.90	2,400	19.90	2,400
Emergency Diesel Generator Coolers C/D	16.10	1,930	16.10	1,930
Spent Fuel Pool Cooling Heat Exchangers (1)	23.80	3,500	23.80	3,500
Central Chiller Condensers (2)	-	-	-	-
Charging Pump Mini-Flow Heat Exchanger	-	-	-	-
Letdown Heat Exchanger	-	-	-	-
Gas Stripper	-	-	-	-
RCP and RCP Motor Coolers (3)	-	-	-	-
Radiation Monitoring # 104	-	-	-	-
Post Accident Primary Sample Cooler Rack	-	-	-	-
Boric Acid Concentrator	-	-	-	-
Condensate Receiver Tank Vent Condenser	-	-	-	-
Radiation Monitoring # 103	-	-	-	-
Compound Building Chiller Condensers	-	-	-	-
LRS Seal Water Heat Exchanger	-	-	-	-
Normal Primary Sample Cooler Rack	-	-	-	-
GRS Chiller Skid	-	-	-	-
Secondary Sample Cooler Rack	-	-	-	-
Secondary Sample Chiller	-	-	-	-
Total	361.80	22,360	361.80	22,360

Table 9.2.2-3B (7 of 7)

(1) One of two spent fuel pool cooling heat exchangers for both divisions operates for all operation.

(2) Three of four central chiller condensers for both divisions operate for all operation except the design basis accident. Data apply to the two central chiller condensers in each division.

(3) Each RCP cooler consists of two RCP motor oil coolers, two RCP motor air coolers, one RCP oil cooler, and one RCP high-pressure cooler. The value listed is a total quantity for 4 RCP coolers.

(4) The listed heat load and flow for the emergency diesel generator in normal operation apply for only test period and the test is performed one by one.

(5) The flow is served as bypass line for overflow of cooling water.

Table 9.2.2-4 (1 of 2)

Component Cooling Water System Component Design Parameters

Component Cooling Water Pumps	
Number	4 (2 per division)
Design Code	ASME Section III, Class 3
Type	Centrifugal, Horizontal
Design Pressure	17.58 kg/cm^{2}G (250 psig)
Design Temperature	93.3 °C (200 °F)
Material of Construction	Carbon Steel Casing Stainless Steel Impeller
Design Flow	94,635 L/min (25,000 gpm)
TDH	86.87 m (285 ft)
Component Cooling Water Heat Exchangers	
Number	6 (3 per division)
Design Code	ASME, Section III, Class 3
Type	Plate
Heat Load	18.86 × 10^6 W (64.4 × 10^6 Btu/hr)
Hot Side	
Fluid	Component Cooling Water
Design Pressure	17.58 kg/cm^{2}G(250 psig)
Design Temperature	93.3 °C (200 °F)
Design Flow	43,532 L/min (11,500 gpm)
Temperature, Out	35 °C (95 °F)
Number of Passes	1
Material of Construction	Titanium
Cold Side	
Fluid	Essential Service Water
Design Pressure	7.74 kg/cm^{2}G (110 psig)
Design Temperature	60 °C (140 °F)
Design Flow	[35,962 L/min (9,500 gpm)]
Temperature, In	32.1 °C (89.8 °F)
Number of Passes	1
Material of Construction	Titanium

Table 9.2.2-4 (2 of 2)

Component Cooling Water Surge Tanks	
Number	2 (1 per division)
Design Code	ASME Section III, Class 3
Type	32,200 L (8,500 gal)
Design Pressure	-0.21 kg/cm^{2}G (-3 psig) (vacuum) /0.21 kg/cm^{2}G (3 psig)
Design Temperature	93.3 °C (200 °F)
Material of Construction	Carbon Steel
Component Cooling Makeup Pumps	
Number	2 (1 per division)
Design Code	ASME, Section III, Class 3
Type	Centrifugal, Horizontal
Design Pressure	17.58 kg/cm^{2}G (250 psig)
Design Temperature	65.6 °C (150 °F)
Design Flow	1,060 L/min (280 gpm)
Material of Construction	Carbon Steel Casing Stainless Steel Impeller
Component Cooling Water Chemical Addition Tanks	
Number	2 (1 per division)
Design Code	ASME Section VIII
Total Volume	284 L (75 gal)
Design Pressure	17.58 kg/cm^{2}G (250 psig)
Design Temperature	93.3 °C (200 °F)
Material of Construction	Carbon Steel

Table 9.2.2-5 (1 of 3)

Component Cooling Water System Active Valves

Valve Number	Safety Function[(1)(2)(3)]	Valve Type	ASME Section III Code Class	Actuator Type
CC-V-0011	Operate	Globe	3	Electric Motor
CC-V-0012	Operate	Globe	3	Electric Motor
CC-V-0021	Open	Butterfly	3	Electric Motor
CC-V-0022	Open	Butterfly	3	Electric Motor
CC-V-0023	Open	Butterfly	3	Electric Motor
CC-V-0024	Open	Butterfly	3	Electric Motor
CC-V-0025	Open	Butterfly	3	Electric Motor
CC-V-0026	Open	Butterfly	3	Electric Motor
CC-V-0027	Close	Butterfly	3	Electric Motor
CC-V-0028	Close	Butterfly	3	Electric Motor
CC-V-0031	Open	Butterfly	3	Electric Motor
CC-V-0032	Open	Butterfly	3	Electric Motor
CC-V-0033	Open	Butterfly	3	Electric Motor
CC-V-0034	Open	Butterfly	3	Electric Motor
CC-V-0035	Open	Butterfly	3	Electric Motor
CC-V-0036	Open	Butterfly	3	Electric Motor
CC-V-0037	Close	Butterfly	3	Electric Motor
CC-V-0038	Close	Butterfly	3	Electric Motor
CC-V-0097	Open	Butterfly	3	Electric Motor
CC-V-0098	Open	Butterfly	3	Electric Motor
CC-V-0131	Operate	Butterfly	3	Electric Motor
CC-V-0132	Operate	Butterfly	3	Electric Motor
CC-V-0143	Close	Butterfly	3	Electric Motor
CC-V-0144	Close	Butterfly	3	Electric Motor
CC-V-0145	Close	Butterfly	3	Electric Motor
CC-V-0146	Close	Butterfly	3	Electric Motor
CC-V-0147	Close	Butterfly	3	Electric Motor

Table 9.2.2-5 (2 of 3)

Valve Number	Safety Function	Valve Type	ASME Section III Code Class	Actuator Type
CC-V-0148	Close	Butterfly	3	Electric Motor
CC-V-0149	Close	Butterfly	3	Electric Motor
CC-V-0150	Close	Butterfly	3	Electric Motor
CC-V-0181	Open	Butterfly	3	Electric Motor
CC-V-0182	Open	Butterfly	3	Electric Motor
CC-V-0191	Open	Butterfly	3	Electric Motor
CC-V-0192	Open	Butterfly	3	Electric Motor
CC-V-0231	Operate	Butterfly	2	Electric Motor
CC-V-0249	Operate	Butterfly	2	Electric Motor
CC-V-0250	Operate	Butterfly	2	Electric Motor
CC-V-0296	Close	Butterfly	2	Electric Motor
CC-V-0297	Close	Butterfly	2	Electric Motor
CC-V-0301	Close	Butterfly	2	Electric Motor
CC-V-0302	Close	Butterfly	2	Electric Motor
CC-V-0351	Close	Butterfly	3	Electric Motor
CC-V-0352	Close	Butterfly	3	Electric Motor
CC-V-0383	Operate	Butterfly	3	Electric Motor
CC-V-0384	Operate	Butterfly	3	Electric Motor
CC-V-0389	Open	Butterfly	3	Electric Motor
CC-V-0390	Open	Butterfly	3	Electric Motor
CC-V-0901	Operate	3Way	3	Pneumatic
CC-V-0902	Operate	3Way	3	Pneumatic
CC-V-0905	Operate	3Way	3	Pneumatic
CC-V-0906	Operate	3Way	3	Pneumatic
CC-V-1001	Operate	Swing Check	3	None
CC-V-1002	Operate	Swing Check	3	None
CC-V-1003	Operate	Swing Check	3	None
CC-V-1004	Operate	Swing Check	3	None
CC-V-1099	Operate	Swing Check	2	None
CC-V-1100	Operate	Swing Check	2	None

Table 9.2.2-5 (3 of 3)

Valve Number	Safety Function	Valve Type	ASME Section III Code Class	Actuator Type
CC-V-1107	Operate	Relief	3	None
CC-V-1108	Operate	Relief	3	None
CC-V-1109	Operate	Swing Check	3	None
CC-V-1110	Operate	Swing Check	3	None
CC-V-1111	Operate	Relief	3	None
CC-V-1112	Operate	Relief	3	None
CC-V-1303	Operate	Swing Check	3	None
CC-V-1304	Operate	Swing Check	3	None
CC-V-1309	Operate	Swing Check	3	None
CC-V-1310	Operate	Swing Check	3	None
CC-V-1317	Operate	Swing Check	3	None
CC-V-1318	Operate	Swing Check	3	None
CC-V-1319	Operate	Swing Check	3	None
CC-V-1320	Operate	Swing Check	3	None
CC-V-1325	Operate	Swing Check	3	None
CC-V-1326	Operate	Swing Check	3	None
CC-V-1685	Operate	Swing Check	2	None
CC-V-1686	Operate	Swing Check	2	None

(1) “Operate” is defined as valve being capable of both opening and closing.

(2) “Close” is defined as valve being capable of moving to or maintaining a closed position.

(3) “Open” is defined as valve being capable of moving to or maintaining an open position.

Table 9.2.2-6 (1 of 3)

Component Cooling Water System Emergency Power Requirements

CCWS Pump Motors	
Motor	Train
CCW Pump Motor 1A	A
CCW Pump Motor 1B	B
CCW Pump Motor 2A	C
CCW Pump Motor 2B	D
CCWS Motor-Operated Valves	
Valve	Train
CC-V-0011	C
CC-V-0012	D
CC-V-0021	A
CC-V-0022	B
CC-V-0023	A
CC-V-0024	B
CC-V-0025	A
CC-V-0026	B
CC-V-0027	A
CC-V-0028	B
CC-V-0031	C
CC-V-0032	D
CC-V-0033	C
CC-V-0034	D
CC-V-0035	C
CC-V-0036	D
CC-V-0037	C
CC-V-0038	D
CC-V-0097	C
CC-V-0098	D
CC-V-0131	C
CC-V-0132	D

Table 9.2.2-6 (2 of 3)

CCWS Motor-Operated Valves (Cont'd)	
Valve	Train
CC-V-0143	A
CC-V-0144	B
CC-V-0145	C
CC-V-0146	D
CC-V-0147	C
CC-V-0148	D
CC-V-0149	A
CC-V-0150	B
CC-V-0181	C
CC-V-0182	D
CC-V-0191	A
CC-V-0192	B
CC-V-0231	C
CC-V-0249	A
CC-V-0250	C
CC-V-0296	A
CC-V-0297	B
CC-V-0301	B
CC-V-0302	A
CC-V-0351	A
CC-V-0352	B
CC-V-0383	A
CC-V-0384	B
CC-V-0389	A
CC-V-0390	B
CC-V-1037	A
CC-V-1038	B
CC-V-1039	C
CC-V-1040	D

Table 9.2.2-6 (3 of 3)

Component Cooling Water System Controls	
Controls	Channel
CCW Pump 1A Start/Stop	A
CCW Pump 1B Start/Stop	B
CCW Pump 2A Start/Stop	C
CCW Pump 2B Start/Stop	D
CCW Heat Exchanger 1A Outlet Jogging Control Valve CC-V-021, Position Control	A
CCW Heat Exchanger 1B Outlet Jogging Control Valve CC-V-022, Position Control	B
CCW Heat Exchanger 2A Outlet Jogging Control Valve CC-V-023, Position Control	A
CCW Heat Exchanger 2B Outlet Jogging Control Valve CC-V-024, Position Control	B
CCW Heat Exchanger 3A Outlet Jogging Control Valve CC-V-025, Position Control	A
CCW Heat Exchanger 3B Outlet Jogging Control Valve CC-V-026, Position Control	B
CCW Heat Exchanger 1A Outlet Jogging Control Valve CC-V-031, Position Control	C
CCW Heat Exchanger 1B Outlet Jogging Control Valve CC-V-032, Position Control	D
CCW Heat Exchanger 2A Outlet Jogging Control Valve CC-V-033, Position Control	C
CCW Heat Exchanger 2B Outlet Jogging Control Valve CC-V-034, Position Control	D
CCW Heat Exchanger 3A Outlet Jogging Control Valve CC-V-035, Position Control	C
CCW Heat Exchanger 3B Outlet Jogging Control Valve CC-V-036, Position Control	D

Table 9.2.4-1

Domestic Water and Sanitary Water Systems Component Data

Hydropneumatic Tank	
Quantity	1
Type	Cylindrical
Capacity	25,363 L/min (6,700 gpm)
Usable water volume	1,325 L (350 gal)
Design pressure	10.5 kg/cm^{2}G (150 psig)
Design temperature	40 °C (104 °F)
Vessel material	ASTM A240 TP304
Domestic Water Pumps	
Quantity	2
Type	Centrifugal
Capacity (per each)	1,325 L/min (350 gpm)
Design head	36.6m (120 ft)

Table 9.2.5-1

Ultimate Heat Sink Maximum Head Loads for All Modes of Operation

Operation Mode	Max Heat Load (MW/MBtu/hr) per Division	Required ESW Flow (L/min/gpm) per Division	Supply Temperature to ESW (°C / °F)
Normal	37.7 / 128.7	71,923 / 19,000	≤ 32.1 / 89.8
3.5 hr after Shutdown	80.2 / 273.8	100,692 / 26,600	≤ 32.1 / 89.8
Accident			
SIAS	23.9 / 81.6	75,708 / 20,000	≤ 33.2 / 91.8
CSAS	56.1 / 191.6	75,708 / 20,000	≤ 33.2 / 91.8
Safe Shutdown	106.0 / 361.8	75,708 / 20,000	≤ 33.2 / 91.8

Table 9.2.5-2 (1 of 2)

Ultimate Heat Sink Head Loads for LOCA and Safe Shutdown with LOOP

Time after Reactor trip (hr)	Safe Shutdown (1 Division operation)		LOCA (1 Division operation)	
	(MW)	(MBtu/hr)	(MW)	(MBtu/hr)
1	21.6	73.8	44.2	150.8
2	21.6	73.8	49.8	169.9
3	21.6	73.8	52.7	180.0
4	21.6	73.8	54.4	185.7
5	21.6	73.8	55.3	188.8
6	21.6	73.8	55.8	190.5
7	21.6	73.8	56.0	191.2
8	21.6	73.8	56.1	191.6
9	21.6	73.8	56.0	191.2
10	21.6	73.8	55.8	190.6
11	21.6	73.8	55.6	189.8
12	21.6	73.8	55.3	188.8
13	21.6	73.8	55.0	187.7
14	106.0	361.8	54.6	186.6
15	105.8	361.4	54.3	185.4
16	89.3	304.8	54.0	184.2
17	71.9	245.4	53.6	183.0
18	62.6	213.9	53.2	181.8
19	57.5	196.5	52.9	180.5
20	54.7	186.6	52.5	179.4
21	52.9	180.6	52.2	178.2
22	51.7	176.6	51.9	177.1
23	50.9	173.8	51.5	175.9
24	50.3	171.8	51.2	174.9
2 days	44.8	153.1	45.9	156.8
3 days	42.1	143.7	43.2	147.5
4 days	40.2	137.4	41.4	141.5
5 days	38.9	132.9	39.8	136.0
6 days	37.9	129.5	38.8	132.4

Table 9.2.5-2 (2 of 2)

Time after Reactor trip (hr)	Safe Shutdown (1 Division operation)		LOCA (1 Division operation)	
	(MW)	(MBtu/hr)	(MW)	(MBtu/hr)
7 days	37.1	126.8	37.8	129.2
8 days	36.3	124.1	37.1	126.8
9 days	35.6	121.7	36.5	124.7
10 days	35.1	120.0	36.0	122.8
11 days	34.8	118.7	35.5	121.3
12 days	34.4	117.5	35.1	120.0
13 days	34.1	116.5	34.9	119.0
14 days	33.8	115.4	34.6	118.2
15 days	33.5	114.5	34.4	117.4
16 days	33.3	113.7	34.1	116.6
17 days	33.1	113.0	33.9	115.8
18 days	32.9	112.2	33.7	115.0
19 days	32.7	111.5	33.4	114.2
20 days	32.5	110.9	33.2	113.4
21 days	32.3	110.4	33.0	112.6
22 days	32.2	109.9	32.7	111.8
23 days	32.0	109.4	32.5	111.1
24 days	31.9	108.9	32.4	110.5
25 days	31.7	108.3	32.2	110.1
26 days	31.6	107.9	32.1	109.7
27 days	31.5	107.4	32.0	109.4
28 days	31.3	107.0	31.9	109.0
29 days	31.2	106.5	31.8	108.7
30 days	31.1	106.2	31.7	108.3
31 days	30.9	105.6	31.6	108.0
32 days	30.8	105.2	31.5	107.6
33 days	30.7	104.8	31.4	107.2
34 days	30.5	104.3	31.3	106.9
35 days	30.4	103.9	31.2	106.5
36 days	30.3	103.5	31.1	106.2

Table 9.2.5-3

Ultimate Heat Sink Design Parameters

[[UHS Cooling Towers]]	
[[Type]]	[[Wet Type, Mechanical Draft Counter Flow Linear Type Concrete Structure]]
[[Total Number of Body/Cells, ea]]	[[1 /3]]
[[Design Heat Load, MW/MBtu/hr]]	[[37.7 / 128.7 (for Normal Operation)]] [[80.2 / 273.8 (for 3.5 hours after Shutdown)]] [[106 / 361.8 (for Safe Shutdown)]] [[The UHS cooling tower is selected based on the head load of 3.5 hours after Shutdown.]]
[[Total Water Flow (cell), L/min/gpm]]	[[71,923 / 19,000 (for Normal Operation)]] [[100,692 / 26,600 (for 3.5 hours after Shutdown)]] [[75,708 / 20,000 (for Safe Shutdown)]]
[[Design Cold Water Temperature, °C/°F]	[[32.1 / 89.8 (for Normal Operation and Shutdown)]] [[33.2 / 91.8 (for Accident and Safe Shutdown)]]
[[Design Wet Bulb Temperature, °C/°F]]	[[≤ 27.2 / 81 (non-coincident) at 0% exceedance value for accident conditions]] [[≤ 26.1 / 79 at 5% exceedance value for normal plant operation]]
[[Basin Size, m (ft)]]	[[Footprint : Approx. 93.9 (308) × 30.5 (100) Depth : Approx. 5.2 (17)]]
[[Required Basin Water Volume, m^3/gal]]	[[≥ 5,110 / 1.35 × 10^6 for 72 hours (3 days)]]
[[Basin Minimum Water Level]]	[[≥ 8.2 m (27 feet) above basin bottom]]
[[Maximum Makeup Water Flow Rate, L/min/gpm]]	[[2,362 / 624]]
[[Fan and Motor, ea]]	[[One per each cell]]
[[Fan Driver per cell]]	[[250 HP]]
[[Design Air Flow per Fan, cfm]]	[[920,500]]
[[Cooling Tower Design Life]]	[[60 years]]

Table 9.2.5-4

Ultimate Heat Sink Failure Mode and Effects Analysis

Component	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
[[UHS Cooling Tower]]	[[One UHS cooling tower inoperable /mechanical or electrical failure]]	[[Loss of cooling capacity to one division None; two UHS cooling towers are available per division.]]	[[Fan status light indication in MCR]]	[[The trouble alarm of the UHS cooling tower is initiated for the operator to operate the UHS cooling tower in redundant loop/division. One operable loop is capable of removing 100 % of required heat duty under accident conditions.]]
[[UHS Makeup Water Pump]]	[[One UHS makeup water pump inoperable/mechanical or electrical failure]]	[[Loss of makeup flow to one division None; two UHS makeup water pumps are available per division.]]	[[Motor Status and flow indication in the MCR]]	[[Low-low level alarm of the UHS cooling tower basin is initiated for the operator to operate the UHS makeup water pump. Redundant division is provided.]]
[[UHS Inlet Valve and Bypass Valve]]	[[Valve fails to close/mechanical or electrical failure]]	[[None; redundant division is available]]	[[Valve position and/or flow indication in the MCR]]	[[Redundant division is provided.]]
[[UHS Makeup Water Pump Discharge Valve]]	[[Valve fails to close/mechanical or electrical failure]]	[[Valve fails to close/mechanical or electrical failure]]	[[Valve position and/or flow indication in the MCR]]	[[Redundant division is provided.]]

Table 9.2.6-1

Tank and Pump Design Parameters

Demineralized Water Storage Tank	
Quantity	1
Type	Cylindrical, Cone roof
Content fluid	Demineralized water
Design capacity	1,135,624 L (300,000 gal)
Design pressure	Atmosphere
Materials	Stainless steel
Demineralized Water Transfer Pumps	
Quantity	2
Type	Centrifugal, Horizontal
Capacity	1,514 L/min (400 gpm)
Condensate Storage Tanks	
Quantity	2
Capacity per tank	965,280 L (255,000 gal)
Material	Stainless Steel
Design/Operating Pressure	1.05 kg/cm^2G (15 psig) / 0.14 kg/cm^2G (2 psig)
Design/Operating Temperature	65.6 °C (150 °F) /40 °C (104 °F)

Table 9.2.6-2

Makeup Water Operating Specification

Parameter	Normal range	Remarks
Chloride	< 0.005 ppm	
Fluoride	< 0.005 ppm	
Total Silica	< 0.01 ppm	
Conductivity	< 0.2 μS/cm	May be as high as 1.0 if CO_2 absorption occurs.
pH	6.0 ~ 8.0	May be as low as 5.8 if CO_2 absorption occurs.
Suspended solids	< 0.05 ppm	
Sodium	< 0.003 ppm	
Sulfate	< 0.005 ppm	
Magnesium(1)	< 0.04 ppm	For primary makeup water only
Calcium plus Magnesium(1)	< 0.08 ppm	For primary makeup water only
Aluminum(1)	< 0.08 ppm	For primary makeup water only
Iron	< 0.005 ppm	For secondary makeup water only
Copper	< 0.001 ppm	For secondary makeup water only
Dissolved Oxygen	≤ 0.1 ppm	

(1) Magnesium, calcium plus magnesium, and aluminum must be less than 1 ppb (0.001 ppm) if RCS silica is in the range of 1~2 ppm.

Table 9.2.7-1 (1 of 2)

Essential Chilled Water System Component Data

1. Essential chiller

Quantity:	4 at 100 % (2 per division)
Type:	Hermetic-centrifugal
Capacity, kcal/hr (USRT):	2,814,200 (930)
Seismic Category:	I

2. Essential chilled water pump

Quantity:	4 at 100 % (2 per division)
Type:	Centrifugal, single suction
Flow rate, L/min (gpm):	8,710 (2,300)
Total differential head, m (ft):	32 (105)
Seismic Category:	I

3. Essential chilled water makeup pump

Quantity:	2 at 100 % (1 per division)
Type:	Centrifugal, single suction
Flow rate, L/min (gpm):	76 (20)
Total differential head, m (ft):	58 (190)
Seismic Category:	II

4. Essential chilled water compression tank

Quantity:	2 at 100 % (1 per division)
Type:	Horizontal
Design pressure, kg/cm^2 G (psig):	7 (100)
Capacity, L (gal):	2,460 (650)
Seismic Category:	I

5. Essential chilled water air separator

Quantity:	2 at 100 % (1 per division)
Type:	Vertical
Flow rate, L/min (gpm):	8,710 (2,300)
Seismic Category:	I

Table 9.2.7-1 (2 of 2)

6. Essential chilled water chemical additive tank

Quantity:	2 at 100 % (1 per division)
Type:	Horizontal
Capacity, L (gal):	68 (18)
Seismic Category:	II

Table 9.2.7-2 (1 of 6)

Essential Chilled Water Heat Load and Flow Rate

Div.	Components	Flow Rate, L/min (gpm)		Heat Load, kcal/hr (Btu/hr)	
		Normal Operation	Abnormal Operation	Normal Operation	Abnormal Operation
I	Control Room Supply AHU (VC-HV01A)	1,135 (300)	1,135 (300)	374,970 (1,488,000)	374,970 (1,488,000)
	Control Room Supply AHU (VC-HV01C)	1,135 (300)	1,135 (300)	- (1)	-
	EDG RM Normal Supply AHU (VD-HV11A)	129 (34)	129 (34)	42,638 (169,200)	42,638 (169,200)
	EDG RM Normal Supply AHU (VD-HV11C)	159 (42)	159 (42)	52,894 (209,900)	52,894 (209,900)
	EDG Room Emergency CC (VD-HV12A)	-	908 (240)	-	299,951 (1,190,300)
	EDG Room Emergency CC (VD-HV13A)	-	908 (240)	-	299,951 (1,190,300)
	EDG Room Emergency CC (VD-HV12C)	-	908 (240)	-	299,951 (1,190,300)
	EDG Room Emergency CC (VD-HV13C)	-	908 (240)	-	299,951 (1,190,300)
	EDG Control RM CC (VD-HV10A)	53 (14)	53 (14)	16,884 (67,000)	16,884 (67,000)
	EDG Control RM CC (VD-HV10C)	38 (10)	38 (10)	11,819 (46,900)	11,819 (46,900)
	SFP Cooling H/X RM CC (VF-HV02A)	27 (7)	27 (7)	8,442 (33,500)	8,442 (33,500)
	Class 1E SWGR 01C RM CC (VE-HV01A)	61 (16)	61 (16)	19,404 (77,000)	19,404 (77,000)
	Class 1E Load Center 01C RM CC (VE-HV02A)	72 (19)	72 (19)	23,688 (94,000)	23,688 (94,000)
	Channel A DC and IP Equip. RM CC (VE-HV03A)	148 (39)	148 (39)	49,139 (195,000)	49,139 (195,000)
	Channel C DC and IP Equip. RM CC (VE-HV04A)	197 (52)	197 (52)	65,267 (259,000)	65,267 (259,000)
	480V Class 1E MCC 01A RM CC (VE-HV06A)	11 (3)	11 (3)	2,772 (11,000)	2,772 (11,000)

(1) Dash (-) indicates no requirement.

Table 9.2.7-2 (2 of 6)

Div.	Components	Flow Rate, L/min (gpm)		Heat Load, kcal/hr (Btu/hr)	
		Normal Operation	Abnormal Operation	Normal Operation	Abnormal Operation
I	Class 1E SWGR 01A RM CC (VE-HV07A)	102 (27)	102 (27)	33,767 (134,000)	33,767 (134,000)
	Elect. Penetration (C) RM CC (VE-HV09A)	30 (8)	30 (8)	9,324 (37,000)	9,324 (37,000)
	480V Class 1E MCC 03C RM CC (VE-HV10A)	23 (6)	23 (6)	6,804 (27,000)	6,804 (27,000)
	Elect. Penetration RM (C) CC (VE-HV11A)	34 (9)	34 (9)	10,332 (41,000)	10,332 (41,000)
	Penetration MUX A RM CC (VE-HV12A)	45 (12)	45 (12)	14,616 (58,000)	14,616 (58,000)
	Elect. Penetration RM (A) CC (VE-HV13A)	27 (7)	27 (7)	8,820 (35,000)	8,820 (35,000)
	Class 1E MCC 03A RM CC (VE-HV14A)	19 (5)	19 (5)	5,292 (21,000)	5,292 (21,000)
	480V Class 1E MCC 04A RM CC (VE-HV15A)	19 (5)	19 (5)	5,292 (21,000)	5,292 (21,000)
	I&C Equip. RM (A) CC (VE-HV16A)	57 (15)	57 (15)	18,900 (75,000)	18,900 (75,000)
	I&C Equip. RM (C) CC (VE-HV17A)	80 (21)	80 (21)	25,704 (102,000)	25,704 (102,000)
	RSR CC (VE-HV18A)	53 (14)	53 (14)	16,632 (66,000)	16,632 (66,000)
	CS Pump and Mini-flow HX RM CC (VK-HV10A)	-	133 (35)	-	44,099 (175,000)
	SC Pump and Mini-flow HX RM CC (VK-HV16A)	-	110 (29)	-	36,287 (144,000)
	SI Pump RM CC (VK-HV11A)	-	125 (33)	-	41,327 (164,000)
	SI Pump RM CC (VK-HV12A)	-	125 (33)	-	41,579 (165,000)
	CCW Pump RM CC (VK-HV13A)	125 (33)	125 (33)	41,579 (165,000)	41,579 (165,000)
	CCW Pump RM CC (VK-HV14A)	129 (34)	129 (34)	41,831 (166,000)	41,831 (166,000)

Table 9.2.7-2 (3 of 6)

Div.	Components	Flow Rate, L/min (gpm)		Heat Load, kcal/hr (Btu/hr)	
		Normal Operation	Abnormal Operation	Normal Operation	Abnormal Operation
I	CS Heat Exchanger RM CC (VK-HV15A)	-	53 (14)	-	16,884 (67,000)
	SC Heat Exchanger RM CC (VK-HV17A)	-	27 (7)	-	8,820 (35,000)
	Charging Pump RM CC (VK-HV18A)	-	110 (29)	-	35,531 (141,000)
	Mechanical Penetration RM CC (VK-HV19A)	27 (7)	27 (7)	8,568 (34,000)	8,568 (34,000)
	Mechanical Penetration RM CC (VK-HV20A)	80 (21)	80 (21)	26,208 (104,000)	26,208 (104,000)
	Aux Charging Pump RM CC (VK-HV21B)	-	42 (11)	-	12,852 (51,000)
	Aux. Bldg. Controlled Area Emergency Exhaust ACU RM CC (VK-HV22A)	-	27 (7)	-	8,568 (34,000)
	Aux. Bldg. Controlled Area Emergency Exhaust ACU RM CC (VK-HV23A)	-	27 (7)	-	-
	Essential Chiller RM CC (VO-HV31A)	19 (5)	19 (5)	5,065 (20,100)	5,065 (20,100)
	Essential Chiller RM CC (VO-HV32A)	23 (6)	23 (6)	7,157 (28,400)	7,157 (28,400)
	Motor-Driven Aux Feedwater Pump RM CC (VO-HV33A)	-	133 (35)	-	43,041 (170,800)

Table 9.2.7-2 (4 of 6)

Div.	Components	Flow Rate, L/min (gpm)		Heat Load, kcal/hr (Btu/hr)	
		Normal Operation	Abnormal Operation	Normal Operation	Abnormal Operation
II	Control Room Supply AHU (VC-HV01B)	1,135 (300)	1,135 (300)	374,970 (1,488,000)	374,970 (1,488,000)
	Control Room Supply AHU (VC-HV01D)	1,135 (300)	1,135 (300)	-	-
	EDG RM Normal Supply AHU (VD-HV11B)	129 (34)	129 (34)	42,638 (169,200)	42,638 (169,200)
	EDG RM Normal Supply AHU (VD-HV11D)	159 (42)	159 (42)	52,894 (209,900)	52,894 (209,900)
	EDG Room Emergency CC (VD-HV12B)	-	908 (240)	-	299,951 (1,190,300)
	EDG Room Emergency CC (VD-HV13B)	-	908 (240)	-	299,951 (1,190,300)
	EDG Room Emergency CC (VD-HV12D)	-	908 (240)	-	299,951 (1,190,300)
	EDG Room Emergency CC (VD-HV13D)	-	908 (240)	-	299,951 (1,190,300)
	EDG Control RM CC (VD-HV10B)	53 (14)	53 (14)	16,88 (67,000)	16,884 (67,000)
	EDG Control RM CC (VD-HV10D)	38 (10)	38 (10)	11,819 (46,900)	11,819 (46,900)
	SFP Cooling H/X RM CC (VF-HV02B)	27 (7)	27 (7)	8,442 (33,500)	8,442 (33,500)
	Class 1E SWGR 01D RM CC (VE-HV01B)	61 (16)	61 (16)	19,404 (77,000)	19,404 (77,000)
	Class 1E Load Center 01D RM CC (VE-HV02B)	72 (19)	72 (19)	23,688 (94,000)	23,688 (94,000)
	Channel B DC and IP Equip. RM CC (VE-HV03B)	159 (42)	159 (42)	52,667 (209,000)	52,667 (209,000)
	Channel D DC and IP Equip. RM CC (VE-HV04B)	197 (52)	197 (52)	65,267 (259,000)	65,267 (259,000)
	480V Class 1E MCC 01B RM CC (VE-HV06B)	11 (3)	11 (3)	2,772 (11,000)	2,772 (11,000)

Table 9.2.7-2 (5 of 6)

Div.	Components	Flow Rate, L/min (gpm)		Heat Load, kcal/hr (Btu/hr)	
		Normal Operation	Abnormal Operation	Normal Operation	Abnormal Operation
II	Class 1E SWGR 01B RM CC (VE-HV07B)	136 (36)	136 (36)	42,083 (167,000)	42,083 (167,000)
	Swing Load Center Room CC (VE-HV08B)	11 (3)	11 (3)	3,528 (14,000)	3,528 (14,000)
	Elect. Penetration (D) RM CC (VE-HV09B)	30 (8)	30 (8)	9,324 (37,000)	9,324 (37,000)
	480V Class 1E MCC 03D RM CC (VE-HV10B)	19 (5)	19 (5)	6,048 (24,000)	6,048 (24,000)
	Elect. Penetration RM (D) CC (VE-HV11B)	34 (9)	34 (9)	10,332 (41,000)	10,332 (41,000)
	Penetration MUX B RM CC (VE-HV12B)	61 (16)	61 (16)	19,404 (77,000)	19,404 (77,000)
	Elect. Penetration RM (B) CC (VE-HV13B)	27 (7)	27 (7)	8,820 (35,000)	8,820 (35,000)
	480V Class 1E MCC 03B RM CC (VE-HV14B)	11 (3)	11 (3)	3,528 (14,000)	3,528 (14,000)
	480V Class 1E MCC 04B RM CC (VE-HV15B)	11 (3)	11 (3)	3,528 (14,000)	3,528 (14,000)
	I&C Equip. RM (B) CC (VE-HV16B)	76 (20)	76 (20)	25,200 (100,000)	25,200 (100,000)
	I&C Equip. RM (D) CC (VE-HV17B)	80 (21)	80 (21)	25,704 (102,000)	25,704 (102,000)
	RSR CC (VE-HV18B)	53 (14)	53 (14)	16,632 (66,000)	16,632 (66,000)
	CS Pump and Mini-flow HX RM CC (VK-HV10B)	-	133 (35)	-	44,099 (175,000)
	SC Pump and Mini-flow HX RM CC (VK-HV16B)	-	110 (29)	-	36,287 (144,000)
	SI Pump RM CC (VK-HV11B)	-	125 (33)	-	41,327 (164,000)
	SI Pump RM CC (VK-HV12B)	-	125 (33)	-	41,579 (165,000)
	CCW Pump RM CC (VK-HV13B)	125 (33)	125 (33)	41,579 (165,000)	41,579 (165,000)

Table 9.2.7-2 (6 of 6)

Div.	Components	Flow Rate, L/min (gpm)		Heat Load, kcal/hr (Btu/hr)	
		Normal Operation	Abnormal Operation	Normal Operation	Abnormal Operation
II	CCW Pump RM CC (VK-HV14B)	129 (34)	129 (34)	41,831 (166,000)	41,831 (166,000)
	CS Heat Exchanger RM CC (VK-HV15B)	-	53 (14)	-	16,884 (67,000)
	SC Heat Exchanger RM CC (VK-HV17B)	-	27 (7)	-	8,820 (35,000)
	Charging Pump RM CC (VK-HV18B)	-	110 (29)	-	35,531 (141,000)
	Mechanical Penetration RM CC (VK-HV19B)	61 (16)	61 (16)	19,404 (77,000)	19,404 (77,000)
	Mechanical Penetration RM CC (VK-HV20B)	61 (16)	61 (16)	19,404 (77,000)	19,404 (77,000)
	Aux Charging Pump RM CC (VK-HV21B)	-	42 (11)	-	12,852 (51,000)
	Aux. Bldg. Controlled Area Emergency Exhaust ACU RM CC (VK-HV22B)	-	27 (7)	-	8,568 (34,000)
	Aux. Bldg. Controlled Area Emergency Exhaust ACU RM CC (VK-HV23B)	-	27 (7)	-	-
	Essential Chiller RM CC (VO-HV31B)	19 (5)	19 (5)	5,065 (20,100)	5,065 (20,100)
	Essential Chiller RM CC (VO-HV32B)	23 (6)	23 (6)	5,065 (20,100)	5,065 (20,100)
	Motor-Driven Aux Feedwater Pump RM CC (VO-HV33B)	-	133 (35)	-	43,041 (170,800)

Table 9.2.7-3

Essential Chilled Water System Failure Modes and Effect Analysis

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
ECW Pump WO-PP01A WO-PP01B, WO-PP02A, WO-PP02B	One pump inoperable/ mechanical or electrical failure	Loss of chilled water in one division None; two pumps are available per division.	Pump status and pump trip alarm in the MCR	The standby ECW pump in the respective division will automatically start. Redundant division is provided.
Essential Chiller WO-CH01A WO-CH01B WO-CH02A WO-CH02B	One chiller inoperable/ mechanical or electrical failure	Loss of chilled water in one division None; two chillers are available per division.	Chiller status and chiller trip alarm in the MCR	The standby chiller in the respective division will automatically start. Redundant division is provided.
ECW Makeup Pump WO-PP03A WO-PP03B	One pump inoperable/ mechanical or electrical failure	Loss of makeup flow to one division None; redundant division is available.	Pump status and pump trip alarm in the MCR	Redundant division is provided.
3-Way Flow Control Valve WO-V906, WO-V906B WO-V906C WO-V906D	Valve fails to operate/mechanical or electrical failure	Out of control chilled water flow to cooling coil None; redundant division is available.	Temperature indication and alarm in the MCR	Redundant division is provided.
3-Way Flow Control Valve WO-V917A WO-V917B WO-V918A WO-V918B	Valve fails to operate/mechanical or electrical failure	Out of control chilled water flow to cooling coil None; redundant division is available.	Temperature indication and alarm in the MCR	Redundant division is provided.

Table 9.2.7-4

Plant Chilled Water System Failure Modes and Effect Analysis

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Containment Isolation Valve WI-V012	Failure to close/ mechanical or electrical failure	None; redundant containment isolation valve WI-V015 closes to isolate containment penetration.	Valve position status is indicated in the MCR.	Redundant containment isolation valve is provided.
Containment Isolation Valve WI-V015	Failure to close/ mechanical or electrical failure	None; redundant containment isolation valve WI-V012 closes to isolate containment penetration.	Valve position status is indicated in the MCR.	Redundant containment isolation valve is provided.
Containment Isolation Valve WI-V013	Failure to close/ mechanical or electrical failure	None; redundant containment isolation valve WI-V1043 closes to isolate containment penetration.	Valve position status is indicated in the MCR.	Redundant containment isolation valve is provided.
Containment Isolation Valve WI-V1043	Failure to close/ mechanical failure	None; redundant containment isolation valve WI-V013 closes to isolate containment penetration.	None	Redundant containment isolation valve is provided.

Table 9.2.8-1

TGBCCW System Component Design Parameters

Turbine Generator Building Closed Cooling Water Pump	
Quantity	2
Type	Centrifugal, Horizontal
Design Flow	53,000 L/min (14,000 gpm)
TDH	23.5m (77ft)
Turbine Generator Building Closed Cooling Water Heat Exchanger	
Quantity	3
Type	Plate
Heat Load	23×10^6 W (77×10^6 BTU/hr)
Number of Passes	1
Material of Construction	Titanium

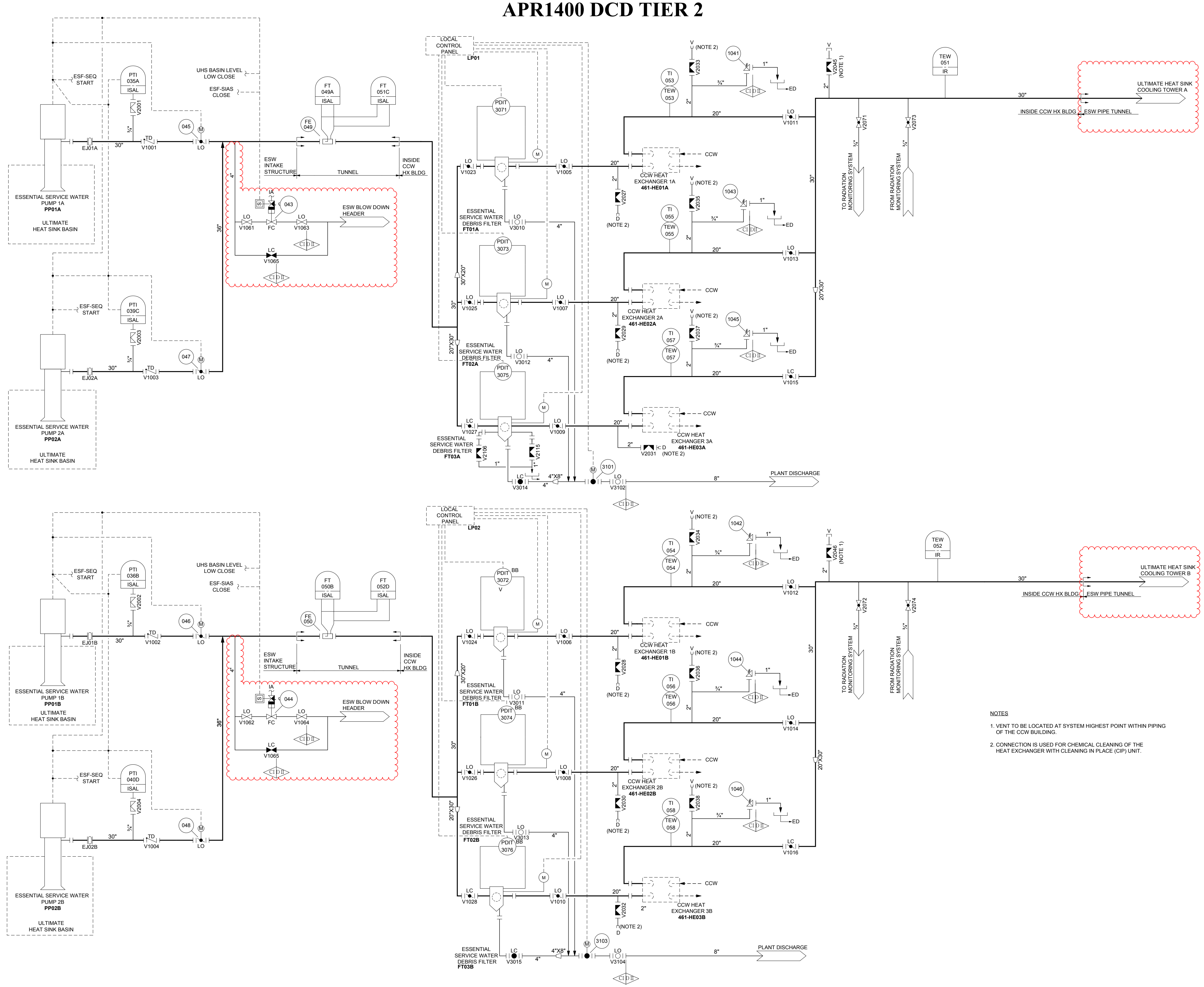


Figure 9.2.1-1 Essential Service Water System Flow Diagram

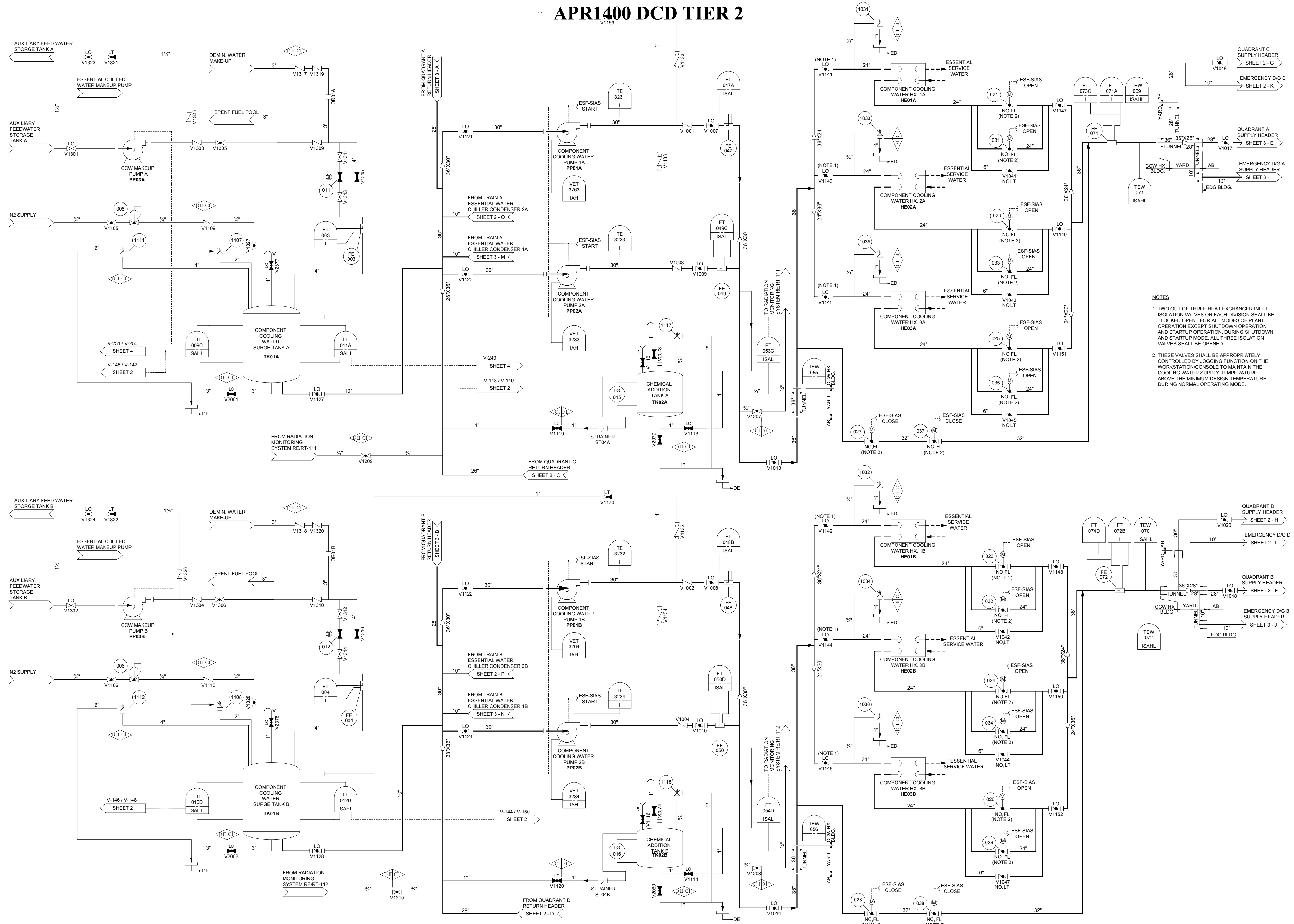


Figure 9.2.2-1 Component Cooling Water System Flow Diagram (1 of 4)

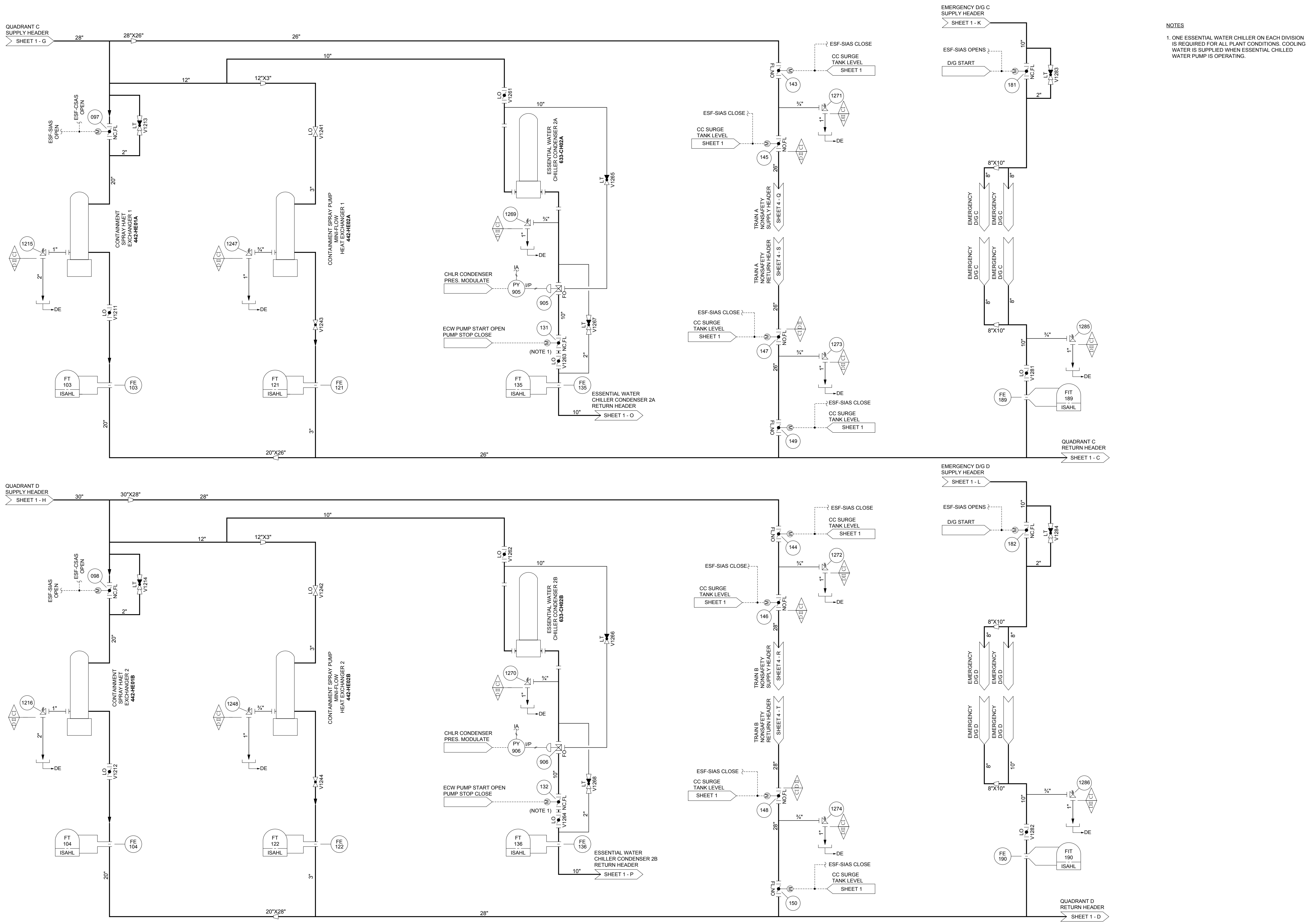


Figure 9.2.2-1 Component Cooling Water System Flow Diagram (2 of 4)

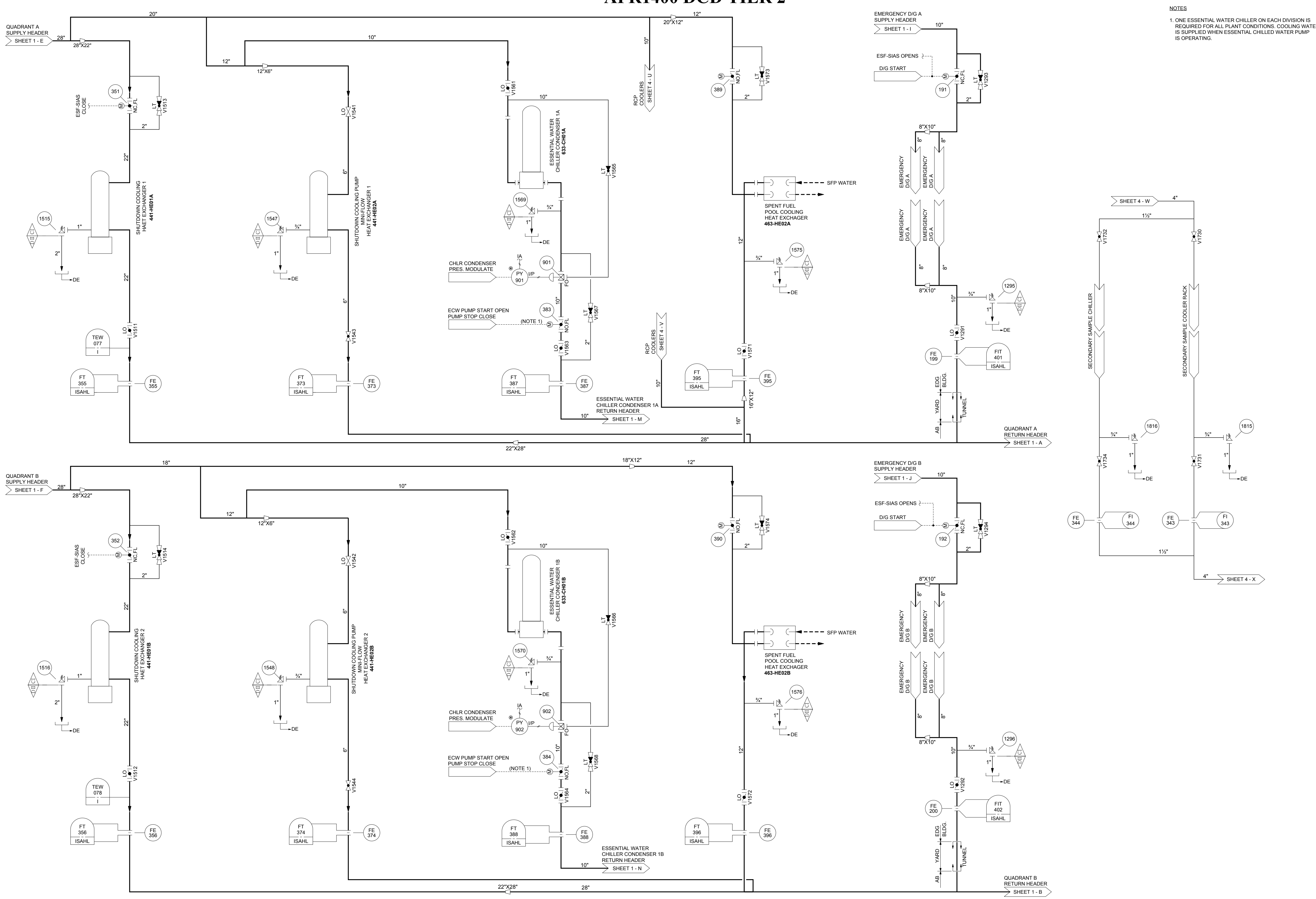


Figure 9.2.2-1 Component Cooling Water System Flow Diagram (3 of 4)

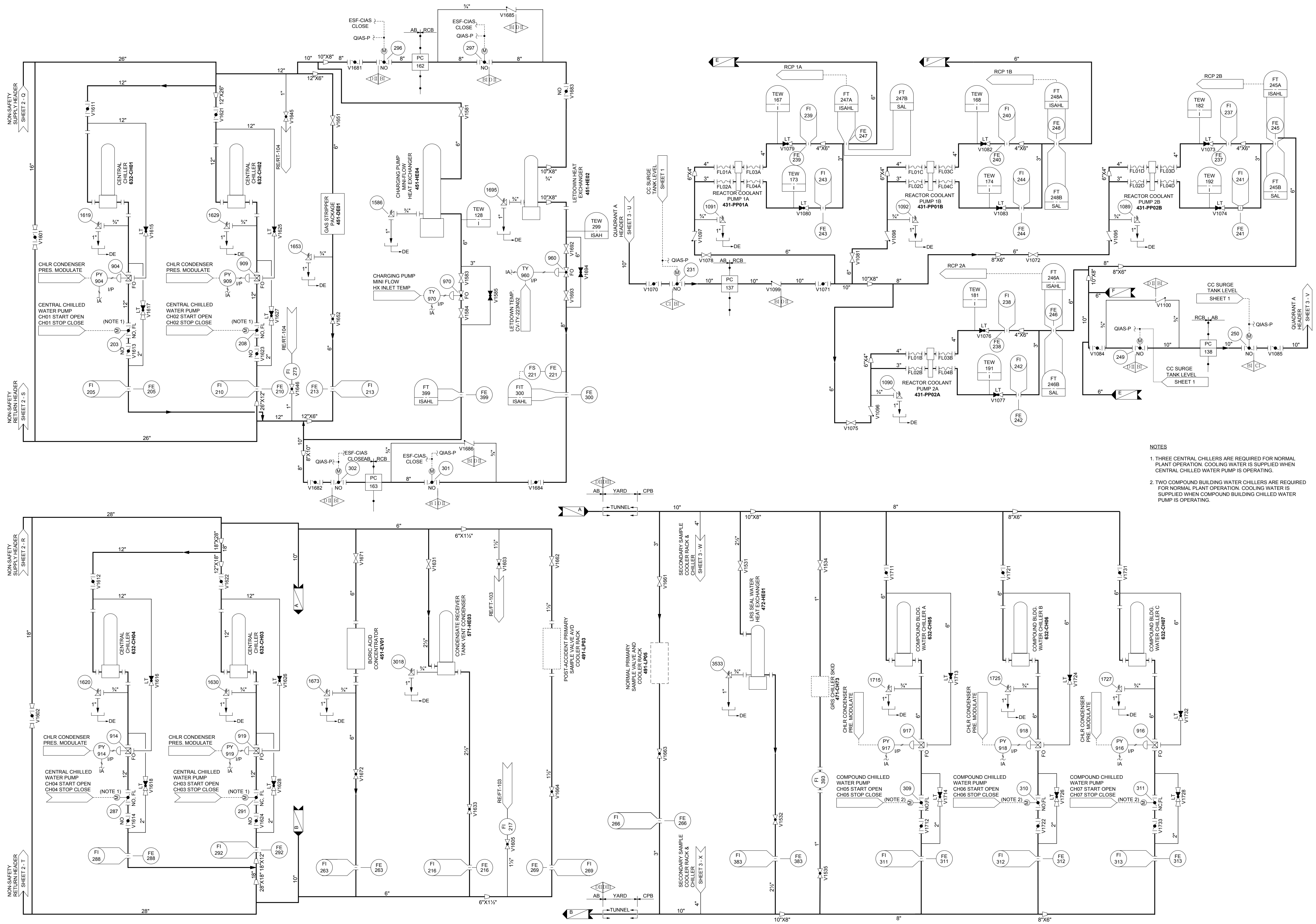


Figure 9.2.2-1 Component Cooling Water System Flow Diagram (4 of 4)

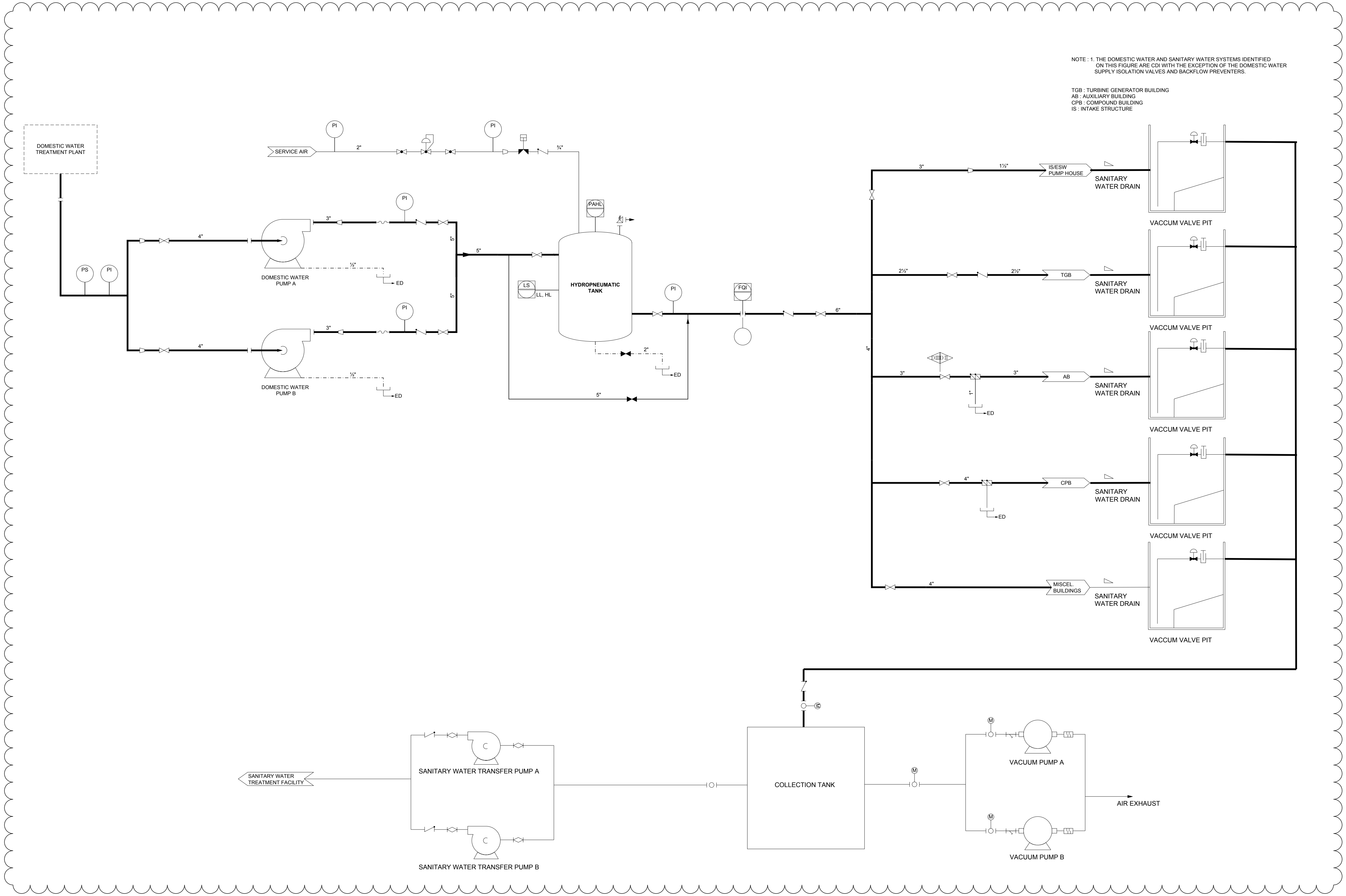


Figure 9.2.4-1 Domestic Water and Sanitary Systems Flow Diagram

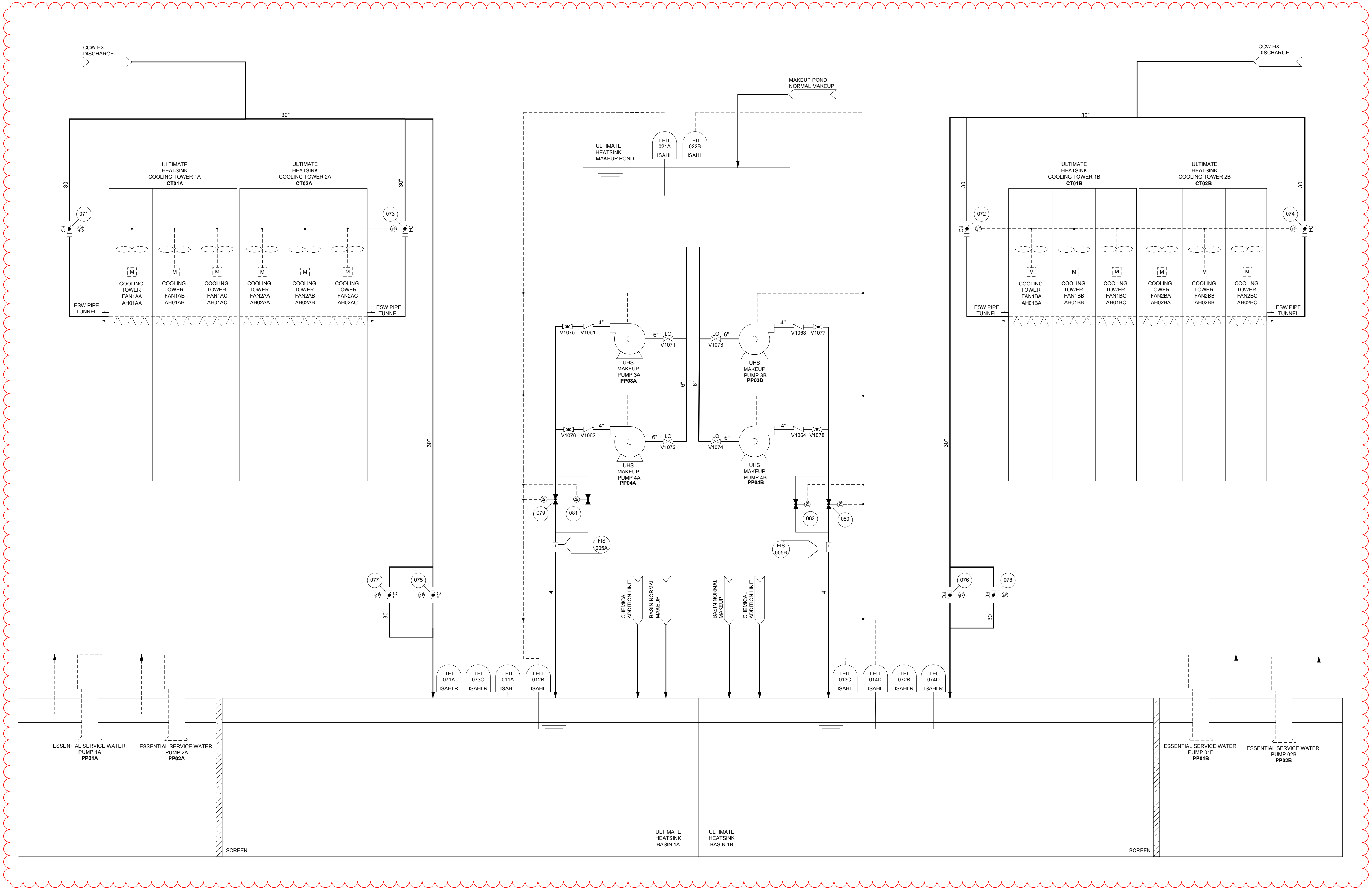


Figure 9.2.5-1 Ultimate Heat Sink (Cooling Tower) Flow Diagram

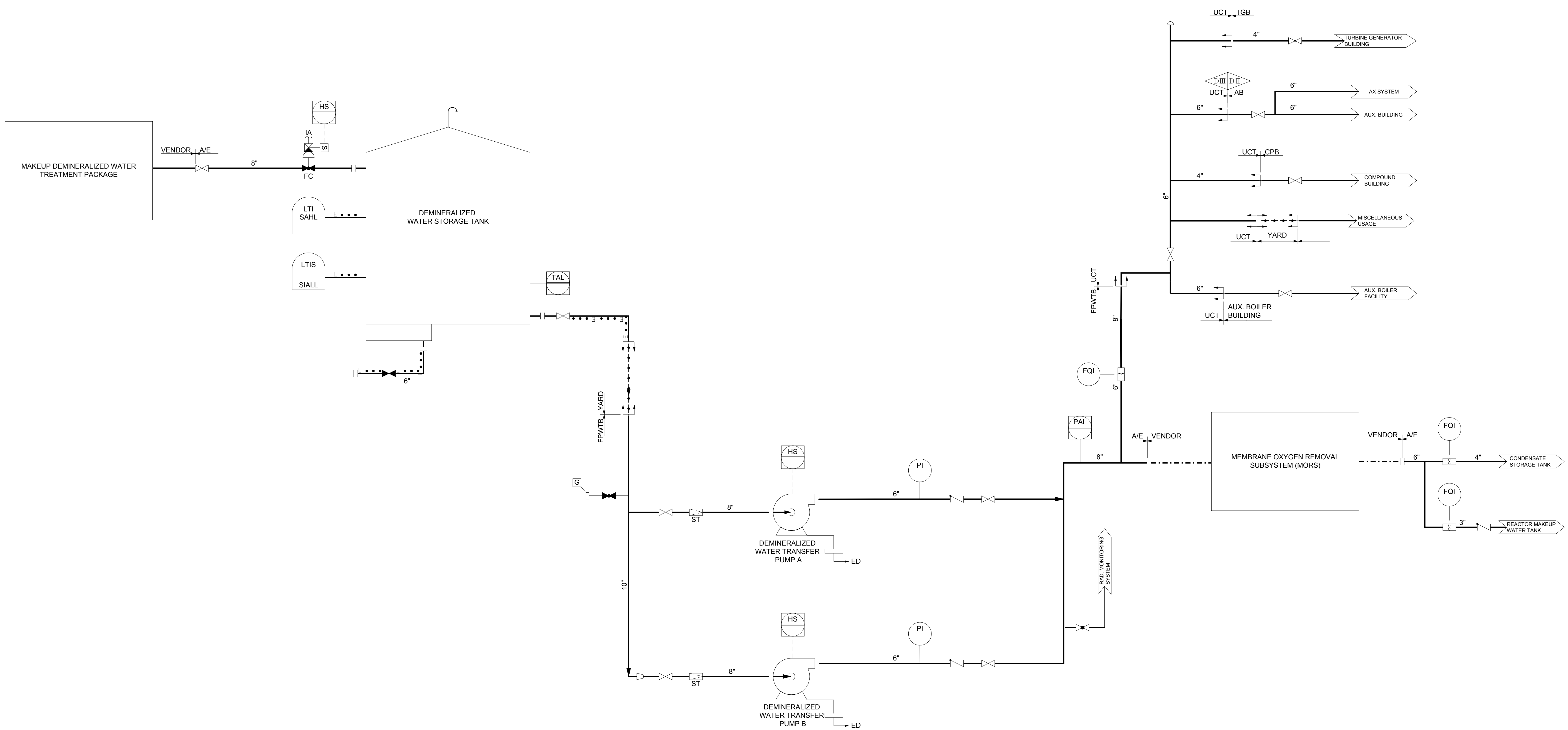


Figure 9.2.6-1 Makeup Demineralizer System Flow Diagram

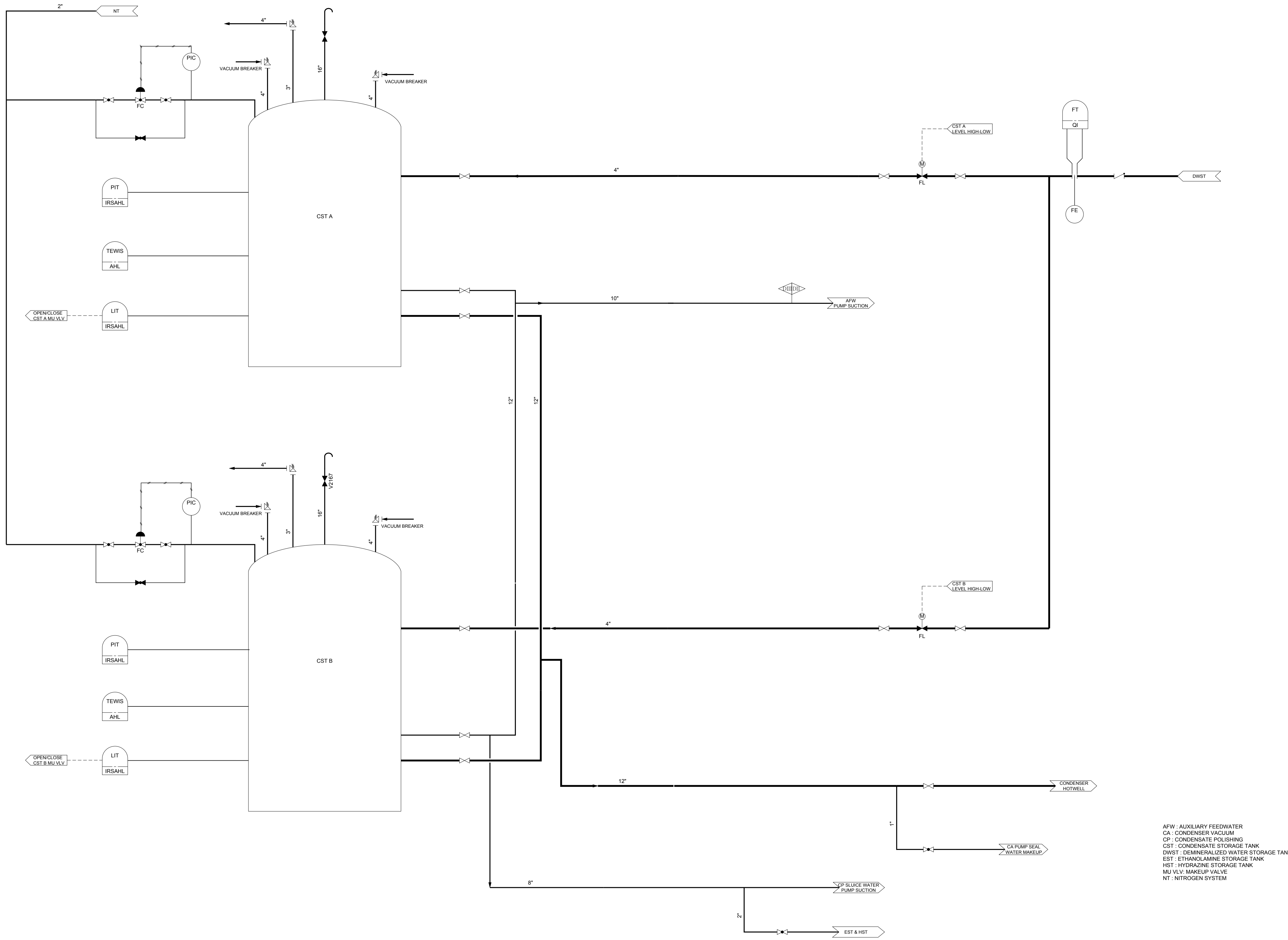


Figure 9.2.6-2 Condensate Storage and Transfer System Flow Diagram

NOTES

1. ALL PROCESS LINES AND VALVES ARE SAFETY-RELATED, SEISMIC CATEGORY I, UNLESS OTHERWISE NOTED.

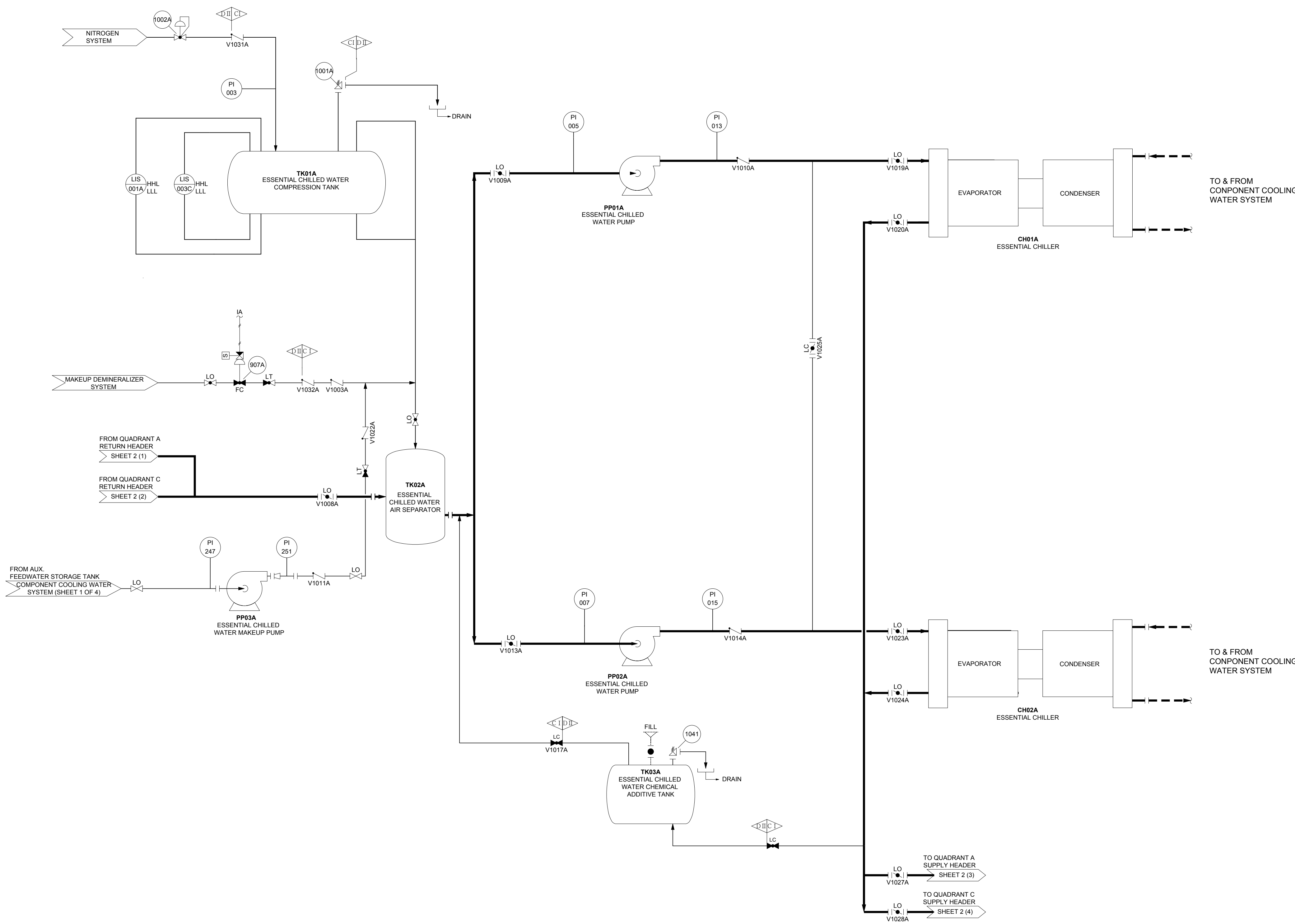


Figure 9.2.7-1 Essential Chilled Water System Flow Diagram (1 of 6)

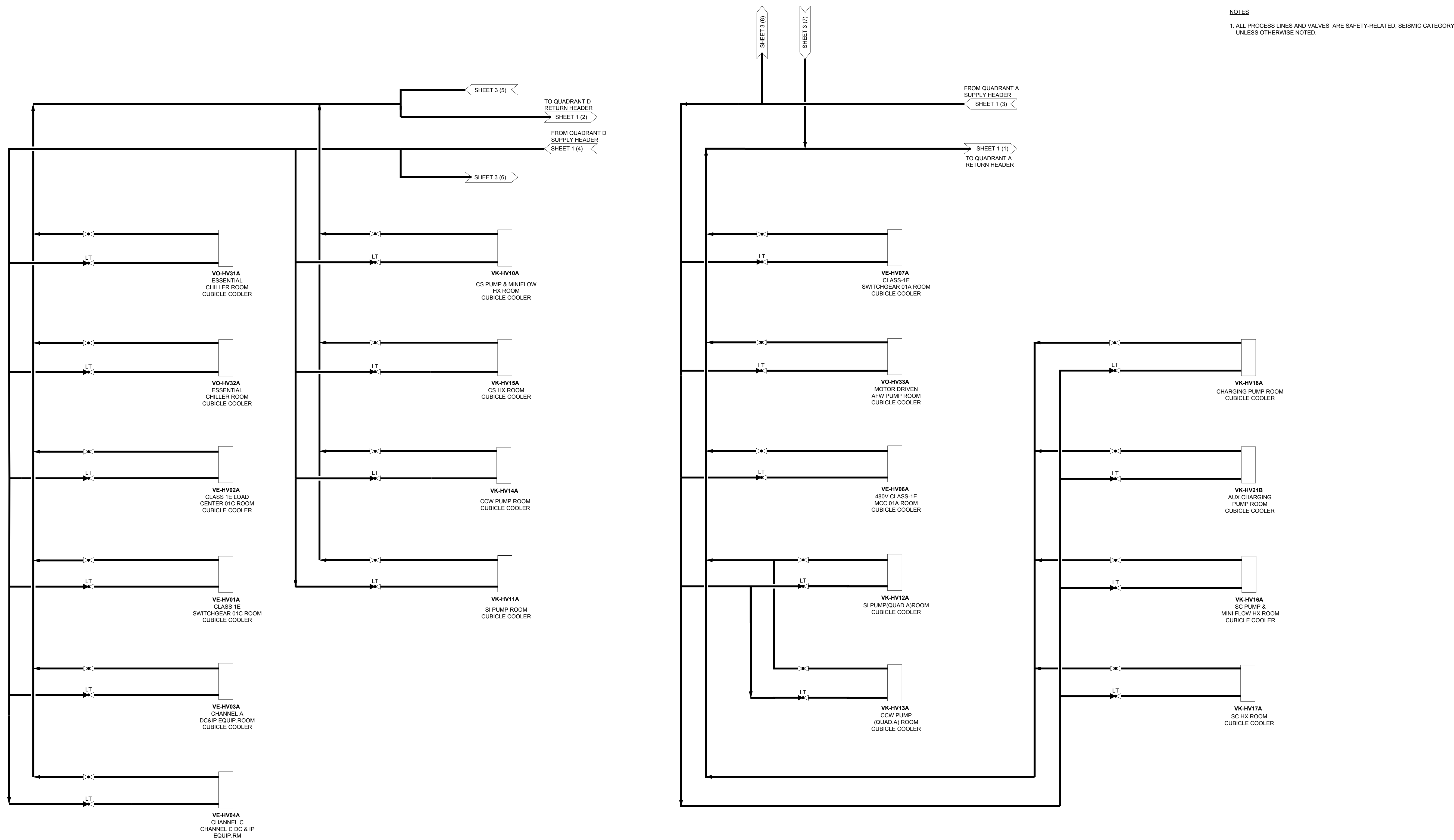


Figure 9.2.7-1 Essential Chilled Water System Flow Diagram (2 of 6)

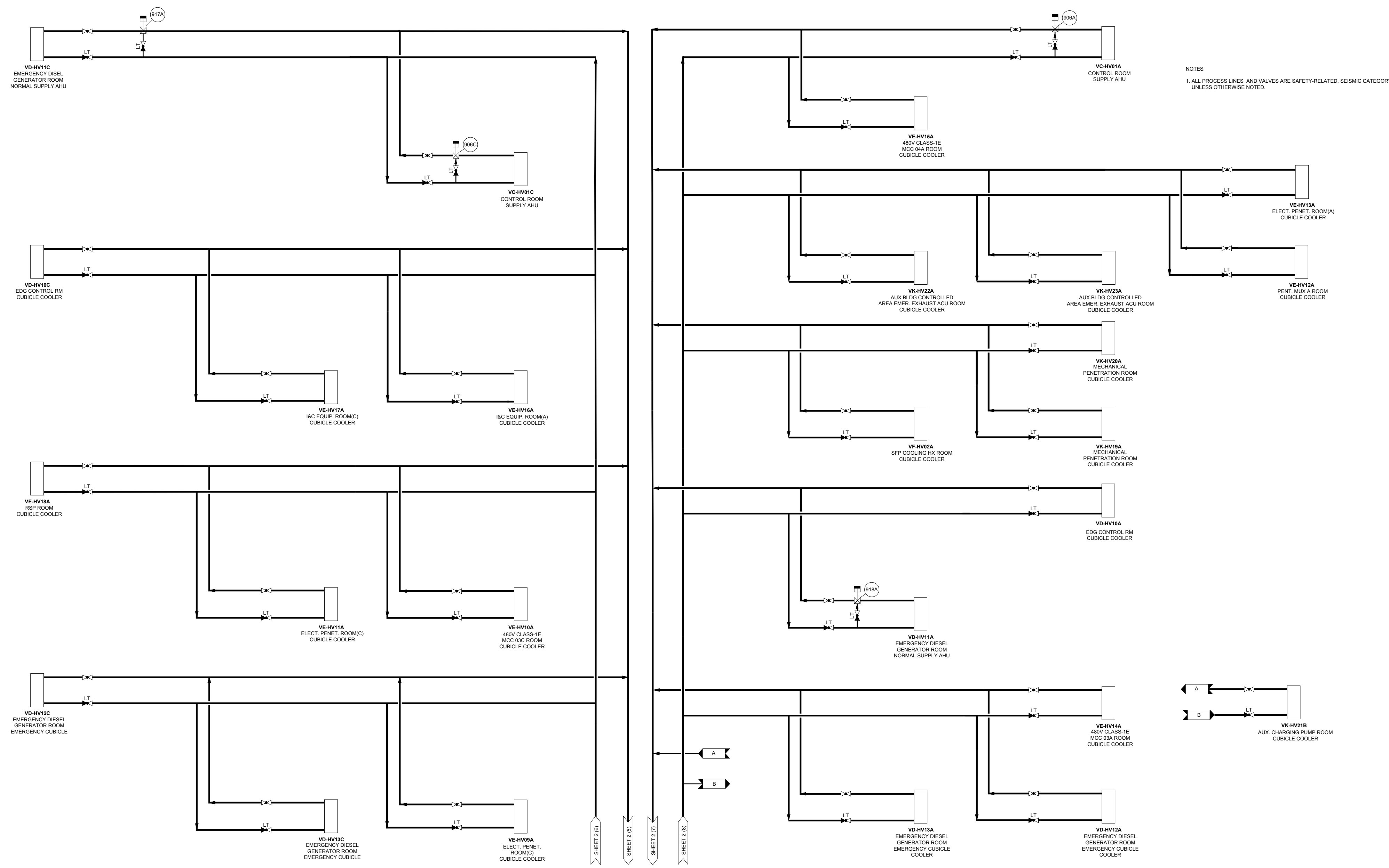


Figure 9.2.7-1 Essential Chilled Water System Flow Diagram (3 of 6)

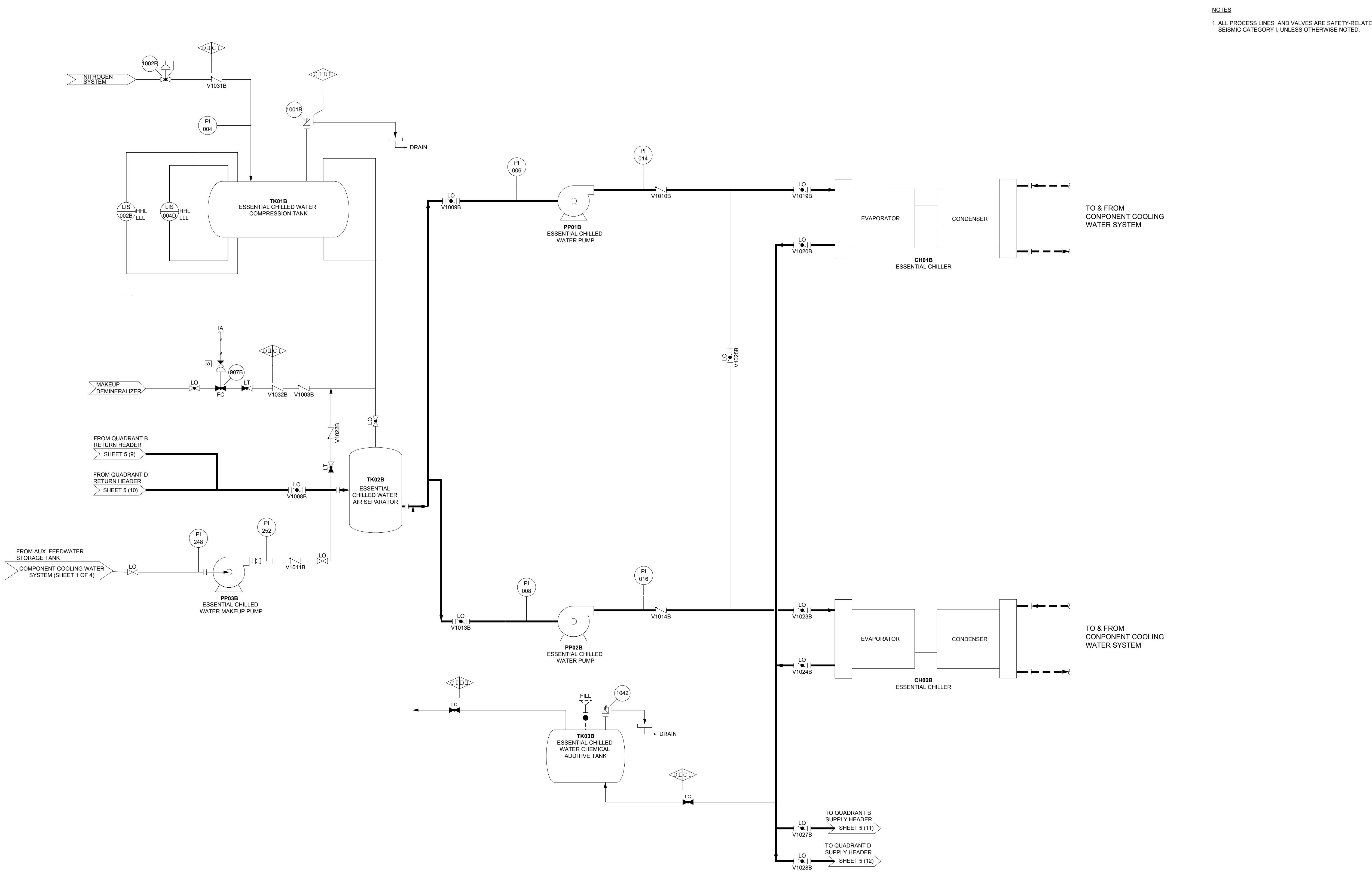


Figure 9.2.7-1 Essential Chilled Water System Flow Diagram (4 of 6)

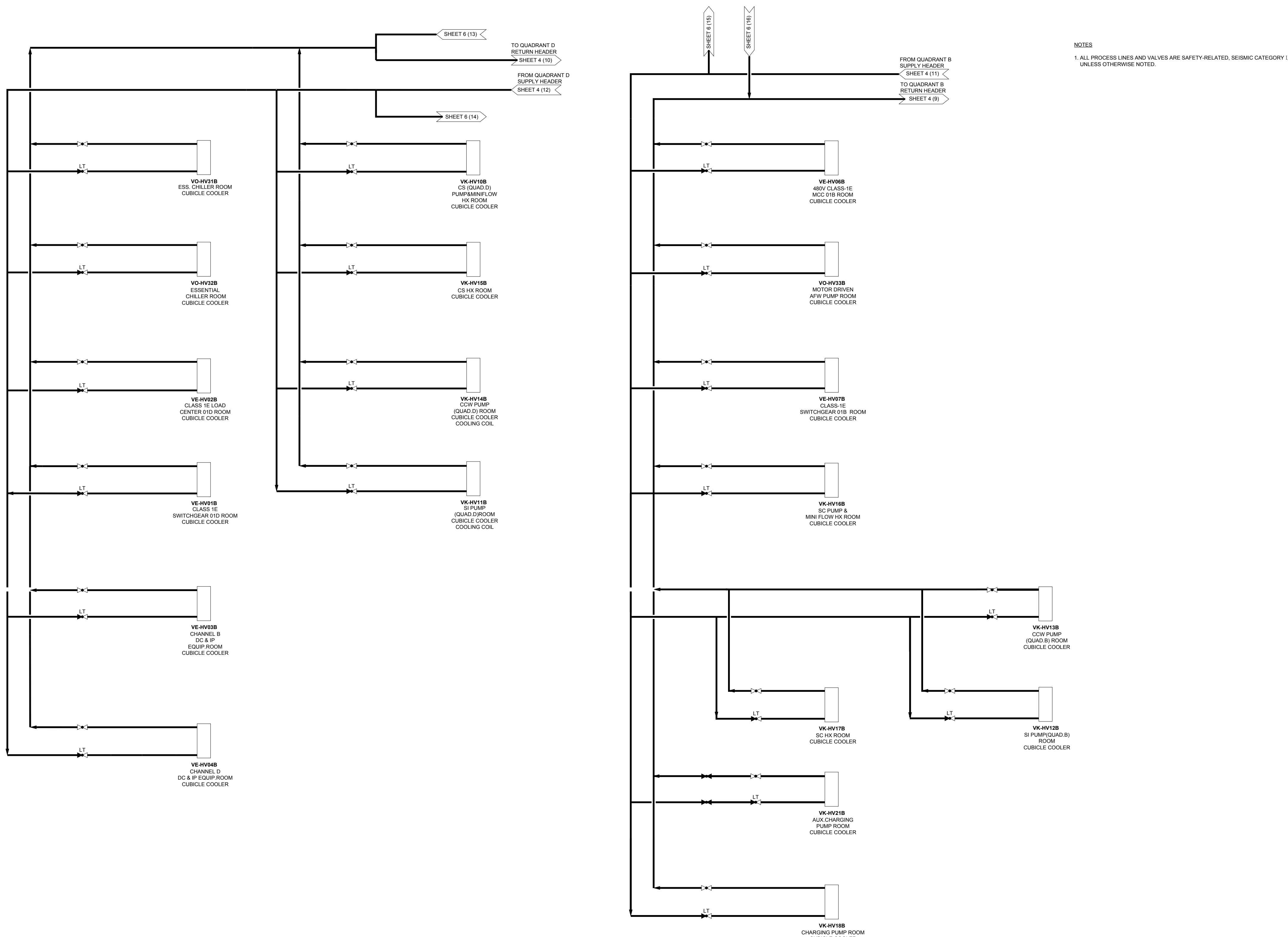


Figure 9.2.7-1 Essential Chilled Water System Flow Diagram (5 of 6)

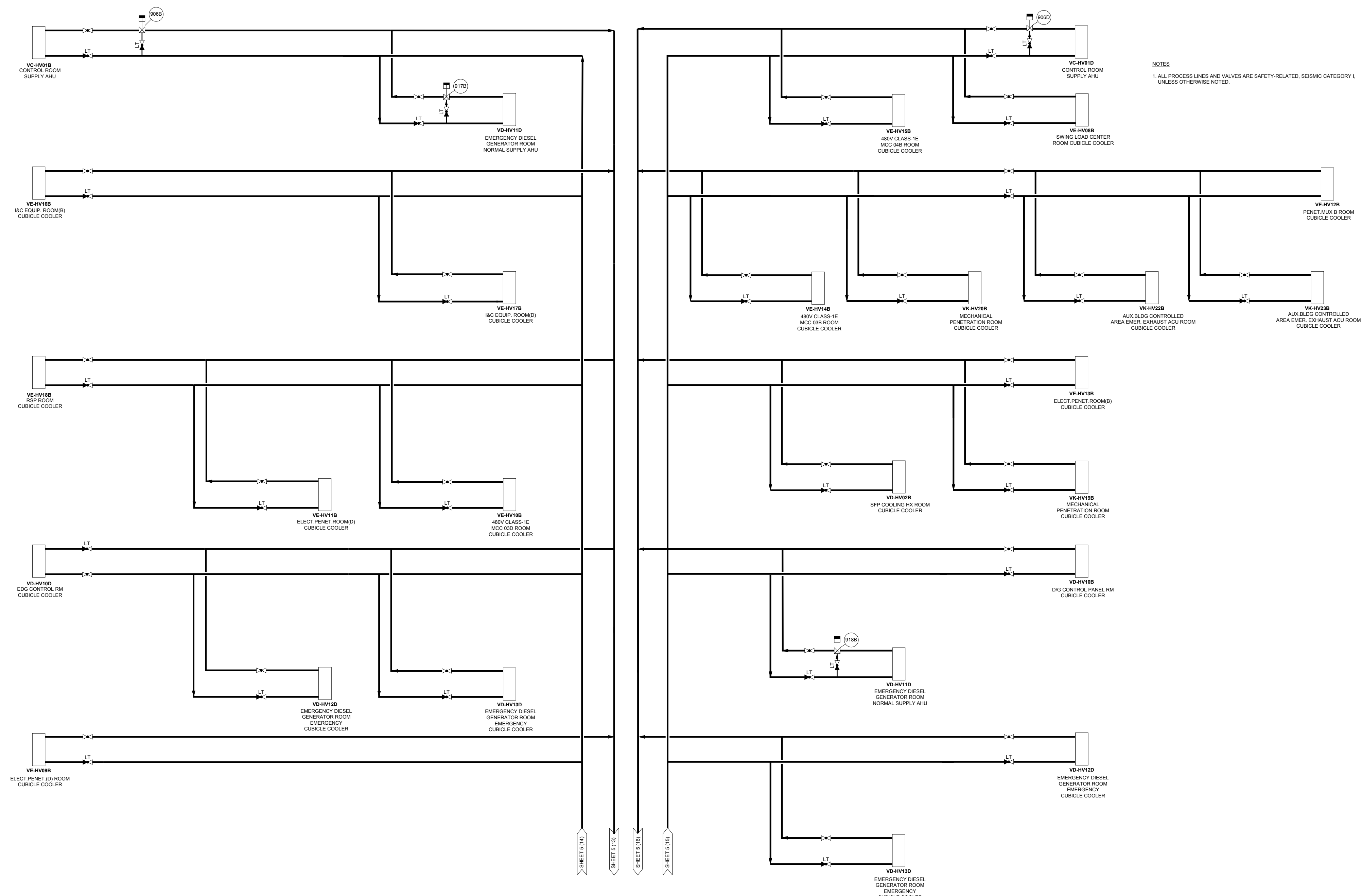


Figure 9.2.7-1 Essential Chilled Water System Flow Diagram (6 of 6)

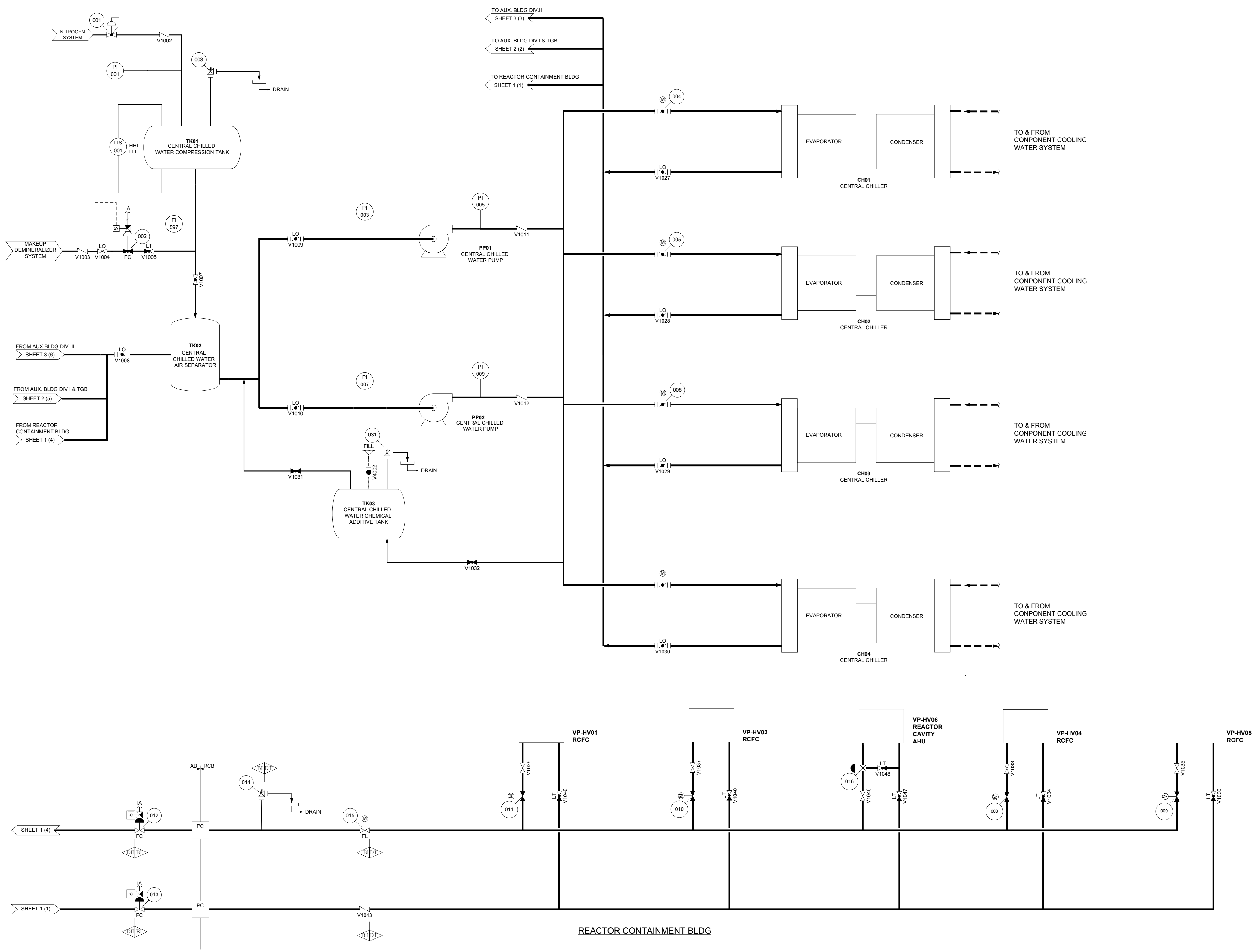


Figure 9.2.7-2 Plant Chilled Water System Flow Diagram (1 of 4)

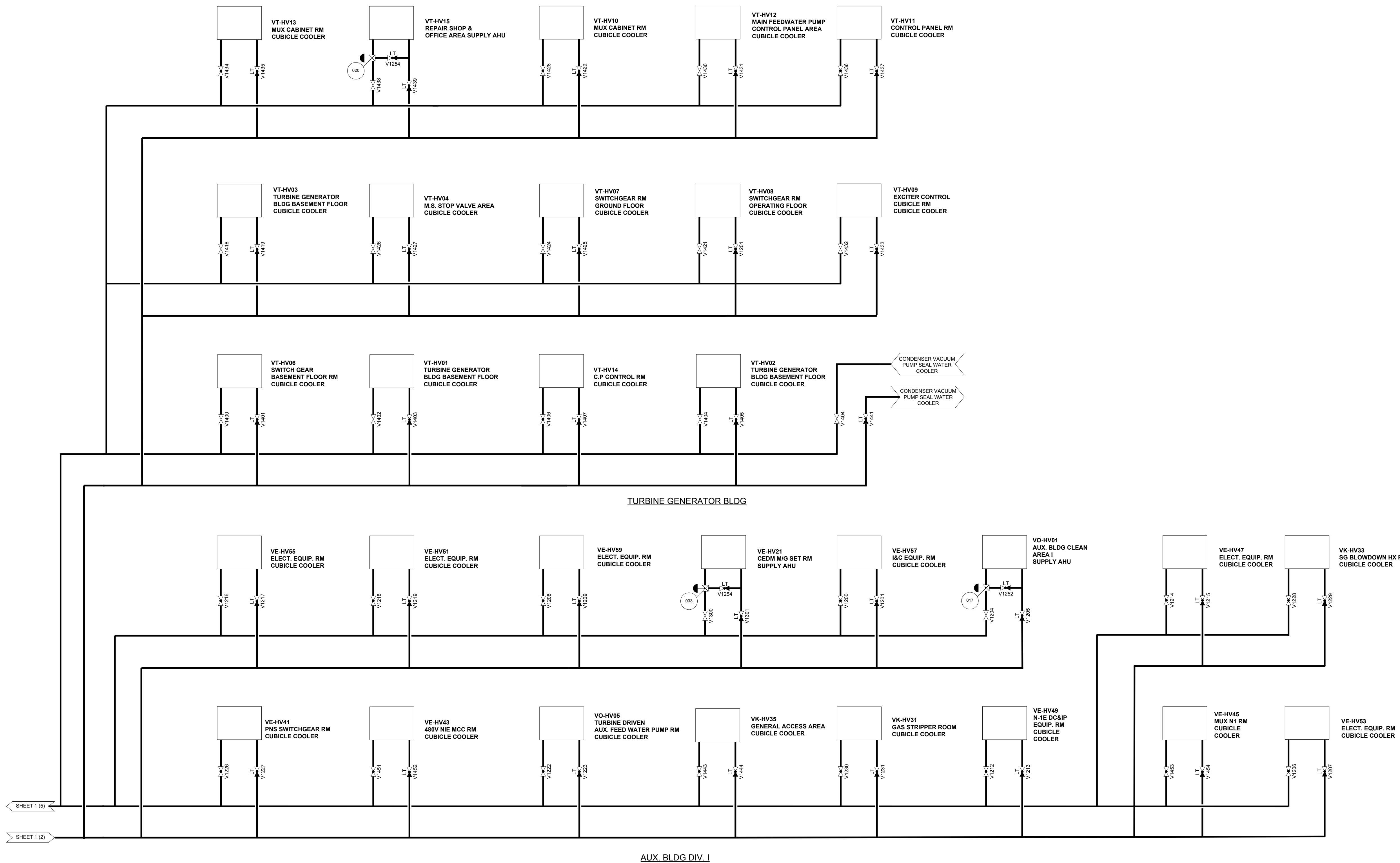


Figure 9.2.7-2 Plant Chilled Water System Flow Diagram (2 of 4)

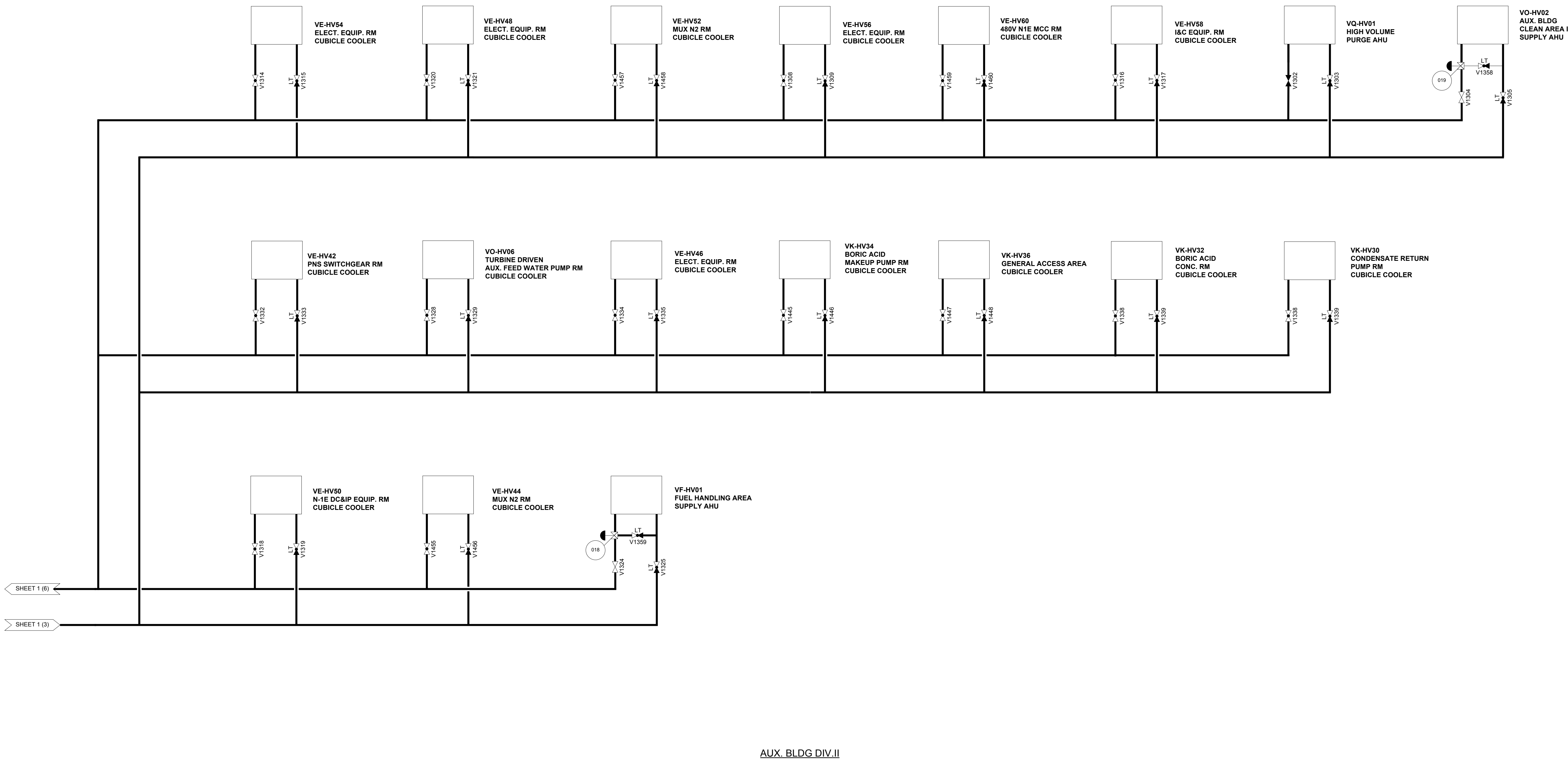


Figure 9.2.7-2 Plant Chilled Water System Flow Diagram (3 of 4)

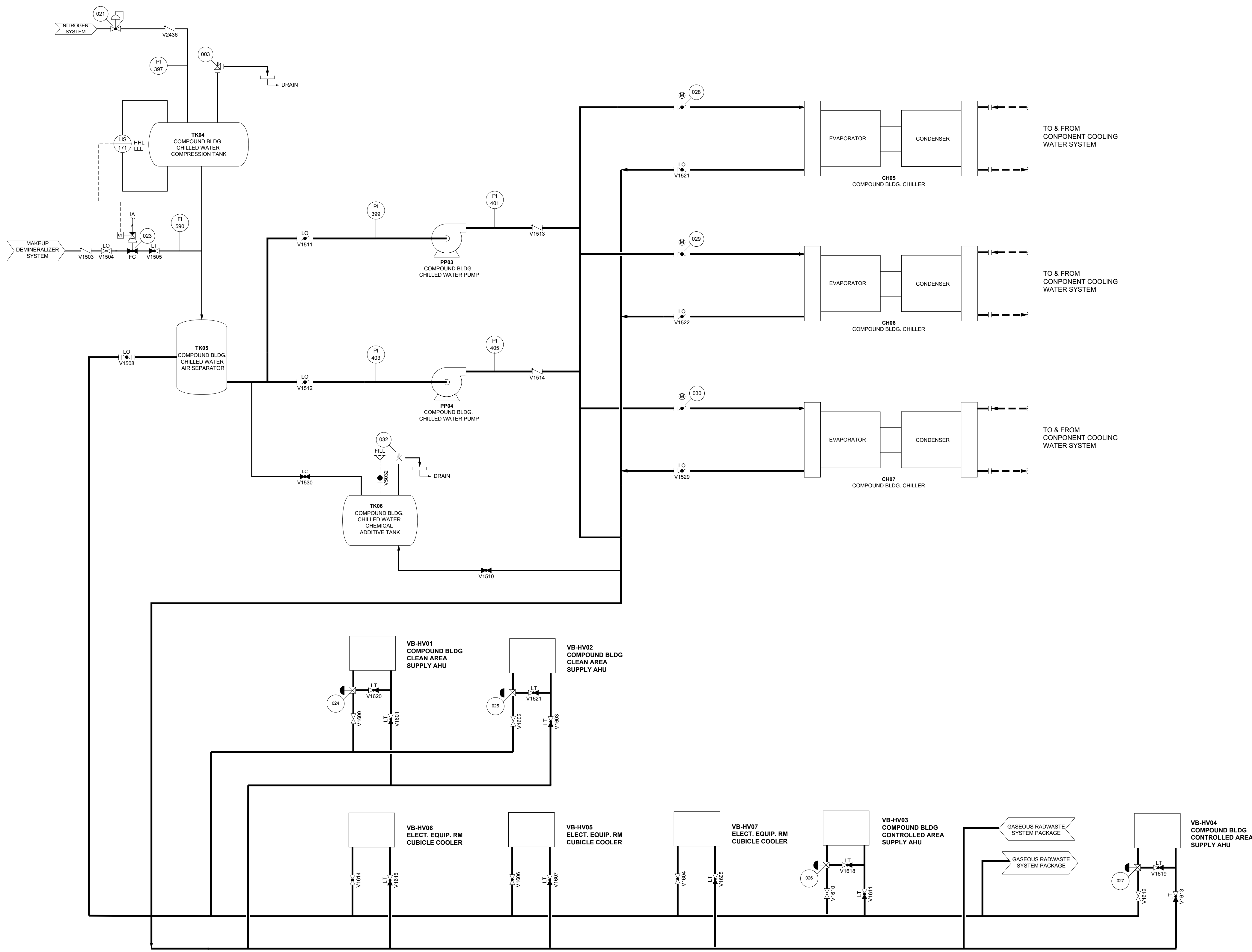


Figure 9.2.7-2 Plant Chilled Water System Flow Diagram (4 of 4)

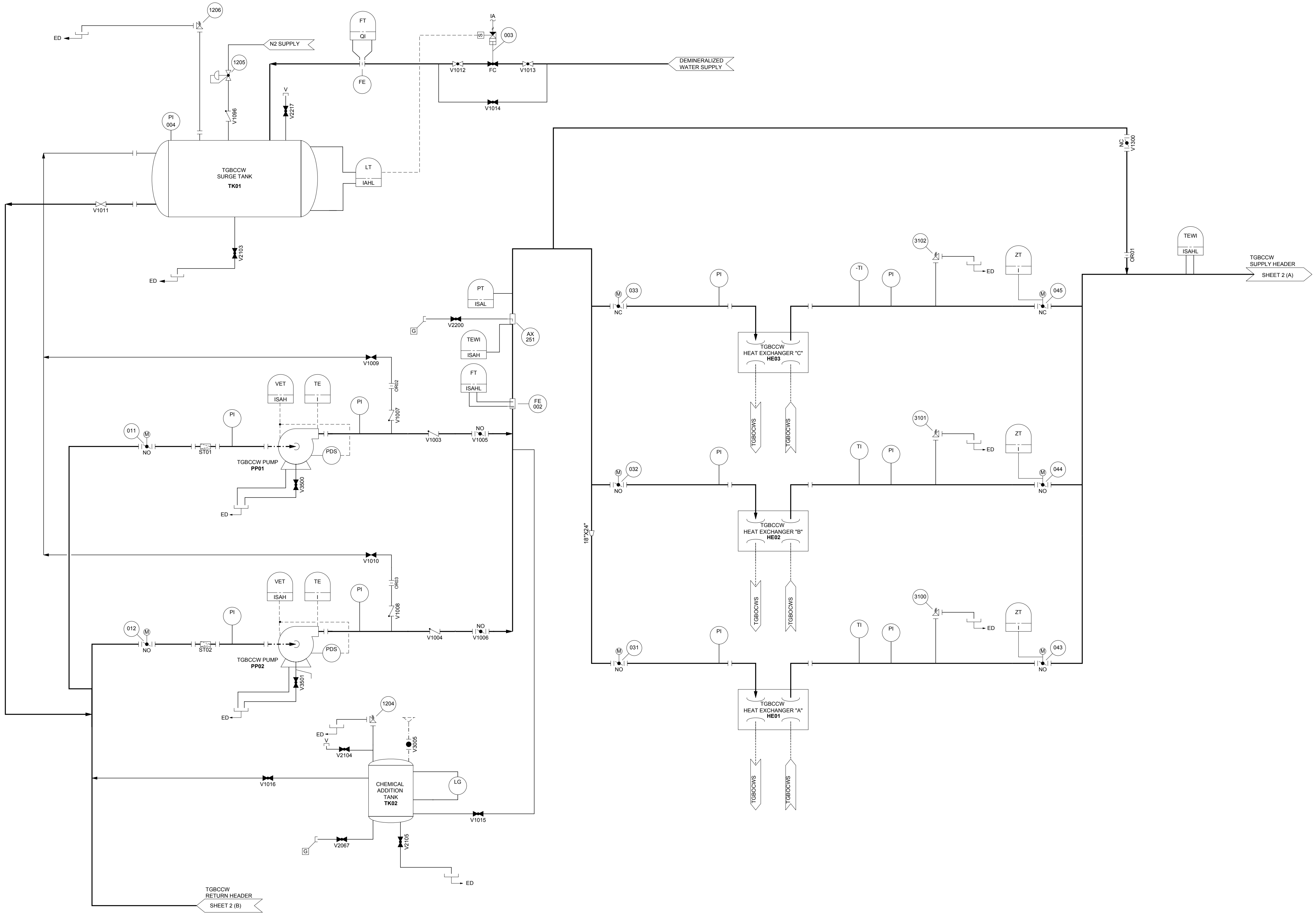


Figure 9.2.8-1 Turbine Generator Building Closed Cooling Water System Flow Diagram (1 of 4)

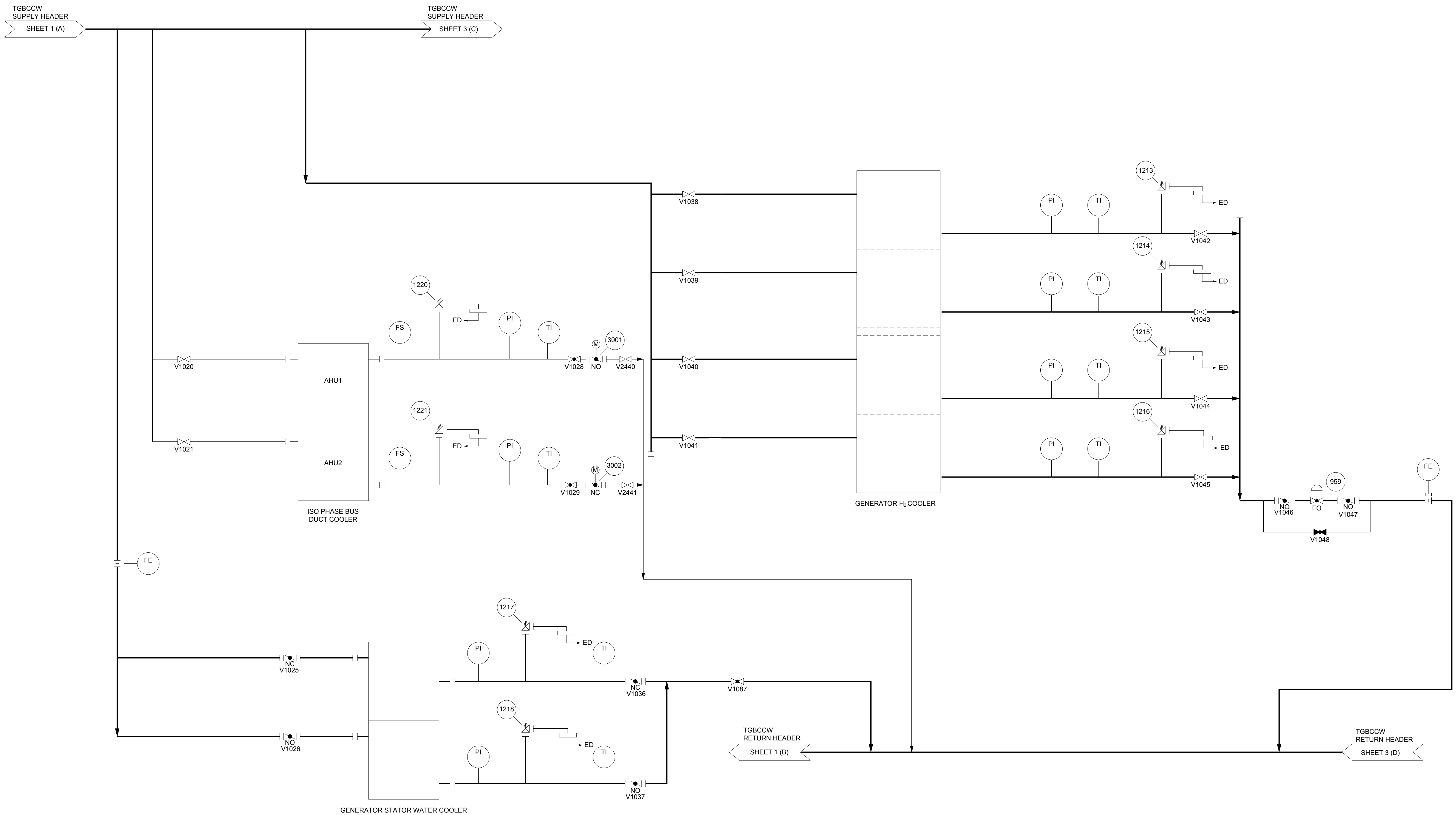


Figure 9.2.8-1 Turbine Generator Building Closed Cooling Water System Flow Diagram (2 of 4)

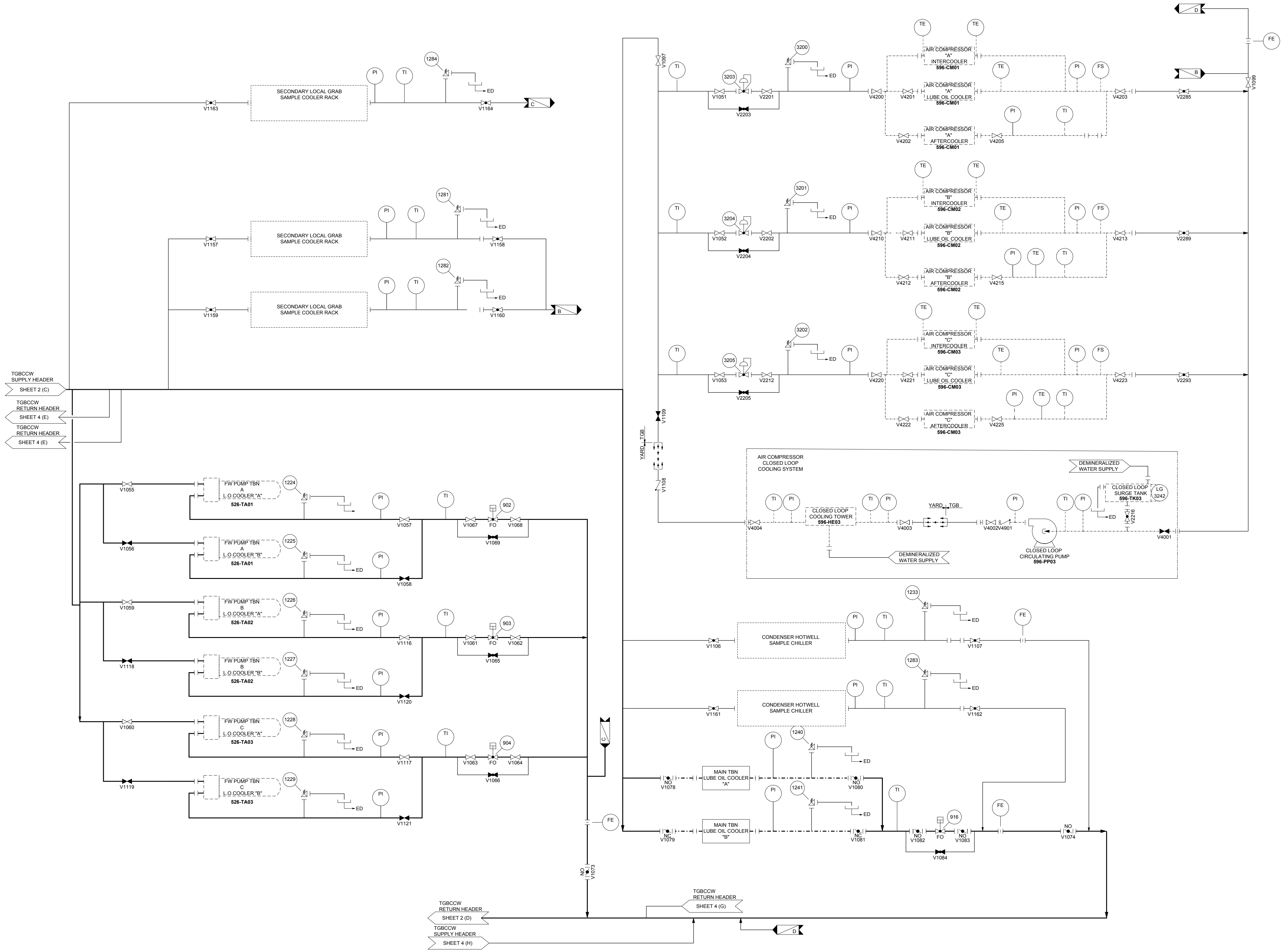


Figure 9.2.8-1 Turbine Generator Building Closed Cooling Water System Flow Diagram (3 of 4)

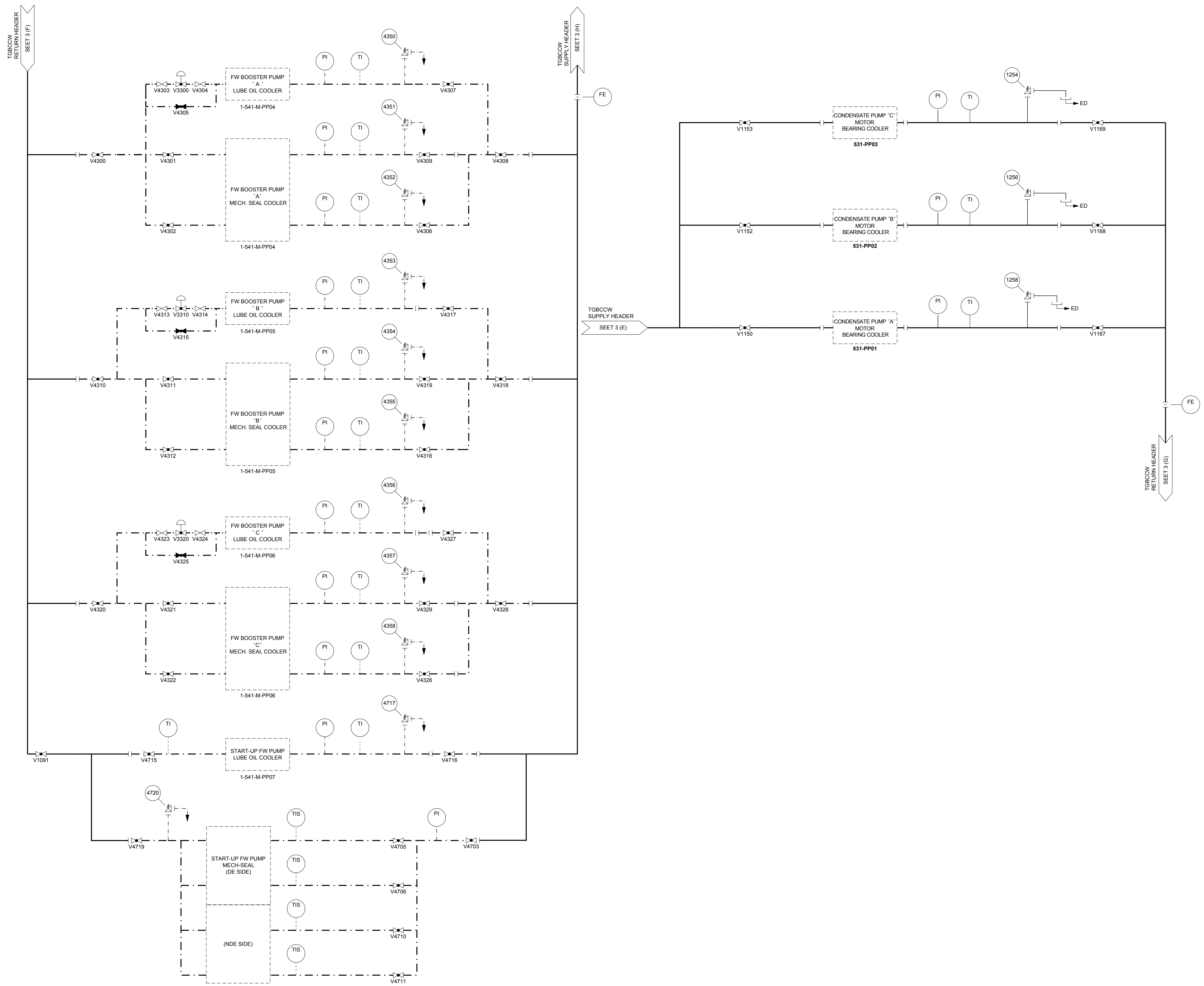


Figure 9.2.8-1 Turbine Generator Building Closed Cooling Water System Flow Diagram (4 of 4)

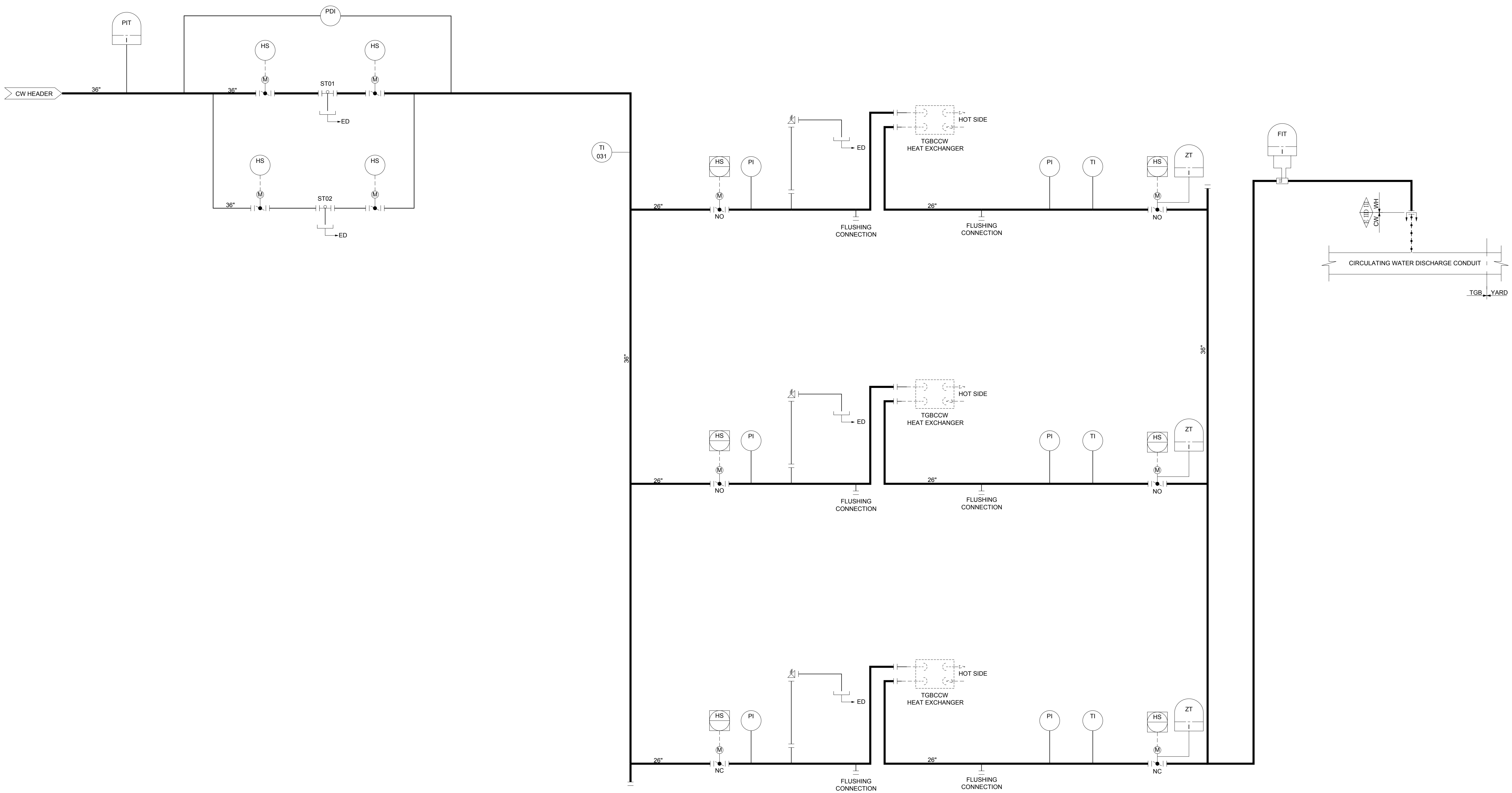


Figure 9.2.9-1 Turbine Generator Building Open Cooling System Flow Diagram

9.3 Process Auxiliaries

9.3.1 Compressed Air and Gas Systems

The compressed air and gas systems are composed of the compressed air system (CAS), compressed gas system, and breathing air system.

The compressed air system (CAS) provides compressed air for service and maintenance use. The CAS comprises the instrument air system (IAS) and the service air system (SAS).

9.3.1.1 Design Bases

a. The CAS provides compressed air for the following services:

   1) Instrument air for instrumentation and control air to safety-related and non-safety-related components and systems

   2) Service air to non-safety-related service equipment such as pneumatic tools, miscellaneous equipment, and maintenance throughout the plant

b. The CAS meets the following design bases:

   1) The CAS serves no safety function and therefore has no safety design basis, except for containment isolation, which is described in Subsection 6.2.4.

   2) The safety-related air-operated valves and air-operated control dampers served by the IAS, shown in Table 9.3.1-1, do not require instrument air to perform their safety-related function, and these components fail in the safe position on loss of instrument air pressure and following a station blackout. The design is in compliance with 10 CFR 50.63 (Reference 1).

   3) For the safety-related air-operated valves, each valve has an air accumulator with two cycles of minimum capacity as a backup compressed air to the IAS to perform its safety-related function on loss of instrument air pressure, if needed.

4) An independent closed loop cooling system allows operation of one air compressor when the air compressor cooling water is not available.

5) The CAS is designed for one unit and is not shared with other units.

6) The IAS meets the air quality requirements of ANSI/ISA-S7.3 (Reference 2) to supply clean, dry, oil-free instrument air.

c. The compressed gas system is composed of the nitrogen subsystem, hydrogen subsystem, and carbon dioxide subsystem.

d. The breathing air system supplies emergency breathing air for control room personnel. Breathing air is Grade D respiratory quality air, as defined in ANSI/CGA G-7.1 (Reference 12).

9.3.1.2 System Description

9.3.1.2.1 General Description

9.3.1.2.1.1 Instrument Air System

The IAS supplies clean, oil-free, and dried air in accordance with ANSI/ISA-S7.3 to air-operated valves, pneumatic instrumentations and controls, and air-operated control dampers throughout the plant.

The IAS consists of two redundant and independent sets of equipment. A cross-connecting line with a normally closed valve is provided between the two redundant air lines. Each line consists of one 100 percent capacity air compressor, one 100 percent air receiver, one 150 percent set of air dryers, one 150 percent air filtering unit and related instruments and controls, and air supply piping and valves that are located in the turbine generator building. Provisions to cross connect the IAS and SAS are installed at the distribution header upstream of the dryers. In event that the instrument air compressors cannot meet the demand for instrument air, the service air compressor provides a backup supply of air. Isolation valve and check valves are provided on the cross-connect to permit isolation of the systems. An independent closed loop cooling system is provided

with to air compressors. The closed loop cooling system consists of one pump, one surge tank, one cooling tower, related instruments and controls. The location of major components in the turbine building minimizes the likelihood of leakage from radioactive systems to be permeated into the CAS. A flow diagram of the IAS is shown in Figure 9.3.1-1, and major system components are described in Table 9.3.1-2.

Cooling water is supplied to the compressors from the turbine generator building closed cooling water (TGBCCW) system. The compressors are designed to cool the hot compressed air and remove water that is condensed during the cooling process. Each compressor has an intake filter rated to remove all particles greater than a specific size. The compressor intakes are located in an area that is free of corrosive contaminants and hazardous gases.

Two instrument air receivers are designed with adequate reserve capacity to allow time for standby compressors to start and recharge the air receivers to operating pressure following a compressor trip. Each air receiver has an automatic condensate drain trap to remove accumulated condensate. Overpressure protection is provided via pressure relief valves located on the air receivers. The pressure indicators are provided in the MCR for remote indication of the air receiver outlet header and the afterfilter outlet header pressure, respectively.

One Air dryer is installed downstream of each air receiver to remove moisture from the instrument air. Timer and automatic controls are provided to alternate the air flow between the two chambers of each dryer to permit drying of the desiccant in one chamber while the other is in service. The filtering unit is provided with a prefilter to protect the dryer and an afterfilter to prevent the carryover of dust. The air is dried to a dew point of -40 °C (-40 °F) or less at a line pressure of 8.79 kg/cm^2 G (125 psig).

Downstream of the afterfilters, the two instrument air lines are connected to a common air header and a ring distribution header system around the turbine building supplying instrument air throughout the plant.

The IAS piping material is stainless steel and of welded construction to prevent air leakage.

9.3.1.2.1.2 Service Air System

The service air system (SAS) supplies compressed air for air-operated tools, miscellaneous equipment, and for maintenance services, including periods of plant shutdown.

The SAS is shown in Figure 9.3.1-2. The SAS is independent of the IAS. The SAS consists of one 100 percent capacity air compressor, one 100 percent air receiver, instrumentations and controls, and air supply piping and valves that are located in the turbine generator building. Cooling water is supplied to the compressor from the TGBCCW system. The compressor is designed to cool the hot compressed air and remove water that is condensed during the cooling process. The compressor has an intake filter rated to remove all particles greater than a specific size. The compressor intake is located in an area that is free of corrosive contaminants and hazardous gases.

One service air receiver is designed with adequate reserve capacity to supply a limited amount of compressed air following a compressor failure.

Downstream of the air receivers, two service air supply lines are connected to a ring distribution header system around the turbine building supplying service air throughout the plant. The SAS piping material is carbon steel.

9.3.1.2.1.3 Compressed Gas System

Each the subsystem of the compressed gas system consists of the gas supply system and the distribution headers, distribution piping, valves, instrumentation and controls.

The hydrogen gas supply system consists of a hydrogen storage cylinder assembly divided into an active bank and a reserve bank, a control cabinet assembly, and distribution piping.

The carbon dioxide supply system consists of a carbon dioxide storage cylinder assembly divided into an active bank and a reserve bank, electric vaporizer, a control cabinet assembly, and distribution piping.

The nitrogen supply system consists of a liquid nitrogen storage tank, a low pressure ambient vaporizer, a high pressure electric vaporizer, a liquid nitrogen pump, high pressure

nitrogen storage vessels, high and low pressure supply headers, associated piping, instrumentation and controls. The nitrogen subsystem is divided into high and low pressure subsystems. High pressure nitrogen gas is stored in the high pressure nitrogen storage vessels. The liquid nitrogen pump takes suction from the liquid nitrogen storage tank and discharges nitrogen to the high pressure electric vaporizer. The vaporized high pressure nitrogen gas is stored in the high pressure nitrogen storage vessels. Liquid nitrogen is withdrawn from liquid nitrogen storage tank, vaporized by a low pressure ambient vaporizer and discharged through a pressure reducing valve to the low pressure nitrogen gas header.

9.3.1.2.1.4 Breathing Air System

The breathing air supply system consists of two compressed air bottle assemblies, filters, facemasks, piping, valves, controls and instrumentation.

The breathing air system includes nine self contained breathing apparatus (SCBA) units and eighteen extra air cylinders. Six SCBA units located in the MCR are available for the MCR personnel, and three SCBA units located in the compound building are available to the damage control team. Eighteen extra SCBA cylinders are used for the replacement of the exhausted cylinders. The SCBA units are of the full facemask type.The compressed air bottle assemblies are located in the auxiliary building. The compressed air bottle assemblies store and supply emergency breathing air to the MCR personnel by means of a permanent piping system.

The air filters remove a minimum 99 percent of 0.3 micron and larger particulates.

The COL applicant is to provide the supply systems of the nitrogen gas subsystem, the hydrogen subsystem, the carbon dioxide subsystem, and the breathing air systems(COL 9.3 (4)).

9.3.1.2.2 System Operation

9.3.1.2.2.1 Instrument Air System

When the plant is in normal operation, one oil-free rotary screw compressor is in operation and maintains instrument air header pressure while the other is on standby.

In the automatic mode, the operating compressor is automatically loaded and unloaded in response to the system pressure, and the standby compressor starts automatically if the operating compressor cannot meet the system demand commensurate with the pressure drop in the instrument air supply header downstream of the air receivers. The compressor controls are designed so that failure of an operating compressor does not cause the IAS pressure to fall below the minimum required system operating pressure.

Each dryer consists of two desiccant chambers, which switch alternately from the operation mode to the regeneration mode via its own controller automatically.

When the TGBCCW system is not available, the closed loop cooling system supplies coolant to the coolers of the compressor. More details on the TGBCCW system are provided in Subsection 9.2.8.

9.3.1.2.2.2 Service Air System

During system normal operation, compressed air is produced by a single oil-free rotary screw compressor, stored in the air receiver, and supplied throughout the plant. The compressor is operates, auto

When the TGBCCW system is not available, the closed loop cooling system supplies coolant to the coolers of the compressor. A more details on the TGBCCW system is provided in Subsection 9.2.8.

9.3.1.2.2.3 Compressed Gas System

Each subsystem has pressure regulation and over pressure protection provision.

The hydrogen subsystem supplies hydrogen from the hydrogen gas supply system to the volume control tank of the chemical and volume control system for oxygen scavenging, to the turbine generator for initial fill and pressurization for hydrogen-cooled rotor, and to make up losses from the turbine generator during normal operation.

The carbon dioxide subsystem supplies carbon dioxide gas from the carbon dioxide supply system to the main generator for purging to remove all air and oxygen before the introduction of hydrogen to prevent explosions and fires.

The nitrogen subsystem supplies nitrogen from the nitrogen supply system to various plant components and systems for blanketing, pressurizing, and purging. The high pressure nitrogen storage vessels provide nitrogen makeup for the safety injection tanks, steam generator blowdown lines, reactor drain tank, auxiliary charging pump pulsation dampener, main steam isolation valves, main feedwater isolation valves, main steam isolation valves bypass valves, and main steam atmospheric dump valves. The low pressure nitrogen gas subsystem provides low pressure nitrogen to the various users throughout the plant.

9.3.1.2.2.4 Breathing Air System

The breathing air system supplies respiratory air for the control room personnel when the control room air is contaminated with toxic chemicals or airborne radioactivity. The system provides the portable respiratory air units to be used by the MCR personnel for emergency evacuation, and by the damage control team while working in the contaminated area.

9.3.1.3 Safety Evaluation

The compressed air and gas systems are non safety-related systems with the exception of the containment isolation portion, which is described in Subsection 6.2.4. No safety evaluation is required.

A loss of instrument air during an accident or SBO causes all pneumatically operated safety-related valves and control dampers served by the IAS to fail in the safe position. However, each auxiliary feedwater turbine steam supply valve has an air accumulator with two cycles of minimum capacity as backup compressed air to perform its safety-related

function on loss of instrument air pressure. Therefore, failure of the IAS does not affect any safe shutdown or accident mitigation function and also does not cause degradation of barriers to radiation releases during normal operation.

The IAS is designed to produce the quality of air as stipulated in ANSI/ISA-S7.3.

Provisions to cross connect the IAS and SAS are installed at the distribution header upstream of the dryers. In event that the instrument air compressors cannot meet the demand for instrument air, the service air compressor provides a backup supply of air.

The compressed air and gas systems are not shared with other units, and the requirements of GDC 5 (Reference 3) are therefore not applicable.

9.3.1.4 Inspection and Testing Requirements

Preoperational testing is carried out as described in Section 14.2 to demonstrate that the compressed air and gas systems operate in accordance with applicable test programs and specifications.

Air compressors and associated components of the CAS on standby are checked and operated periodically. Air filters of the IAS are inspected for cleanliness, and the desiccant is changed when it no longer performs according to the manufacturer’s specifications. The compressed air sample of the IAS is analyzed for moisture, air, and particulate content at each refueling outage to provide reasonable assurance that air quality meets the requirements of ISA-S7.3.

9.3.1.5 Instrumentation Requirements

Adequate instrumentation, including pressure elements, is provided to monitor the system operation and to present annunciation in the MCR whenever system pressure drops below setpoint limits.

Air compressor status lights are also provided in the MCR and RSR to inform the operator of the status of air compressors. The pressure indicators on each air line of the IAS are provided in the MCR for remote indication of the air receiver outlet common header and

the afterfilter outlet header pressure. The pressure indicator is also provided in the MCR for remote indication of the air receiver outlet in the SAS.

The instrumentation of air compressors and dryer packages includes locally mounted temperature and pressure switches, indicators, and automatic protection devices.

9.3.2 Process and Post-Accident Sampling System

The process and post-accident sampling system is designed to collect and deliver representative samples of liquids and gases in various process systems to various sample stations for chemical and radiological analysis. The system consists of the normal primary sampling system (NPSS), the post-accident sampling system (PASS), and the secondary sampling system (SSS) and permits sampling during normal operation, including shutdown cooling and post-accident modes without access to the containment. Samples in high radiation areas are taken remotely without access to these areas. Local grab sampling points, as listed in Table 9.3.2-1, are provided for various locations throughout the plant. Manual grab sampling is performed by the operator for the liquid samples as required. After sampling, the sampling lines are flushed with demineralized water. Their connections are shown on the flow diagram of the respective systems and are not considered part of the sampling system. The sampling system performs no safety function except the containment isolation.

Process and effluent radiation monitoring and sampling systems are described in Section 11.5. Containment hydrogen monitoring is described in Subsection 6.2.5.2.2. Containment radiation monitoring is described in Subsection 11.5.2.2.

9.3.2.1 Design Bases

a. The NPSS is designed to meet the relevant requirements of 10 CFR 20.1101(b), GDC 1, 2, 13, 14, 26, 41, 60, 63, and 64. The PASS is designed to meet the relevant requirements of 10 CFR 50.34(f)(2)(viii) and 10 CFR 50.34(f)(2)(xxvi), Items II.B.3 and III.D.1.1 in NUREG 0737, 20.1101(b), GDC 1, 2, 13, 14 and 60.

b. The NPSS and PASS has no safety function except the containment isolation capability, which is described in Subsection 6.2.4. Sample lines penetrating the

containment are provided with isolation valves in accordance with 10 CFR 50, Appendix A, GDC 54, 55, and 56. The automatic containment isolation valves are closed on containment isolation actuation signal (CIAS).

c. The NPSS and SSS are designed to collect samples of the fluids in the primary and secondary systems for water quality analysis by the operator. Chemical and radiochemical analyses are performed on these samples to determine fluid characteristics such as boron concentration, fission and corrosion product activity, crud concentration, dissolved gas and corrosion product concentrations, chloride concentration, fluid pH and conductivity, and noncondensable gas concentration. The results of these analyses are used to regulate the reactor coolant boron concentration, monitor the fuel cladding integrity, evaluate ion exchanger and filter performance, specify chemical additions to the various systems, and maintain the proper hydrogen concentration in the reactor coolant system.

d. The seismic design classification and quality group classification of sample lines and components conform to the classification of the system to which each sampling line and component is connected, out to a point where classification to lower seismic and quality group classification is justified on the basis that adequate isolation valve or flow restriction is provided. The design of the sample probes and their connection to sampled system piping provides reasonable assurance of the structural integrity of the sample probe within the pipe. The NPSS, PASS, and SSS component and seismic classification are discussed in Section 3.2.

e. The sampling system is designed to direct most reactor coolant sample purge fluids to the volume control tank or equipment drain tank, and other radioactive samples that purge and overflow a sample sink to the radioactive drain system during normal conditions.

f. The liquid sample flow rate is sufficient to provide reasonable assurance of turbulent flow in the sample line upstream of the sampling or monitoring location. Sample flow rates are selected based on sample line size, fluid temperature, and sample station location to provide reasonable assurance that the turbulent flow requirement is met.

g. A constant gaseous flow rate is maintained for continuous samples. The gaseous flow provides reasonable assurance of laminar flow to decrease plateout where particulates are to be measured.

h. The PASS is designed to take reactor coolant samples for boron concentration and total dissolved gas measurements within 8 hours and 24 hours, respectively, after plant shutdown. Reactor coolant and containment atmosphere samples for radiological measurements can be obtained within 24 hours after plant shutdown. These features are consistent with the recommendations in SECY-93-087.

i. The system provides the capability to take reactor coolant and containment atmosphere samples for the analyses identified above. These analyses are performed either continuously or by grab sample and analysis. Backup grab samples are provided for any online monitoring capability consistent with NUREG 0737, Item II.B.3, Clarification (8). Under the accident conditions, liquid samples are directed to the holdup volume tank (HVT), while containment air samples are directed back to containment atmosphere.

j. Provisions are made for dilution of liquid and gas grab samples for subsequent laboratory analysis. Dilution of the liquid and gas grab samples is performed either at the sampling station or in the laboratory, whichever leads to simpler equipment consistent with ALARA practices. Collection and dilution of the post-accident samples is performed remotely to the maximum extent feasible.

k. All remotely operated valves for post-accident sampling have reliable power supplies and reset features that allow reopening of the valves after containment isolation without clearing the isolation signal for other containment isolation valves. Individual valve reset features are provided to allow opening of individual sampling valves after system reset. Valves inaccessible during an accident are environmentally qualified to provide reasonable assurance of operability under accident conditions.

l. Sample lines that are not isolable from the RCS during normal system operations (including shutdown cooling system operation) are provided with a flow restriction device of 0.2 mm ID × 25 mm orifice (7/32 in ID × 1 in orifice) to limit the loss of coolant in the event of a sample line piping break.

m. Sample lines that continuously draw samples at temperature 60 °C (140 °F) and above are insulated.

n. In order to provide reasonable assurance that representative samples are obtained, all sample lines have provisions for flushing and purging. Purge flow is high enough to inhibit deposition of suspended solids and to remove crud from sampling lines.

9.3.2.2 System Description

9.3.2.2.1 Normal Primary Sampling System

The NPSS consists of a normal primary sample cooler rack, a normal primary sample sink with primary off-gas H_2/O_2 analyzer, and a normal primary sample control panel for normal sampling. The function of the NPSS is to provide liquid and gaseous samples for analysis in order to provide a basis for control of the RCS chemistry and radiochemistry. The system provides representative samples for both on-line and laboratory analysis during normal operating conditions. The NPSS is controlled from the sampling rooms located in the compound building with the exception of the containment isolation valves, which are operated from the MCR.

Figure 9.3.2-1 illustrates the portions of the normal primary sampling system used for reactor coolant sampling during normal operations. The system provides a constant and continuous sample flow to the on-line monitors or analyzers identified in Table 9.3.2-1.

In addition to the general system procedures discussed above, the following primary sampling procedures provide reasonable assurance of a reliable system.

a. Reactor coolant system samples

   1) The NPSS provides a means of obtaining remote liquid samples from the pressurizer surge line and one RCS hot leg. A sample connection is also provided from the pressurizer steam space via the pressurizer safety valve inlet piping. Each sample line contains a flow restricting orifice. The orifice serves to separate the safety Class 2 from safety Class 1 boundary.

2) Sampling of the RCS hot leg is possible during both normal and accident conditions. Sampling of the pressurizer surge line and pressurizer steam space is only possible during normal operation.

3) The normal high-pressure and high-temperature samples from the pressurizer surge line, the pressurizer steam space, and the hot leg are individually routed to a sampling station where they are first cooled in a sample heat exchanger to 48.9 °C (120 °F) or less and then reduced in pressure by a throttling valve to approximately 1.76 kg/cm^2 G (25 psig).

4) Provisions are made to allow sampling of the RCS during startup.

5) Provisions are made to allow reactor coolant sampling during the shutdown cooling operation.

6) The RCS sample lines provide a delay time of at least 60 seconds inside the containment to allow decay of N-16 activity.

7) Remote sampling lines are also provided on the safety injection tanks (SITs) (four sample points, one per tank). Samples from the SITs are at a pressure of less than 49.2 kg/cm^2 G (700 psig) and a temperature of less than 93.3 °C (200 °F).

b. Shutdown cooling system samples

1) The NPSS provides a means of obtaining remote liquid samples from the shutdown cooling system for chemical and radiochemical laboratory analysis. Two sample points are provided:

    a) SCS mini-flow heat exchanger 1 inlet (63.3 kg/cm^2 G (900 psig), 204.4 °C [400 °F))

    b) SCS mini-flow heat exchanger 2 inlet (63.3 kg/cm^2 G (900 psig), 204.4 °C [400 °F])

2) In addition to the sample points described above, a sample tap is also provided in each CS mini-flow heat exchanger inlet line (total of two taps). These taps permit sampling during SC operations when the CS pumps are used.

c. Chemical and volume control system samples

1) The NPSS is capable of individually processing samples from the following points:

a) Purification filter influent

Temperature	48.9 ~ 60 °C (120 ~ 140 °F)
Pressure	4.2 ~ 14.1 kg/cm^2 G (60 ~ 200 psig)
Activity	Refer to Chapter 11
Chemical nature	Primary water or refueling water

b) Purification filter effluent

Temperature	48.9 ~ 60 °C (120 ~ 140 °F)
Pressure	4.1 ~ 14.1 kg/cm^2 G (58 ~ 200 psig)
Activity	Refer to Chapter 11
Chemical nature	Primary water or refueling water

c) Purification/deborating ion exchanger effluent

Temperature	48.9 ~ 60 °C (120 ~ 140 °F)
Pressure	3.5 ~ 14.1 kg/cm^2 G (50 ~ 200 psig)

Activity	Refer to Chapter 11
Chemical nature	Primary water or refueling water

2) The sample flow rates from each point at the sample sink are:

Sample flow rate	31.5 ~ 63.1 cm^3/sec (0.5 ~ 1.0 gpm)
Purge flow rate	63.1 cm^3/sec (1.0 gpm)

d. Primary Off-gas samples

The primary off-gas H_2/O_2 analyzer is a part of the NPSS and is designed to sample the gases from the components that are listed below to monitor the hydrogen and oxygen concentrations. After the analysis, the sampled gas is discharged to the gas surge header of the gaseous radwaste management system:

GWMS gas surge header

CVCS reactor drain tank

CVCS volume control tank

CVCS gas stripper

CVCS equipment drain tank

CVCS holdup tank

9.3.2.2.2 Post-accident Sampling System

The PASS consists of a post-accident primary sample cooler rack, a post-accident primary sample sink, and a post-accident primary sample control panel for post-accident sampling. The function of the PASS is to take reactor coolant and containment atmosphere samples during post-accident conditions. The normal high-pressure and high-temperature sample

from the hot leg are individually routed to a post-accident primary sample cooler rack where they are first cooled in a sample heat exchanger to 48.9 °C (120 °F) or less and then reduced in pressure by a throttling valve to approximately 1.76 kg/cm^2 G (25 psig). Under the accident conditions, liquid samples are directed to the holdup volume tank (HVT), while containment air samples are directed back to containment atmosphere. The PASS provides representative samples for both on-line and laboratory analysis during post-accident conditions. The sample line of on-line monitor is provided with heat tracing to prevent dew condensation and is purged before sampling to provide reasonable assurance that samples are representative. The PASS is controlled from the post-accident sampling rooms located in the auxiliary building with the exception of the containment isolation valves, which are operated from the MCR.

Figure 9.3.2-1 provides a functional flow diagram for post-accident sampling of reactor coolant consistent with SECY-93-087. Connections to the RCS hot leg, SIS, and SCS sample lines for post-accident sampling are also shown. The system design appropriately integrates the normal and post-accident functions so as to maximize the familiarity of plant operators with post-accident operation(s). The design uses common sample lines and points for both normal and post-accident sampling to the maximum extent possible.

Sampling of the RCS hot leg is possible during the post-accident operation. In order to permit post-accident sampling of the IRWST, sample taps are provided on SIS, SCS, and CSS pump mini-flow lines. Those are routed to the post-accident sampling subsystem depicted in Figure 9.3.2-1. The system provides a constant and continuous sample flow to the on-line monitors or analyzers identified in Table 9.3.2-3.

9.3.2.2.3 Secondary Sampling System

The SSS takes representative samples from the condenser hotwell, SGs, condensate pump discharge, condensate polishing (CP) demineralizer discharge, high pressure feedwater heater outlets, SG blowdown mixed bed demineralizer outlet, auxiliary steam condensate receiver tank outlet, and other locations designated for remote sample removal in Table 9.3.2-2. SSS is provided to control the SGs secondary side water and steam cycle quality and to detect a leak or failure of SG tubes or contaminated by corrosion products. Water quality analyses are performed to provide a basis for the control of the secondary cycle water chemistry. The analyses performed on the samples (either continuously or by grab sample and lab analysis) to determine pH, sodium, hydrazine, dissolved oxygen, cation

conductivity, and specific conductivity values, as appropriate. In addition, continuous radiation monitoring of each SG is provided also. In the event of high radioactivity, the sample lines will be isolated. Containment isolation valves, located outside the containment, will also close upon receipt of high radiation signal from the steam generator secondary side samples. An alternate path for obtaining a grab sample of each steam generator is available via the normal primary sampling system. The SSS is monitored and controlled from a sampling room. In addition to the general process sampling system requirements, the following specific requirements provide reasonable assurance of a reliable SSS. The SSS provides reasonable assurance that no harmful effects result to sample return piping and valves due to improper water chemistry.

The results of the failure modes and effects analysis, as shown in Table 9.3.2-5, are that safety-related equipment remains functional considering a single failure coincident with a LOOP.

Samples from the blowdown lines originate as close to the blowdown nozzles as possible. Main steam samples for each SG are extracted downstream of the main steam isolation valves, but upstream of the main steam header. Excess sample flow and continuous sample flow is routed back to the condenser. Primary sample coolers are provided for each sample, as necessary, to cool the sample to approximately 40 °C (104 °F). Secondary sample coolers are provided for any samples that require a regulated temperature 25 °C (77 °F) for analysis. All four samples (blowdown hot leg and cold leg, downcomer, and main steam) run outside containment without headering to allow independent simultaneous grab samples to be drawn, and to allow the samples to be continuously monitored in accordance with Table 9.3.2-2. Alarms are provided for all on-line monitors to alert the operator of out of normal conditions specified in the chemistry specification.

Local grab sampling points, as listed in Table 9.3.2-2, are provided as needed for various processes. Local grab sample points are provided for the liquid sample points as required by the operator. Local grab sampling will be taken periodically for analysis in the laboratory at a frequency determined by station procedures. Manual sampling operations, such as purging, sampling, and flushing, are performed at each local grab sample station. Grab sample line lengths are kept to a minimum, and lines terminate at an accessible location.

9.3.2.2.4 Design Features for Minimization of Contamination

The process and post-accident sampling system is designed with features that meet the requirements of 10 CFR 20.1406 (Reference 9) and NRC RG 4.21 (Reference 10). The basic principles of NRC RG 4.21 and the methods of control suggested in the regulations are delineated into four design objectives and two operational objectives, which are described in Subsection 12.3.1.10. The following description summarizes the primary features that address the design and operational objectives for the process and post-accident sampling system.

The process and post-accident sampling system has been evaluated for leakage identification from the SSCs that contain radioactive or potentially radioactive materials, the areas and pathways where probable leakage may occur, and the methods of leakage control incorporated in the design of the system. The leak identification evaluation indicated that the process and post-accident sampling system is designed to facilitate early leak detection and the prompt assessment and response to manage collected fluids. Thus, unintended contamination to the facility and the environment is minimized and/or prevented by the SSC design and is supplemented by operational procedures and programs and inspection and maintenance activities.

Prevention/Minimization of Unintended Contamination

a. The primary sampling system components for normal operation, including anticipated operational occurrences, are located in elevated cubicles inside the compound building. The primary sampling cooler rack and the associated sink are equipped with drain lines that are connected to the local drain piping. A hood is provided to remove radioactive gases from the collected samples during analysis to minimize the spread of contamination. In addition, the cubicle floors are sloped, coated with epoxy, and provided with drains that are routed to the local drain hubs. This design approach prevents unintended contamination of the facility and the environment.

b. The post-accident sampling cooler rack and sink are located at the basemat level in the auxiliary building. The post-accident sampling rack and the sink are equipped with drain lines routed to the local drain piping. A hood is provided to remove radioactive gases from the collected samples during analysis to minimize

the spread of contamination. In addition, the cubicle floors are sloped, coated with epoxy, and provided with drains that are routed to the local drain hubs. This design approach prevents unintended contamination of the facility and the environment.

c. The primary sampling system is designed to be segregated with individual coolers and sampling points. Sampling piping sizes and components are designed to provide desired flow and sampling conditions in order to obtain representative samples.

d. The normal primary sample sink, normal primary sample cooler rack, post-accident primary sample sink, and post-accident primary sample cooler rack are constructed of stainless steel material. The primary off-gas sample pump is fabricated from stainless steel material and is of welded construction for life-cycle planning, thus facilitating decontamination and minimizing the spread of contamination through leakage.

Adequate and Early Leak Detection

a. The primary sampling system is designed with automated operation with manual initiation for the two modes of operation. Adequate instrumentation is provided to control the sampling operations, thus minimizing waste generation.

Reduction of Cross-Contamination, Decontamination, and Waste Generation

a. The SSCs are designed with life-cycle planning through the use of nuclear industry-proven materials compatible with the chemical, physical, and radiological environment, thus minimizing cross-contamination and waste generation.

b. The primary sampling system components are provided with demineralized water and nitrogen gas for decontamination and purging. The utility connections are designed with a minimum of two barriers to prevent the contamination of clean systems.

Decommissioning Planning

a. The SSCs are designed for the full service life and are fabricated as individual assemblies for easy removal. The components are located in accessible areas for operation, maintenance, and decommissioning purposes.

b. The SSCs are designed with decontamination capabilities. Other design features, such as the welding techniques that are used and surface finishes, are implemented in order to minimize the need for decontamination and the resultant waste generation.

c. The primary sampling system is designed without any embedded or buried piping. Piping between buildings is equipped with piping sleeves with leakage directed back to the compound building or auxiliary building for collection, thus preventing unintended contamination of the environment.

Operations and Documentation

a. The primary sampling system is designed for automated and remote operations with manual initiation for the collection of samples. Adequate space is provided around the components to enable prompt assessment and response when required.

b. The primary sampling system is a packaged vendor design. The COL applicant is to prepare operational procedures and maintenance programs as related to leak detection and contamination control. Procedures and maintenance programs are to be completed before fuel is loaded for commissioning.

c. The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations. Documentation requirements are included as a COL information item.

Site Radiological Environmental Monitoring

a. The PASS is designed to be used only for the purpose of collecting and analyzing samples. The procedures for proper handling and treatment of sampled materials

include small volumes in the sampling operation. The process and post-accident sampling system is not included in the site radiological environmental monitoring program.

9.3.2.3 Safety Evaluation

All sample lines are equipped with indicators, pressure throttling valves, heat exchangers, and other components required for plant operator safety when collecting samples. The sampling systems have no safety function except for the containment isolation portion of the system. The sampling valves for the RCS hot leg, pressurizer steam space, pressurizer surge line, holdup volume tank (HVT), and safety injection tank (SIT) samples are closed upon receiving a CIAS. These sampling valves are normally closed, are designed to fail closed if open, and are remotely operated from the MCR. The isolation valves for the SG blowdown hot leg, blowdown cold leg, and downcomer samples are closed upon a CIAS, main steam isolation (MSIS), or auxiliary feedwater actuation signal (AFAS). These valves are normally open. They are designed to fail closed and are remotely operated from the MCR. All sample lines are isolated manually at the sample source prior to entering the sampling panel(s). Subsection 6.2.4 provides the safety evaluation and more information about the containment isolation system.

The boronometer and process radiation monitor are installed in the CVCS letdown line for continuous boron and radiation monitoring during normal operations.

Connections made to the RCS pressure boundary are fitted with flow restriction devices. The sample system piping, up to and including the passive flow restrictors, is designed and fabricated in accordance with the same safety class as the system and related codes. The piping and components in the NPSS and PASS sinks are provided with pressure relief valves for personnel protection.

The sampling system handling of radioactive or potentially radioactive samples has the following special features:

a. Sample lines from the RCS provide the delay time of at least 60 seconds inside the containment building to allow decay of N-16.

b. Adequate shielding is provided to protect personnel when taking a sample during either normal or post-accident conditions.

c. Exhaust hoods are provided for each sample sink to provide reasonable assurance that leakage of any gases is exhausted from the sample room.

d. Sample sinks are provided to collect all spillage.

9.3.2.4 Inspection and Testing Requirements

9.3.2.4.1 Inspection

During the fabrication of the components and during the installation of the systems, safety Class 2 components and systems are examined for conformance with the requirements of ASME Section III, NC 5000. Non-safety-related components and systems are examined for conformance to industry standards. After installation, the systems are examined for the correct routing of piping, placement of hangers, and insulation, and the sample vessels are removed and reinstalled to test the functioning of the disconnects.

9.3.2.4.2 Testing

After installation is completed, the system is hydrostatic and leak tested to the requirements of ASME Section III, NC 6000. The cooling flow to and from the sample coolers is observed before the system valves are operated for a functional check. The sample flow is observed to meet minimum requirements, and the instrumentation is observed to function after the sampled system is pressurized. The adequacy of the sample coolers to cool the sample flow is observed after the sampled system is pressurized and heated.

Parameters (e.g., reactor coolant nuclides, boron, total radioactivity, dissolved gas, conductivity) used for evaluating the states of core damage and accident mitigation system are analyzed. Pressurized undiluted reactor coolant is sampled every 6 months to enhance the operability and familiarity of post-accident sampling system during normal plant operation.

9.3.2.5 Instrumentation Requirements

Local pressure, temperature, and flow indicators are provided to facilitate manual operation, and to verify sample conditions before samples are drawn. Temperature and pressure indication of sample streams is provided downstream of each sample cooler. Flow indication is provided for every sample line. Alarms are provided, as appropriate, based on the inlet sample temperature requirements for continuous monitoring parameters, and the potential transients demand swift corrective action(s).

Radiation monitors are provided for continuous monitoring of SG downcomer samples.

Boron concentration in reactor coolant is continuously monitored by boron concentration instrument.

Continuous analyzers (as defined in Table 9.3.2-2) monitor specific water quality conditions in the secondary system.

9.3.3 Equipment and Floor Drainage Systems

The equipment and floor drainage system (EFDS) collects and transports liquids containing wastes generated within the plant to the liquid waste management system (LWMS). The non-radioactive drainage system that is not potentially radioactive is provided for the collection and disposal of storm drainage, sanitary drainage, oil waste, and non-radioactive water. The EFDS has components in the reactor containment building, the auxiliary building, the turbine generator building, and the compound building.

9.3.3.1 Design Bases

9.3.3.1.1 Safety Design Bases

The following safety design bases are used for the equipment and floor drainage system:

a. The drainage line penetrating the containment is provided with isolation valves in accordance with 10 CFR 50 Appendix A, GDC 56 (Reference 4).

b. Level instruments are provided to measure flooding level in the engineering safety feature (ESF) pump rooms and the floors of quadrants A, B, C, and D in the auxiliary building. The divisional and quadrant separation for internal flooding protection is described in Subsection 3.4.1.3.

The EFDS has the following design basis requirements:

a. Safety-related portions of the EFDS are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, and tsunamis without loss of capability to perform their safety functions in accordance with 10 CFR 50 Appendix A, GDC 2 (Reference 5).

b. Safety-related portions of the EFDS are designed to accommodate the effects of and be compatible with the environmental conditions associated with normal operation, maintenance, surveillance testing, and postulated accidents in accordance with 10 CFR 50 Appendix A, GDC 4 (Reference 6).

c. Safety-related portions of the EFDS are designed to include the means to suitably control the release of radioactive materials in gaseous and liquid effluents produced during normal reactor operation, including anticipated operational occurrences (AOOs), in accordance with 10 CFR 50 Appendix A, GDC 60 (Reference 7).

9.3.3.1.2 Power Generation Design Bases

The following power generation design bases are used for the equipment and floor drainage system:

a. Separate drain headers are provided for each drain type to prevent mixing of different types of liquid wastes. To prohibit the inadvertent release of radioactive waste to the environment, the drainage and collection systems used to handle radioactive or potentially radioactive liquid waste are separated and isolated from the systems used to handle non-radioactive waste. Water-filled loop seals are provided in floor drain piping to preclude the flow of contaminated air from one building area to another.

b. The design and arrangement of the non-radioactive drainage system preclude the possibility for introduction of potentially radioactive contaminated materials.

c. The EFDS serving areas with safety-related equipment are segregated into independent systems so that a postulated flooding of one area does not impair the safety of the redundant equipment.

d. The EFDS is capable of preventing a backflow of water that may exist from maximum flood levels resulting from external or system leakage to areas of the plant containing safety-related equipment.

e. The EFDS has provisions for the detection of leakage from the reactor coolant pressure boundary in accordance with NRC RG 1.45 (Reference 8), as well as refueling pool, in-containment refueling water storage tank (IRWST), auxiliary feedwater storage tank, spent fuel pool, refueling canal, and cask loading pit.

f. The turbine generator building equipment and floor drains are segregated and collected separately. Drains and discharges from sumps in the turbine generator building are not normally processed by the LWMS and are released to the environment after processing by a [[wastewater treatment facility (WWTF).]]

g. Sumps, tanks, and sump pumps are located at lower levels to facilitate transfer to the LWMS. In addition, sumps are sized to accommodate drainage required during normal plant operations and maintenance activities.

h. Sump pumps are sized to pump at a rate at least equal to the maximum expected input rate, including tank overflows.

i. The equipment and floor drain systems and components are designed as non-nuclear safety as listed in Table 3.2-1, except for containment isolation valves and associated piping, and flood alarm loops of ESF pump rooms and floors of each quadrant wall, which are designed as seismic Category I, safety Class 2 and 3. Principal codes and standards and the classification applicable to the EFDS are listed in Table 3.2-1.

j. All equipment and floor drainages in radioactive and potentially radioactive contaminated areas of the reactor containment building, auxiliary building, and compound building are collected in appropriate local collection sumps. Each sump is provided with sump pumps capable of transferring the wastewater to the appropriate waste collection tanks in the LWMS.

k. Chemical drainage from laboratory and chemical decontamination solutions is transferred to the chemical waste tanks of the LWMS. The waste from personnel decontamination and detergent type decontamination solutions is transferred to the detergent waste tanks of the LWMS.

l. Provisions are made to segregate oil from the EFDS in locations where significant amounts of oil are present and near oil containing systems.

m. The EFDS is designed to prevent damage to safety-related systems, structures, and equipment. The EFDS failures will not prevent the proper function of any safety-related equipment since the non-safety related component in safety related areas such as reactor containment building and auxiliary building is designed as seismic Category II.

9.3.3.2 System Description

The EFDS collects radioactive and potentially radioactive liquid wastes at atmospheric pressure from drainage of the reactor containment building, the auxiliary building, the compound building, and the turbine generator building. The liquid wastes are segregated, depending upon water quality and/or building, into four groups: equipment drainage, floor drainage, chemical drainage, and detergent drainage. Such drainages are conveyed by gravity to their respective building sumps and pumped to the LWMS. Chemical wastes collected from equipment decontamination and potentially chemical contamination wastes are sent to the chemical waste tanks of LWMS.

The EFDS consists of collection sumps, sump pumps, valves, piping, and instrumentation.

9.3.3.2.1 General Description

The EFDS consists of several subsystems, as described below. Areas of the plant are served by the appropriate EFDS, based on the potential source of leakage into the subject area. This allows segregation of radioactive and non-radioactive sources. The schematic diagram of radioactive drain system (RDS) is shown in Figures 9.3.3-1.

9.3.3.2.2 Radioactive Drainage Areas

The RDS collects radioactive and potentially radioactive liquid wastes at atmospheric pressure from equipment and floor drainage of the containment building, auxiliary building, and compound building. Such drainage is conveyed by gravity to sumps and pumped from sumps to the LWMS.

Chemical wastes are collected from equipment decontamination and sent to the LWMS chemical waste tanks. Potentially radioactive wastes from personnel decontamination shower facilities are collected and pumped to the detergent waste tanks of LWMS. Potentially radioactive wastewater entering the sump located in the condensate polishing demineralizer and regeneration equipment area in the turbine generator building is pumped to the LWMS.

9.3.3.2.3 Non-Radioactive Drainage Areas

The non-radioactive drain system incorporates several subsystems, which include (1) turbine generator building drain and miscellaneous building drain systems, (2) non-radioactive equipment vent and drain system, (3) roof drain system, and (4) wastewater transfer system. These systems collect liquid wastes from floor drains, equipment drains, or roof drains and direct them to the appropriate system for processing or disposal.

The roof drain system collects water resulting from precipitation on all building roofs. The roof drain system is sized to accept the design rainfall rate and the collected rainwater is conveyed by gravity to the site storm drainage system.

The turbine generator building drain and miscellaneous building drain system collects non-radioactive liquid waste from the turbine generator building, the clean and dirty lube oil

tanks, the main turbine lube oil reservoir, and the auxiliary boiler areas. These non-radioactive wastes are collected in sumps and pumped to a [[wastewater treatment facility (WWTF)]] through the wastewater transfer system for processing and disposal. Drain piping is provided from each curbed transformer area to a local holding tank, where accumulated oily drains are disposed of manually as required.

The non-radioactive equipment vent and drain system transfers liquid wastes from the various equipment and floor drains to their associated building sumps in the turbine generator building drain and miscellaneous building drain system. The wastewater transfer system receives oily and chemical wastewater from the turbine building drain and miscellaneous building drain systems, and collects waste streams in separate oily and chemical wastewater ponds. The wastewater transfer system maintains segregation of the oily and chemical wastes and separately transfers each type of collected waste to a [[WWTF]].

9.3.3.2.4 Component Description

a. Collection piping

   In all areas of potential radioactivity, the collection system piping for the RDS is stainless steel. Potentially radioactive laboratory and decontamination waste, regeneration waste, and detergent waste collection system piping is stainless steel. Offsets in the piping are provided where necessary for radiation shielding. Non-radioactive collection piping is carbon steel.

   All collection piping containing radioactive or potentially radioactive material is provided with a means to prevent air from zones of high airborne contamination potential from circulating through the drain system to normally accessible areas. The prevention of air circulation is accomplished by using water-filled seals or by sealing individual floor drains. The methods used for sealing are not susceptible to plugging and are provided with flushing connections where possible. Where practicable, piping that drains into the same connection sump is provided with a water seal at the sump. This is accomplished by routing separate branch drains with all inlets to the sump turned down and terminated below the level at which the sump pump stops pumping.

b. Collection sumps

The collection sumps are provided with a well-fitted and non-gas-tight manhole for maintenance access. Each sump is fitted with a vent pipe to exhaust potential sump gases into the local area or to the ducted exhaust system. Radioactive sumps are stainless steel construction. Non-radioactive collection sumps are constructed of concrete with corrosion resistant coating or liner. Oil-absorbent material is used for removal of oil in the sumps.

c. Sump pumps

Redundant sump pumps are provided in each sump except sumps in the ESF pump rooms, where one sump pump is provided. Individual pump capacities are determined by the expected maximum inflow from the associated drainage subsystem. Sump pumps are designed to discharge at a flow rate adequate to prevent sump overflow during normal anticipated drainage periods.

d. Reactor containment building equipment and floor drains

Leakage from all reactor containment building floors is directed to the reactor containment building drain sump. The in-core instrumentation (ICI) cavity is also provided with a sump at the lowest point in the reactor containment building. These sumps serve no safety-related function.

The reactor containment building drain sump and the ICI cavity sump are provided with a sump level monitoring system to detect unidentified leakage from the reactor coolant system (RCS).

The sump pump discharge lines penetrating the reactor containment building to the auxiliary building are isolated by one fail-closed air-operated and the one fail-lock motor-operated containment isolation valve (CIV), one inside the reactor containment building and one outside the reactor containment building. These valves close on a containment isolation actuation signal (CIAS). The reactor containment building floor drain piping is a non-safety class piping except for the containment penetration piping and the CIVs, which are safety Class 2.

Reactor coolant quality water from valve and equipment leak-offs, drains, and reliefs within the reactor containment building are collected in the reactor drain tank (RDT). The tank is part of the chemical and volume control system (CVCS) and is described in Subsection 9.3.4.2.

Low-radioactivity condensate from the reactor containment fan cooler (RCFC) and reactor cavity air handling unit (AHU) is routed to and collected in the reactor containment building drain sump.

e. Auxiliary building equipment and floor drains

The auxiliary building floor and equipment drainage system is divided into four separate drainage subsystems. No common floor drain lines are provided between quadrants or divisions.

Each quadrant is provided with a floor drain sump, independent of the sumps serving the other quadrants. Also, each division is provided with an equipment drain sump, independent of the sump serving the other division. The separate floor and equipment drain headers empty into the sumps, each of which is equipped with two 100 percent capacity sump pumps. The sump pumps operate automatically under control of level instrumentation in the sumps, and transfer the collected waste from the sump to the LWMS floor drain tanks and equipment waste tanks.

The auxiliary building equipment drains are directed to the equipment drain tank (EDT) of the CVCS or the LWMS equipment waste tanks depending on waste quality and activity. Recoverable reactor coolant quality water outside the reactor containment building from selected equipment drains, valve leak-offs, and equipment reliefs is collected to the EDT in the auxiliary building. This tank is a portion of CVCS and described in Subsection 9.3.4.2.

One chemical drain sump is provided in the fuel handling areas of the auxiliary building to collect the drainage from equipment decontamination. Two full-capacity sump pumps for each sump are installed to transport the collected waste to the LWMS chemical waste drain tanks for processing.

Non-radioactive floor drain sumps are provided in each division to collect non-contaminated floor drainage from clean areas in the auxiliary building. Each sump is provided with redundant full-capacity sump pumps that discharge to the non-radioactive equipment vent and drain system.

f. Compound building equipment and floor drains

The compound building is provided with four drain sumps: the compound building normal sump, compound building chemical drain sump, spent resin long-term storage tank room sump, and detergent waste subsystem (DWS) drain sump, which collect floor drainage from the building. Each sump is provided with two 100 percent capacity sump pumps that automatically pump the collected waste to the LWMS radwaste collection tanks.

g. Turbine generator building equipment and floor drains

Turbine generator building pump leakages, seal flows, cooling runoffs, drains, and similar valve discharges are piped or channeled to the turbine generator building sumps. Miscellaneous leaks from various sources and general water uses, such as flushing or washdown of floors or equipment, also enter the sumps by way of channels, floor drains, or trenches that are usually covered by open grating in an embedded network within the turbine generator building floors.

9.3.3.2.5 System Operation

The equipment and floor drainage systems operate during all modes of normal plant operation. The various subsystem drainages are conveyed by gravity to their respective building sumps and pumped to the LWMS or [[WWTF]] for processing and disposal.

Sump pumps operation is automatic with manual override. The sump pumps are automatically started and stopped by the preset high, high-high, and low level instrumentation. The sump pumps are not required to operate during design basis accidents.

For sumps with duplex pumps, except the ESF pump room sump with one pump, if the liquid level reaches a high-high setpoint, an alarm is annunciated and a signal is generated to start the second pump. The high and high-high level controls are independent. In addition, for sumps with duplex pumps, if one pump or motor fails on auto-start, the other pump is automatically started.

In case of excessive influent sump fluid so that one pump is insufficient to maintain water level or a failure of the first level switch to start the pump, a second independent switch assembly with a higher setpoint than the first switch closes a contact on rising level to start the second pump or to start both pumps. Both pumps continue to run until the water level drops to the normal low level.

a. Oily waste

For major oil spills or oil draining from equipment for maintenance purposes, oil is collected and disposed of manually by means of oil pans and portable pumps. Equipment drains in which oil may be present are capable of being disposed manually and are not piped to the floor drains. Small quantities of oily waste in the EFDS can be removed in the LWMS.

b. Leak detection

In the event of spurious leakage within a plant building, a high-high sump level alarm, radiation monitor alarm, or abnormal process function alerts the operator. Identification and subsequent action would depend on the location of the leak in the plant. Leakage within the containment is addressed in Subsection 5.2.5. For the ESF pump rooms in auxiliary building, which house safety injection pumps, shutdown cooling pumps, and containment spray pumps, local sump-level indication, main control room (MCR) and remote shutdown room (RSR) alarms permit prompt identification of the leakage area. The ESF pump room sumps are not connected with other drain systems. In the other areas except for the ESF pump rooms in auxiliary building, a centrally located and easily inspected drain is designed to receive drain lines from a few normally inaccessible compartments. Leakage within any of these compartments is identified by visual inspection of the central drain.

c. Chemical wastes

Chemicals used in radiochemistry lab analysis are collected by a separate, local drain system and directed to an expendable container. When filled, the container is removed and absorbent material, such as vermiculite, is added to permit handling and shipment offsite. Chemically contaminated radioactive liquid wastes from the auxiliary and compound buildings are piped to chemical drain sump and decontamination sump and routed to the LWMS chemical waste tanks. In the event of accidental radioactive contamination of the chemical wastes, the LWMS is used to process these wastes.

9.3.3.2.6 Design Features for Minimization of Contamination

The APR1400 is designed with features that meet the requirements of 10 CFR 20.1406 (Reference 9) and NRC RG 4.21 (Reference 10). The basic principles of NRC RG 4.21 and the methods of control suggested in the regulations are delineated into four design objectives and two operational objectives discussed in Subsection 12.3.1.10. The following description summarizes the primary features to address the design and operational objectives for the EFDS.

The EFDS contains floor and equipment drains that may be radioactively contaminated from equipment and piping leakages and equipment drainage. In accordance with NRC RG 4.21, the EFDS has been evaluated for identification of leakage from the system components, primarily sumps and associated piping, that contain radioactive or potentially radioactive materials; the areas and pathways where probable leakage may occur; and the methods of leakage control incorporated in the design of the system. The leak identification evaluation indicated that the EFDS is designed to provide the capability for the prompt assessment and response to manage collected fluids. Thus, unintended contamination to the facility and the environment is minimized and/or prevented by the SSC design, supplemented by operational procedures and programs and inspection and maintenance activities.

Prevention/Minimization of Unintended Contamination

a. The system components, including all of the EFDS sumps that handle radioactive or potentially radioactive liquid, are designed with stainless steel liners encased in

concrete cavities. The concrete cavities are epoxy-coated to provide smooth surfaces for cleaning and decontamination for life-cycle planning. The EFDS sump liners are designed to be sealed at the rim to prevent infiltration of contaminated drainage. The sump liners are also designed to be removable to facilitate cleaning, inspection, and maintenance activities on a predetermined frequency based on the service life of the epoxy coating. This design approach minimizes leakage and unintended contamination of the facility and the environment.

b. The EFDS sumps are equipped with duplex pumps and level instruments to facilitate automated pump starting and stopping operation. Normally one pump in the sump is used. In the event of excessive collected drainage, the second pump in the sump is automatically started on the high-high level signal. This design approach minimizes sump overflow and thus minimizes the spread of contamination and waste generation.

Adequate and Early Leak Detection

a. In areas that are not normally accessible during power operation, such as the ICI cavity sump, the RCB drain sump, and the AB floor drain sumps, continual level indication is provided in the MCR and the RSR. In the event the sump liquid level reaches a preset limit, the level instrument initiates a signal to alarm in the MCR and the RSR for operator actions. This design approach, supplemented with operational procedures, provides adequate leak detection capability and minimizes the potential for the spread of contamination.

Reduction of Cross-Contamination, Decontamination, and Waste Generation

a. The sumps that handle contaminated or potentially contaminated fluids are designed to minimize the spread of contamination through the use of liners, epoxy coating, and seals. This design approach is nuclear-industry proven and is compatible with the chemical, physical, and radiological environment, thus minimizing waste generation.

b. The EFDS sumps are strategically located to collect floor and equipment drainage. Drains are segregated for different handling and processing requirements to

minimize cross-contamination. The pumps are adequately sized for maximum input to prevent overflow; one pump is normally used, but when the sump liquid content level continues to rise, the second pump is initiated at the high-high level. This design approach minimizes the spread of contamination.

c. The sumps are housed in individual cubicles. Cubicle curbs and/or doors are provided to reduce the spread of contamination to other areas and additional needs for decontamination.

d. Sampling points are provided to facilitate sampling and analyses to properly route drainage for treatment and disposal. This design approach minimizes waste generation.

e. Utility connections such as demineralized water and instrument air are designed with a minimum of two barriers to prevent cross-contamination.

Decommissioning Planning

a. The sump liners are designed for the full service life and are fabricated as individual assemblies for easy removal. The drain pipe flange connections to the sumps are also designed to permit disconnect to facilitate removal of the liners for inspection, cleaning, and maintenance of the epoxy coating of the concrete cavity. This design approach minimizes contamination and facilitates decommissioning.

b. The EFDS is designed with minimum embedded or buried piping through the use of pump transfer. Drain pipes are routed through pipe chases as much as practicable. Piping between buildings is equipped with piping sleeves with leakage directed back to the originating facility for collection. This design approach minimizes the spread of contamination and facilitates decommissioning.

Operations and Documentation

a. The EFDS is designed for automated operation. The sumps are designed with dual-level instruments to provide reasonable assurance of a safe operation. A high level signal initiates liquid transfer with one pump. If the liquid level continues

to rise, a high-high signal initiates additional liquid transfer with the secondary pump. Level signals are transmitted to the MCR for monitoring and operator response.

b. Adequate space is provided in the vicinity of the sumps to enable prompt assessment and responses when required.

c. The COL applicant is to provide operational procedures and maintenance programs as related to leak detection and contamination control (COL 9.3 (1)). Procedures and maintenance programs are to be completed before fuel is loaded for commissioning.

d. The COL applicant is to maintain complete documentation of the system design, construction, design modifications, field changes, and operations (COL 9.3 (2)). Documentation requirements are included as a COL information item.

Site Radiological Environmental Monitoring

a. The EFDS is designed to handle radioactive fluids, and the sumps are located at lower elevations to facilitate drainage collection. The EFDS is part of the overall plant and is included in the site radiological environmental monitoring program for monitoring of facility and environmental contamination. The site radiological environmental monitoring program includes sampling and analysis of effluent to be released, meteorological conditions, hydrogeological parameters, and potential migration pathways of radioactive contaminants. The COL applicant is to prepare the Site Radiological Environmental Monitoring Program (COL 9.3 (3)).

9.3.3.3 Safety Evaluation

The EFDS is designed to accomplish the necessary segregation of liquid wastes as required by the LWMS.

Drains are sized for draining of their corresponding equipment. Sump sizes and sump pump capacities are compatible to eliminate undesirable sump pump cycling operation.

Sump pump capacities are sized to handle the maximum leakage rate into their respective sumps. Operators are alerted when abnormal quantities of water are released to the EFDS by comparing pump discharge pressures and flows to the calculated and experimental flows and pressure drops. In addition, the operation of sump pumps is not required to mitigate the effects of internal flooding.

All piping capable of flooding components needed for safe shutdown and accident mitigation is designed as seismic Category I. This minimizes the potential for flooding safety-related components.

Each ESF pump room is provided with a sump, and each sump has no connection with other drain systems except sump pump outlet. The check valves are installed on the pump outlet piping and the outlet piping arrangement prevents the ESF pump rooms from being flooded by backflows.

The ESF pump rooms are provided with seismic Category I, safety Class 3, flood alarm instruments to provide reasonable assurance of the operability of safety-related pumps, and each quadrant of the auxiliary building bottom elevation is provided with seismic Category I, safety Class 3 flood alarm instruments to alert an operator of flooding in each quadrant.

The auxiliary building is further separated by quadrants up to elevation 78'-0". This provides reasonable assurance of train separation of safety-related equipment necessary for safe shutdown and prevents a potential flood in one quadrant from flooding into the other quadrants. Above elevation 78'-0", the auxiliary building is physically separated with concrete walls and curbs so that flooding one division does not affect the other division. Good operating practice dictates that system operation be either terminated or quickly switched over to the redundant train and the leaking component or header isolated. This minimizes the quantity of water available for flooding safety-related equipment.

9.3.3.4 Inspection and Testing Requirement

All EFDS piping is tested hydrostatically. Where the hydrostatic test is not practicable, the exposed welds are tested by nondestructive examination.

Safety-related portions of the EFDS are inspected and tested as part of the initial test program. The initial plant startup test program is described in Section 14.2. The performance and structural integrity of system components are demonstrated by continuous operation.

The function and performance of containment isolation valves are tested in accordance with Technical Specifications in Subsection 3.6.3 of Chapter 16 and 10 CFR 50 Appendix J programmatic requirements (Reference 11). Inservice functional operation is monitored periodically by instrumentation that readily identifies equipment degradation.

The operability of EFDS components dependent on gravity flow is checked by normal usage.

Pumps and level controls are adjusted for maintenance of proper sump level.

9.3.3.5 Instrumentation Requirements

The CIAS is originated by the reactor protection system. Containment isolation and containment isolation valve position indication are available in the MCR and RSR.

Sufficient instrumentation is included in the system to provide reasonable assurance of satisfactory operation.

Sumps and sump pumps have adequate instrumentation to start and stop pumps and monitor performance. Seismic Category I level alarms are provided for floor drain sumps in each quadrant of the auxiliary building. High-level indication, in addition to the level-operated switch used for pump control is provided for all sumps in the containment and auxiliary building to provide backup indication of the presence of large leaks and to provide information as to the source. Level alarms are provided for all other sumps as well. Level alarms are displayed and monitored in the MCR, RSR, and radwaste control room.

9.3.4 Chemical and Volume Control System

The chemical and volume control system (CVCS) is designed to perform the following functions:

a. To maintain the chemistry and purity of the reactor coolant during normal and shutdown operations

b. To maintain the required volume of water in the RCS, compensating for reactor coolant contraction or expansion resulting from changes in reactor coolant temperature and for other coolant losses or additions

c. To receive, store, and separate borated waste for recycle, or discharge to the liquid waste management system (LWMS)

d. To control the boron concentration in the RCS to obtain optimum control element assembly (CEA) positioning; to compensate for reactivity changes associated with major changes in reactor coolant temperature, core burnup, and xenon variations; and to provide shutdown margin for maintenance and refueling operations

e. To provide auxiliary pressurizer spray for (1) control of pressurizer pressure during the final stages of shutdown, and (2) pressurizer cooling

f. To provide injection water at the proper temperature, pressure, and purity for the reactor coolant pump seals and collect the controlled bleedoff from the reactor coolant pump seals

g. To provide a means for continuous removal of noble gases and other dissolved gases from the RCS

9.3.4.1 Design Bases

9.3.4.1.1 Safety Design Bases

The CVCS is designed to have the following safety design bases:

a. The CVCS maintains integrity of components (including piping and valves) in the reactor coolant pressure boundary (RCPB).

b. The CVCS provides the means of isolating CVCS lines that pass through the containment penetrations to confine the release of any radioactivity from the containment following a postulated DBA.

c. The CVCS limits the magnitude of a boron dilution source to the RCS to prevent inadvertent RCS boron dilution.

9.3.4.1.2 Performance Design Bases

The CVCS is designed in accordance with the following performance design bases:

a. In conjunction with the pressurizer, the CVCS is designed to accept RCS letdown flow when the reactor coolant is heated at the maximum administrative rate of 41.7 °C/hr (75 °F/hr) and to provide the required makeup using one of the two charging pumps when the reactor coolant is cooled at the maximum administrative rate of 41.7 °C /hr (75 °F/hr).

b. The CVCS is designed to maintain the reactor coolant chemistry within the limits specified in Tables 9.3.4-1A through 9.3.4-1C.

c. The CVCS has the capacity to receive and process all excess reactor coolant generated during all normal and anticipated modes of operation.

d. The CVCS provides 99.9 L/min (26.4 gpm) of filtered flow to the reactor coolant pump seals and accepts 48.5 L/min (12.8 gpm) controlled bleedoff flow.

e. One charging pump has the capacity to replace the flow lost to the containment due to a break in a small RCS line, such as instrument and sample lines. These lines have 5.56 mm (7/32 in) internal diameter by 25.4 mm (1 in) long flow-restricting orifices installed in their RCS nozzles to limit leakage in the event of a line break.

f. The CVCS is designed to receive discharges from drains and relief valves in the RCS, SIS, and SCS.

g. The CVCS provides for boron concentration adjustment in the RCS by feed-and-bleed. The maximum possible rate of boron dilution is limited so that the operator has sufficient time to identify and terminate a boron dilution incident prior to reaching criticality during any refueling operations (see Subsection 7.7.1.1 for a description of the boron dilution alarm system).

h. The CVCS concentrated boric acid reserve is sufficient to make the reactor subcritical during one shutdown operation to cold shutdown condition and startup, followed by a shutdown for refueling at the most limiting time in the core cycle with the most reactive control rod withdrawn.

i. During the final stage of RCS cooldown, the CVCS provides auxiliary pressurizer spray flow to complete cooldown operations. When the main spray is not available, the auxiliary pressurizer spray provides a means to depressurize the pressurizer manually except for a LOOP event.

j. The CVCS is designed to support the plant ALARA goals with its shutdown purification functions.

9.3.4.2 System Description

The CVCS consists of charging pumps, auxiliary charging pump (ACP), regenerative HX, letdown HX, CCP mini-flow HX, ion exchangers, filters, pumps, tanks and associated valves, piping, and instrumentation. The piping and instrumentation diagram for the CVCS is provided in Figure 9.3.4-1. Design parameters for the major components are shown in Table 9.3.4-2. Normal operating parameters for the CVCS are listed in Table 9.3.4-3. The seismic category and quality group classification for CVCS components are specified in Section 3.2.

9.3.4.2.1 Letdown and Charging Subsystem

Letdown flow from the RCS passes through the tube side of the regenerative HX, where an initial temperature reduction takes place via heat transfer to cooler charging fluid on the shell side of the HX. A final temperature reduction to the purification subsystem operating temperature is made by the letdown HX. The letdown HX is sized to cool inlet

water from the maximum regenerative HX outlet temperature to the purification subsystem operating temperature for most operating conditions. Both the regenerative and the letdown HXs are designed for full RCS pressure, and both are located inside the containment. Cooling of the letdown flow by the letdown HX prior to depressurization enhances the operability of the pressure-reducing devices.

Letdown fluid pressure is reduced from RCS pressure to the operating pressure of the purification subsystem in two stages. The first pressure reduction occurs at the letdown orifices, and the second occurs at the letdown control valves downstream of the orifices. The letdown orifices are located inside the containment. The letdown orifices are sized to pass the maximum letdown flow at full RCS pressure with three letdown orifice isolation valves open. An orifice bypass flow control valve installed parallel to the orifices is provided for low pressure operations. The process flow is then filtered via the purification filter, monitored via a process radiation monitor and a boronometer, purified via a purification ion exchanger, and sprayed into the volume control tank (VCT). An appropriate hydrogen inventory is maintained in the RCS by keeping a hydrogen overpressure on the VCT contents.

The charging pump normally takes suction from the VCT and discharges to the RCS. During normal operations, one charging pump is running and the other is in standby. One charging control valve is normally selected for use and the other is isolated. Seal injection water is supplied to the reactor coolant pumps (RCPs) by diverting a portion of the charging flow downstream of charging control valves. This seal flow is then filtered. Once the flow has been filtered, the seal injection fluid is distributed to the four RCPs. The undiverted charging fluid is sent to the regenerative HX, where it is heated before injection into the RCS.

9.3.4.2.1.1 Reactor Coolant Inventory

The volume of water in the RCS is automatically controlled by the pressurizer level control system. The pressurizer level setpoint is programmed to vary as a function of RCS average temperature to minimize the transfer of fluid between the RCS and CVCS during power changes. This relationship is shown in Figure 5.4.10-2. Reactor power is directly proportional to the average reactor coolant temperature derived from hot and cold leg temperature measurements. A level error signal is obtained by comparing the programmed setpoint with the measured pressurizer water level. Volume control is

achieved by automatic control of the charging control valve and letdown orifice isolation valves in accordance with the pressurizer level error program.

Two parallel charging control valves, two parallel letdown control valves, three letdown orifice isolation valves, and two parallel charging pumps are provided. During reactor power operations, one charging pump is running with one in standby. In addition, one of the letdown control valves and one of the charging control valves are selected for use. Two of three letdown orifice isolation valves are opened for normal power operation.

Charging flow is continuously modulated by the selected charging control valve. The position of the selected charging control valve is varied by the pressurizer level error program in response to the level error to compensate for changes in pressurizer level. Fine control of pressurizer level is accomplished via the operating charging control valve. The letdown flow is maintained by combinations of opened letdown orifice isolation valves. When one letdown orifice isolation valve (CV-110X) is opened, minimum letdown flow is achieved. By opening two or three letdown orifice isolation valves, normal or maximum letdown flow is achieved, respectively. Letdown orifice isolation valves (CV-110Y and CV-110Z) receive a signal from the pressurizer level error program so that letdown flows are discretely changed during reactor power operations. The number of opened letdown orifice isolation valves is selected by the pressurizer level error program in response to pressurizer level conditions as shown in Figure 5.4.10-4. During heatup and cooldown, letdown flow and charging flow are maintained manually by the operator.

The level in the VCT is controlled automatically. Letdown flow is diverted to the holdup tank via the pre-holdup ion exchanger and gas stripper when the VCT high level setpoint is reached. The makeup system is normally set for the automatic mode of operation, in which flow at a preset blend of boric acid from the boric acid storage tank (BAST) and demineralized water from the reactor makeup water tank (RMWT) is provided to the VCT upon a low level signal. A low-low VCT level signal opens gravity feed valves, closes outlet valves on the VCT, opens the direct boration valve, and starts the boric acid makeup pumps to switch the charging pump suction to the BAST.

9.3.4.2.1.2 Reactor Coolant System Corrosion Control via the CVCS

Two chemicals (hydrazine and hydrogen) are added to the reactor coolant to control dissolved oxygen (DO). Hydrazine is maintained in the reactor coolant at 1.5 times the DO concentration whenever the reactor coolant temperature is below 65.6 °C (150 °F).

At power operation, DO concentration is limited by maintaining excess dissolved hydrogen in the coolant. The excess hydrogen forces the water decomposition/synthesis reaction in the reactor core toward water synthesis, rather than hydrogen and oxygen formation. Oxygen added via makeup is removed in this way.

In order to minimize the effect of crud deposition on the reactor core heat transfer surfaces, lithium-7 hydroxide is added. Lithium-7 hydroxide produces pH conditions within the reactor coolant at operating temperatures that reduce the corrosion product solubility and hence, the dissolved crud inventory in the circulating reactor coolant. The elevated pH promotes conditions within the coolant for selective deposition of corrosion products on cooler surfaces (steam generators) rather than hotter surfaces (core). An additional advantage is the formation of a more stable and tenacious passive oxide layer on out-of-core system surfaces. The lithium concentration is maintained as shown in Tables 9.3.4-1B and 9.3.4-1C.

9.3.4.2.1.3 Reactivity Control

Boron concentration is normally controlled by feed-and-bleed. To change concentration, the makeup system supplies either reactor makeup water or boric acid to the VCT, and the letdown stream is diverted to the holdup tank via the pre-holdup ion exchanger and the gas stripper. Toward the end of a fuel cycle, with low boric acid concentration in the coolant, feed-and-bleed to further reduce boron concentration becomes inefficient, and the deborating ion exchanger is used. The deborating ion exchanger contains an anion resin initially in the hydroxyl form, which is converted to a borate form as boron is removed from the reactor coolant.

9.3.4.2.1.4 Shutdown Purification

When the SCS is operational, a flow path through the CVCS can be established for purification. This is accomplished by diverting a portion of the flow from the shutdown cooling HX to the letdown line upstream of the letdown HX or upstream of the letdown control valves. The flow then passes through the purification filter, process radiation monitor and boronometer, purification ion exchanger, and the letdown strainer to the VCT. The fluid is returned to the RCS by the charging pump.

9.3.4.2.2 Boron Recovery Subsystem

The boron recovery portion of the CVCS accepts letdown flow diverted from the VCT as a result of feed-and-bleed operations for shutdowns, startups, and boron dilution over core life. The diverted letdown flow, which has passed through a purification filter and the purification ion exchanger, also passes through the pre-holdup ion exchanger. The pre-holdup ion exchanger retains cesium, lithium, and other ionic radionuclides with high efficiency. The process flow then passes through the gas stripper, where hydrogen and fission gases are removed with high efficiency, thus (1) precluding the buildup of explosive gas mixtures in the holdup tank and (2) minimizing the release of radioactive fission product gases in aerated vents or liquid discharges. The degassed liquid is discharged from the gas stripper to the holdup tank.

Reactor coolant quality water from valve and equipment leak-offs, drains, and reliefs within the containment is collected in the reactor drain tank (RDT) and scheduled for batch processing. Recoverable reactor coolant quality water outside the containment from various equipment and valve leak-offs, reliefs, and drains is collected in the equipment drain tank (EDT) and scheduled for batch processing. Reactor coolant collected in either of these tanks is periodically discharged by the reactor drain pumps through the reactor drain filter and pre-holdup ion exchanger and processed in the same manner as the flow diverted from the VCT, as described above. This liquid is also discharged to the holdup tank.

When a sufficient volume accumulates in the holdup tank, it is pumped by a holdup pump to the boric acid concentrator, where the bottoms are concentrated to 4,000 to 4,400 ppm boron. The boric acid concentrator bottoms are continuously monitored for proper boron concentration and are normally discharged to the BAST. In the event that abnormal

quantities of radionuclides are present, the bottoms are discharged to the LWMS. The boric acid concentrator distillate passes through a boric acid condensate ion exchanger, where boric acid carryover is removed. The distillate is collected in the RMWT for reuse in the plant. If recycle is not desired, the distillate is diverted to the LWMS.

9.3.4.2.3 Makeup Subsystem

A makeup subsystem of the CVCS provides for changes in RCS boron concentration. Boron is initially added to the CVCS using the boric acid batching tank (BABT). Reactor makeup water is added to the BABT via the makeup supply header, and the fluid is heated by immersion heaters. Boric acid powder is added to the heated fluid while a mixer agitates the fluid. A boric acid concentration of up to 12 weight percent can be prepared. Electric immersion heaters maintain the temperature of the solution in the BABT high enough to preclude precipitation. The concentrated boric acid solution in the BABT is drawn into the boric acid batching eductor and diluted by fluid being circulated from the BAST or the IRWST via the boric acid makeup pump. The reactor makeup water pump can also be used by taking suction from the reactor makeup water tank and pumping the water through the eductor to the BAST or the IRWST.

Boric acid solution stored in the BAST is normally supplied to the RCS via the boric acid makeup pump, while the reactor makeup water stored in the RMWT is supplied via the reactor makeup water pump. Four operational modes of CVCS makeup are provided: dilute, borate, manual, and automatic. In the dilute mode, a preset quantity of reactor makeup water is introduced into the VCT, or directly into the charging pump suction header via the VCT bypass valve, at a preset rate. In the borate mode, a preset quantity of boric acid is introduced into the VCT, or directly into the charging pump suction header via the VCT bypass valve, at a preset rate. In the manual mode, the flow rates of the reactor makeup water and the boric acid can be preset to give any blended boric acid solution between zero and 4,000 to 4,400 ppm of the boron concentration in the BAST. In the automatic mode, a preset blended boric acid solution is automatically introduced into the VCT based on the signal from the VCT level controller. The preset solution concentration is adjusted periodically by the operator to match the boric acid concentration in the RCS.

The CVCS is designed to operate with no boric acid concentration above the point where precipitation could occur. The BABT and discharge lines are the only portions of the system requiring heat tracing to preclude boric acid precipitation. These portions of the

system can contain fluid concentrated to 12 weight percent boric acid. The remaining portions of the system contain a lower boric acid concentration (maximum 2.5 weight percent, 4,400 ppm boron), and heat tracing to prevent precipitation is not required. However, the BAST, RMWT, and holdup tank including portions of inlet and discharge lines located in the yard are provided with heaters and/or heat tracing to maintain the operating temperature within the normal ranges.

Proper connections exist between the CVCS and the in-containment refueling water storage tank (IRWST) to allow for filtration, inventory adjustments, and boron adjustments to the contents of the IRWST.

9.3.4.2.4 Seal Injection Subsystem

The auxiliary charging pump (ACP) is a positive displacement pump that is placed in parallel with the CVCS centrifugal charging pumps. The ACP is manually started and supplies injection water when RCP seal injection is not available through the two centrifugal charging pumps. The ACP takes suction from the VCT or the BAST and supplies seal injection water to the RCPs through the normal CVCS seal injection flow path. The seal injection water from the ACP passes through the seal injection filter before being distributed to the four RCPs. Seal injection from the ACP can be controlled and monitored using the valves and instrumentation in the normal seal injection line.

9.3.4.2.5 Degasification

When continuous degasification of the RCS is desired, the letdown flow is diverted from the inlet of the VCT to the gas stripper, bypassing the pre-holdup ion exchanger. The letdown flow is processed in the gas stripper and returned to the VCT via the normal spray nozzle. The VCT hydrogen overpressure can be used to replace the hydrogen removed during the gas stripping process. The charging pump takes suction from the VCT and returns the processed fluid to the RCS.

9.3.4.2.6 Purification Isolation

A temperature sensor monitors the temperature of the letdown flow downstream of the letdown HX. If the letdown temperature exceeds the allowable resin temperature, a high

temperature signal automatically actuates two three-way valves and diverts the letdown flow to bypass process radiation monitor (PRM), boronometer, and the purification ion exchangers. The letdown flow isolation on high-high temperature signal protects the resin in the purification ion exchangers from being exposed to temperatures that could damage the resins.

9.3.4.2.7 Chemistry and Purity Control

The CVCS controls the chemistry and purity of the reactor coolant to:

a. Minimize the corrosion of hardware, which includes minimizing the fouling of heat transfer surfaces

b. Control core reactivity throughout the life of the core (by adjusting the chemical shim)

c. Limit the transport of radioactive corrosion products

d. Provide reasonable assurance that the quality of reactor coolant fluid is maintained within specific operating limits

Tables 9.3.4-1A through 9.3.4-1C describe the chemistry specification of the reactor coolant.

During plant startup, the DO and chloride limits presented in Table 9.3.4-1B of ≤ 0.1 ppm and ≤ 0.15 ppm, respectively, were established from the relationships between oxygen and chloride concentrations and their effect on the susceptibility to stress corrosion cracking of austenitic stainless steel. No chloride stress corrosion occurs at DO concentrations below approximately 0.8 ppm. The DO limit was reduced to give a conservative concentration of 0.1 ppm oxygen. The maximum amount of oxygen from air dissolved in water at 25 °C (77 °F) is approximately 8 ppm. At this concentration, a chloride concentration of less than approximately 1.5 ppm precludes the possibility of chloride stress corrosion. This limit was reduced to provide a conservative chloride limit of 0.15 ppm.

The fluoride limit of 0.15 ppm for reactor coolant during plant startup or shutdown operations is the result of the fluoride ion being identified as causing intergranular

corrosion of sensitized austenitic stainless steels. Based on this, it is essential to minimize fluoride ions in the reactor coolant. Therefore, the concentration chosen as the maximum limit is the lowest concentration that can be both readily detected in bulk water and maintained by the action of the purification ion exchanger.

Chemistry control of the reactor coolant consists of preoperational removal of oxygen by hydrazine scavenging, degasification (via the gas stripper) if necessary during heatup, control of oxygen concentration by maintaining an excess hydrogen concentration during normal power operation, and pH control by maintaining lithium within a specific control band. A chemical addition tank and pump are used to transfer hydrazine and/or lithium hydroxide to the RCS.

Lithium is generated in significant quantities in the core region by the reaction B^{10} (n,α) Li^{7}. Therefore, lithium hydroxide is the logical choice for a pH control agent. However, there exists a threshold for accelerated attack of Zircaloy at approximately 35 ppm lithium. Therefore, a wide margin between the upper operating limit and the threshold for accelerated attack is specified in the event that any concentrating phenomena exist.

Early in core life, periodic removal of lithium by ion exchange is required to control the lithium concentration below the upper limit. One purification ion exchanger is used intermittently to control the lithium concentration. Prior to refueling shutdown, when large boration operations are necessary, lithium additions will be necessary to maintain the lithium concentration within the control band. The lower limit on lithium concentration provides reasonable assurance that sufficient lithium hydroxide is present during operation to provide the benefits noted in Subsection 9.3.4.2.1.2.

The control of other impurities is accomplished by the continuous operation of the second purification ion exchanger, which has been converted to the lithium or ammonia lithium form and does not remove lithium.

The normal method of adjusting boron concentration is by feed-and-bleed. To change the boron concentration, the makeup portion of the CVCS supplies either reactor makeup water or boric acid to the VCT. To prevent overfilling the VCT, the incoming letdown stream is diverted to the holdup tank via the pre-holdup ion exchanger. Toward the end of the core cycle, the quantities of waste produced due to feed-and-bleed operations become excessive, and the deborating ion exchanger is used to reduce the reactor coolant system boron

concentration. An anion resin, initially in the hydroxyl form, is converted to a borate form as boron is removed.

Various reactions taking place in the reactor during normal power operation result in the production of tritium, which appears in the reactor coolant as tritiated water. Tritium is addressed in Subsection 11.1.4.

9.3.4.2.8 Component Description

The major components of the CVCS are described in this subsection. The principal component data summary, including design code, is provided in Table 9.3.4-2. Component seismic and safety classifications are addressed in Section 3.2.

9.3.4.2.8.1 Chemical and Volume Control System Pumps

a. Charging pumps

   Two multi-stage centrifugal charging pumps are provided to supply reactor coolant to the RCS. Each pump is provided with vent and drain connections to minimize radiation levels during maintenance operations. During all plant operating modes, only one pump is operating while the other is on standby.

b. Auxiliary charging pump

   The auxiliary charging pump is a positive displacement pump with an air-cooled motor. Its capacity is sufficient to perform reactor coolant hydrostatic tests and provide seal injection water to four reactor coolant pumps when the charging pumps are unavailable. Vent, drain, and flushing connections are provided to minimize radiation levels during maintenance operations. The pump is provided with a suction stabilizer and pulsation dampener.

c. Boric acid makeup pumps

   Two single-stage centrifugal boric acid makeup pumps are used for transfer and circulation of boric acid solution in the BAST. Each pump is operated by a

squirrel cage induction motor. The capacity of each boric acid makeup pump is greater than the maximum charging capacity.

d. Reactor makeup water pumps

Two single-stage centrifugal reactor makeup water pumps are provided to transfer reactor makeup water in the RMWT. Each pump is operated by a squirrel cage induction motor. The capacity of each reactor makeup water pump is greater than the maximum charging capacity.

e. Holdup pumps

Two single-stage centrifugal holdup pumps are provided to transfer the liquid in the holdup tank. Each pump is operated by a squirrel cage induction motor. The capacity of each holdup pump is greater than the flow required to operate the boric acid concentrator.

f. Reactor drain pumps

Two single-stage centrifugal reactor drain pumps are provided to transfer the liquid from RDT to the pre-holdup ion exchanger. Each pump is operated by a squirrel cage induction motor.

9.3.4.2.8.2 Chemical and Volume Control System HXs

a. Regenerative heat exchanger

The regenerative HX is a vertically mounted, shell and tube (U-tube) HX. The letdown flow passes through the tube side, and the charging flow passes through the shell side. The regenerative HX conserves RCS thermal energy by transferring heat from the letdown fluid to the charging fluid. Heating the charging fluid serves to minimize charging nozzle thermal transients. The HX is designed to maintain a letdown outlet temperature below 232.2 °C (450 °F) and to heat charging flow to the RCS by a minimum of 55.6 °C (100 °F) under all normal

operating conditions. The heat exchanger tubes are designed to withstand shell side external pressure without mechanical damage.

b. Letdown heat exchanger

The letdown HX is a horizontally mounted, shell-and-tube HX. Coolant leaving the regenerative HX passes through the tube side while component cooling water passes through the shell side. The component cooling water cools the letdown fluid from the outlet temperature of the regenerative HX to a temperature suitable for operation of the purification system. The letdown HX is sized to cool the letdown fluid from the maximum outlet temperature of the regenerative HX to below the maximum allowable operating temperature of the ion exchange resins.

c. Charging pump mini-flow heat exchanger

The charging pump mini-flow HX is a horizontally mounted, shell-and-tube HX. Mini-flow from the charging pump passes through the tube side while component cooling water passes through the shell side. The mini-flow HX uses component cooling water to cool the recirculation flow from an operating charging pump. The mini-flow HX is sized to maintain the temperature of the recirculation flow returning to the charging pump suction below that of the VCT fluid temperature to prevent cavitation under shutoff condition and not to exceed the maximum operating temperature of the charging line.

9.3.4.2.8.3 Chemical and Volume Control System Tanks

a. Volume control tank (VCT)

The VCT is designed to accumulate letdown water from the RCS, provide for control of hydrogen concentration in the reactor coolant, and provide a reservoir of reactor coolant for the charging pumps. The VCT has sufficient volume below the normal operating band and above a reserve volume (provided for vortex prevention) to accommodate maximum charging flow with no makeup provided to the VCT. The VCT has sufficient volume above the normal operating band to accumulate maximum letdown flow (with charging secured), plus an additional

volume for a gas cushion that is sized to maintain VCT pressure in the normal operating range. The normal operating level band accommodates the maximum allowable RCS leakage for 1 hour without the need for makeup addition. The tank has hydrogen and nitrogen gas supplies and a vent to the gaseous waste management system (GWMS) to enable venting of hydrogen, nitrogen, and fission gases.

b. Reactor drain tank (RDT)

The RDT is designed to:

1) Receive leakage from the pressurizer pilot-operated safety relief valves.

2) Receive discharge from thermal relief valves in the containment.

3) Receive gravity drains and leakage of reactor coolant grade water from components in the containment.

4) Receive gravity drains from the RCS.

5) Receive discharge from reactor coolant gas vent system for a limited period.

6) Receive a diversion of RCP controlled bleedoff for a limited period.

c. Equipment drain tank (EDT)

The EDT receives gravity drains from the recycle drain header, ion exchanger drain header, and equipment drain relief header. The EDT is also sized to accept gas stripper bypass flow for 30 minutes and to accept discharges from miscellaneous relief valves.

d. Boric acid storage tank (BAST)

The BAST is sized to permit one shutdown operation to cold shutdown, followed by a shutdown for refueling at the most limiting time in core cycle with the most

reactive CEA withdrawn. The maximum concentration of boric acid in the tank is 2.5 weight percent (4,400 ppm boron).

e. Holdup tank

The holdup tank is sized to store all recoverable reactor coolant generated by one cold shutdown operation with the most reactive CEA withdrawn and subsequent startup at the most limiting time in core cycle.

f. Reactor makeup water tank (RMWT)

The RMWT capacity is based on providing dilution to allow total recycle. The tank also provides dilution for one cold shutdown operation and subsequent startup at the most limiting time in core cycle.

g. Boric acid batching tank (BABT)

The BABT allows the operator to conveniently mix boric acid. The tank is designed to permit handling of up to 12 weight percent boric acid. The tank is insulated and has a reactor makeup water supply from the makeup supply header. Sampling provisions, a mixer, temperature controller, and electric immersion heaters are provided.

9.3.4.2.8.4 Chemical and Volume Control System Ion Exchangers

a. Purification ion exchangers

Each of the two purification ion exchangers contains a mixed-bed resin and is provided with the necessary connections to replace the resin by sluicing and the screen to prevent the release of resin through vent and effluent nozzles. Each ion exchanger is designed to pass the maximum letdown flow and is identical in mechanical design to the other. The cation/anion resin volume ratio is selected so that approximately equal capacities are provided for cation and anion impurities in the purification flow. The volume of resin contained in one ion exchanger is sufficient to continuously remove impurities and radionuclides from letdown flow

over core life. The other purification ion exchanger is used intermittently to control the lithium concentration in the reactor coolant.

b. Deborating ion exchanger

The deborating ion exchanger is identical in mechanical design to the purification ion exchangers and is provided with the screen to prevent the release of resin through vent and effluent nozzles. The deborating ion exchanger contains an anion resin or a mixed-bed resin. The deborating ion exchanger is sized to reduce the reactor coolant boron concentration when the reactor coolant boron concentration is below 50 ppm near the end of core life and can be used to remove impurities for shutdown chemistry control.

c. Preholdup ion exchanger

The preholdup ion exchanger is identical to the purification ion exchangers in mechanical design and is provided with the screen to prevent the release of resin through vent and effluent nozzles. The preholdup ion exchanger contains a mixed-bed resin and is designed to pass the maximum letdown flow. The volume of resin contained in the preholdup ion exchanger is sufficient to remove impurities and radionuclides from letdown flow.

d. Boric acid condensate ion exchanger

The boric acid condensate ion exchanger contains an anion resin of sufficient volume to remove boron carryover from the boric acid concentrator distillate and is designed to pass the maximum boric acid concentrator bypass flow. The screen is provided to prevent the release of resin through vent and effluent nozzles.

9.3.4.2.8.5 Chemical and Volume Control System Filters

a. Purification filters

Each of the two purification filters is designed to remove insoluble particulates from the letdown flow. Each filter is designed to pass the maximum letdown

flow without exceeding the allowable differential pressure across the filter elements in the maximum fouled condition. Each filter is designed for efficient remote removal of filter cartridges due to the buildup of high activity levels during filter operation.

b. Boric acid filter

The boric acid filter is designed to remove insoluble particulates from the BAST and makeup flow. Each filter is designed to pass the maximum flow without exceeding the allowable differential pressure across the filter elements in the maximum fouled condition. The filter has a removable cartridge type filter element.

c. Reactor makeup water filter

The reactor makeup water filter is designed to remove insoluble particulates from the reactor makeup water supply to the resin sluice supply header, makeup header, and makeup system. Each filter is designed to pass the maximum flow without exceeding the allowable differential pressure across the filter elements in the maximum fouled condition. The filter has a removable cartridge type filter element.

d. Reactor drain filter

The reactor drain filter is designed to remove insoluble particulates from the contents of the RDT, EDT, and holdup tank. Each filter is designed to pass the maximum flow without exceeding the allowable differential pressure across the filter elements in the maximum fouled condition. Each filter is designed for efficient remote removal of filter cartridges due to the buildup of high activity levels during filter operation.

e. Seal injection filters

These two redundant filters are designed to remove insoluble particulates from the seal injection flow to the reactor coolant pumps. Each unit is designed to pass

the maximum anticipated flow without exceeding the allowable differential pressure across the element in the maximum fouled condition. The filter has a removable cartridge type filter element.

9.3.4.2.8.6 Chemical and Volume Control System Orifices

a. Letdown orifices

Three multi-stage letdown orifices are installed in parallel in the letdown line downstream of letdown HX. A manual bypass line is provided around the orifice to allow enough flow when the RCS pressure is low.

b. Charging restricting orifices

Two charging restricting orifices are designed to limit excessive charging flow when the RCS pressure is low and when the RCS is being depressurized for plant shutdown. In the case of inadvertent closure of the charging restricting orifice bypass valve during normal conditions, the flow passing through the orifice is sufficient to maintain the minimum charging operational condition.

9.3.4.2.8.7 Chemical and Volume Control System Package Components

a. Chemical addition unit

A chemical addition unit is used to transfer chemical additives to the charging pump suction header. The chemical addition unit consists of a chemical addition tank, chemical addition pump, and strainer. The capacity of the chemical addition tank is based on the maximum anticipated amount of chemical to be added in one batch. The chemical addition pump is a positive displacement pump with a variable capacity.

b. Gas stripper package

The gas stripper achieves efficient gas stripping of reactor coolant by heating the process fluid and passing it through a packed tower, which uses steam as a

stripping medium. The gas stripper package includes pumps to transfer the degassed process fluid to the holdup tank or to the VCT during continuous degassing of letdown flow. Non-condensable gases, along with trace quantities of fission gases and water vapor, flow to the GWMS.

c. Boric acid concentrator package

The boric acid concentrator concentrates the boric acid solution in the process flow by means of evaporation. The process flow enters the concentrator and is heated via recirculation through a steam heater. The vapor leaving the recirculation flow is stripped of entrained liquid by demisters, condensed, and pumped to the RMWT. The concentrate (bottoms) is cooled and pumped to either the BAST or the LWMS.

9.3.4.2.8.8 Chemical and Volume Control System Valves

The CVCS valves are made of stainless steel except for those used for gaseous system components for compatibility with the borated reactor coolant. Isolation valves are provided at connections to the RCS.

The CVCS employs non-leakage type valves such as diaphragm-type valves or leak control valves with packing for handling radioactive fluid. For components that cannot structurally employ these types of valves, a leak-off connection is provided to prevent leakage to the atmosphere.

Some lines penetrating the containment normally have check valves inside the containment to prevent reverse flow from the containment.

Containment isolation valves are located in the following lines:

a. Charging line

b. Letdown line

c. Shutdown cooling purification line

d. RCP seal injection line

e. RCP controlled bleedoff line

f. Resin sluice supply header drain line

g. IRWST makeup line

h. RDT discharge line

Relief valves are provided as follows:

a. Letdown relief valve

b. VCT relief valve

c. VCT gas supply relief valve

d. RCP controlled bleedoff header relief valve

e. Boric acid batching eductor relief valve

f. EDT relief valve

g. RDT relief valve

h. Charging pump mini-flow relief valve

i. Regenerative HX thermal relief valve

j. ACP discharge relief valve

k. RMWT relief valve

l. Reactor cavity line thermal relief valve

9.3.4.2.9 System Operation

The chemical and volume control system is designed to be operated as follows:

9.3.4.2.9.1 Plant Startup

Plant startup is the series of operations that bring the plant from a cold shutdown condition to a hot standby condition (normal operating pressure, zero-power temperature, with the reactor critical at a low power level), consistent with the Technical Specification operational limits.

A charging control valve and the letdown control valve are used during the initial phase of reactor coolant system heatup to maintain RCS pressure until the pressurizer steam bubble is established. Prior to establishing a pressurizer steam bubble, the RCS is in a water-solid condition with one charging pump, one letdown control valve, and one charging control valve in operation. All letdown orifice isolation valves and the letdown orifice bypass flow control valve are fully opened. The charging control valve is adjusted manually to allow minimum charging flow. A pressurizer steam bubble is formed by adjusting RCS pressure via the letdown control valve and then increasing the pressurizer temperature until it is heated to saturation condition. Removing reactor coolant from the RCS causes flashing in the pressurizer steam space.

During the RCS heatup, pressurizer level and RCS pressure are maintained by adjusting the position of the letdown control valve in conjunction with placing individual orifices in service. As the RCS pressure increases, the letdown control valve is controlled manually so that the pressurizer level is maintained within a specified level. Once the backpressure of the letdown control valve reaches its preset value, the pressure controller is placed in automatic mode with a setpoint. As the plant heats up, letdown flow is limited by throttling of the letdown orifice bypass flow control valve. Finally, the pressurizer level control system is placed in automatic mode. RCS pressure is automatically maintained by the pressurizer pressure control system. Letdown flow is discretely controlled by the pressurizer level control system.

The VCT is initially purged with nitrogen and a hydrogen overpressure is established. The RCS boron concentration may be reduced during heatup in accordance with shutdown margin limitations. The makeup controller is operated in the dilute mode to inject a

predetermined amount of reactor makeup water at a preset rate. Compliance with the shutdown margin limitations is verified by sample analysis and boronometer indication.

9.3.4.2.9.2 Normal Operation

Normal operation includes hot standby operation and power generation (RCS operations at normal RCS pressure and temperature). A description of normal operation is contained in Subsections 9.3.4.2.1 through 9.3.4.2.6.

9.3.4.2.9.3 Plant Shutdown

Plant shutdown is a series of operations that bring the plant from a hot standby condition to a cold shutdown condition for maintenance or refueling, consistent with the Technical Specifications. During normal shutdown, a charging pump, charging control valve, letdown orifices, letdown orifice isolation valves, and letdown control valve are used to adjust and maintain the pressurizer level. The letdown orifice bypass flow control valve can also be used to adjust letdown flow during shutdown.

Prior to the plant cooldown, the gas space of the VCT is vented to reduce fission gas activity and the RCS dissolved hydrogen concentration to less than 10 cm^3 (STP) /kgH_2O. The purification rate may be increased to accelerate the degasification, ion exchange, and filtration processes. Degassing the reactor coolant is accomplished by diverting letdown flow to the gas stripper and returning the process fluid to the VCT. The normal VCT hydrogen overpressure is replaced with nitrogen purges to maintain a low reactor coolant hydrogen concentration.

Boron concentration in the RCS is normally increased concurrently with the cooldown by providing a direct charging pump suction source from the BAST. Borating concurrent with the cooldown reduces the amount of liquid waste generated during the shutdown process. The correct boron concentration in the reactor coolant is verified by sample analysis. The shutdown operation may be accomplished simultaneously with degasification operation.

Once the required RCS boron concentration has been reached, the charging pump suction is switched from the BAST to the VCT. Following the switchover, the low level condition in

the VCT causes automatic makeup at the required shutdown boron concentration. Pressurizer level is maintained via positioning of the charging and letdown control valve. All or part of the charging flow may be used for auxiliary spray to cool the pressurizer and increase its boron content when RCS pressure is below that required to operate the reactor coolant pumps.

Because a refueling shutdown requires a greater cold shutdown boron concentration in the RCS than can easily be obtained by feed-and-bleed, the suction of the charging pump is switched to the BAST via the boric acid makeup pumps to make up for contraction during cooldown. By the end of cooldown, the RCS is at the refueling concentration.

During shutdown, the charging restricting orifice bypass valve is closed before the RCS pressure reaches 49.2 kg/cm^2 G (700 psig) to limit charging flow below the allowable maximum flow. When the shutdown cooling system (SCS) is in service, a flow path through the CVCS from the SCS can be established for purification to remove fission product from the reactor coolant.

During refueling shutdown, the reactor makeup water supply piping is continuously monitored via flow switch. An alarm is annunciated if flow is detected to prevent dilution of the refueling pool.

9.3.4.2.9.4 Accident Operation

The CVCS is not required to perform any accident mitigation or safe shutdown function. In particular, the CVCS is not required to function to provide reasonable assurance of the capability to shut down the reactor and maintain it in a safe shutdown condition or to provide reasonable assurance of the capability to mitigate the consequences of plant accidents. The safety functions are performed by dedicated safety systems. The SIS is credited for RCS inventory control and boration in Chapter 15 accident analyses, and safe shutdown. Pressure control during these events is accomplished via the pilot-operated safety relief valves.

Although not required to perform any accident mitigation or safe shutdown function, the CVCS is essential for the normal day-to-day operation of the plant. The CVCS is therefore provided with a high degree of reliability and redundancy and is designed in

accordance with accepted industry standards and quality assurance commensurate with its importance to plant operations.

9.3.4.2.10 Design Features for Minimization of Contamination

The APR1400 is designed with features that meet the requirements of 10 CFR 20.1406 and NRC RG 4.21. The basic principles of NRC RG 4.21, and the methods of control suggested in the regulations, are delineated into four design objectives and two operational objectives discussed in Subsection 12.3.1.10. The following evaluation summarizes the primary features to address the design and operational objectives for the CVCS.

The CVCS has been evaluated for leak identification from the SSCs that contain radioactive or potentially radioactive materials, the areas and pathways where probable leakage may occur, and the methods of leakage control incorporated in the design of the system. The leak identification evaluation indicated that the CVCS is designed to facilitate early leak detection and the prompt assessment and response to manage collected fluids. Thus unintended contamination to the facility and the environment is minimized and/or prevented by the SSC design, supplemented by operational procedures and programs and inspection and maintenance activities.

Prevention/Minimization of Unintended Contamination

a. The system design, including the VCT, the EDT, and the letdown purification equipment inside the auxiliary building (AB); the RDT located inside the reactor containment building; and the holdup tank, BAST, and RMWT located outside the auxiliary building are designed with stainless steel and carbon steel materials that are compatible with the chemical and radiological environment. All components are of welded construction for life-cycle planning, thus minimizing leakage and unintended contamination of the facility and the environment.

b. The CVCS is also designed to collect drainage from system components, including relief valve leakages, for purification and recycle. This design approach minimizes unintended contamination of the facility and the environment.

c. The heat exchangers inside the containment are designed to minimize the potential for leakage by using shell and tube type heat exchangers designed for compliance with ASME III.

d. Butt weld joints are used for all piping 25.4 mm (1 in) and larger in the letdown line to the letdown strainer, the charging line from the charging pump to the RCS, the pressurizer auxiliary spray line, the RCP seal injection line, the RCP bleedoff line to the VCT, the boric acid makeup line from the BAST to the VCT, resin sluice lines to the high activity spent resin tank, and the boric acid concentrate line from the holdup tank through the holdup pumps to the BAST or liquid waste management system. This design minimizes leakage from the CVCS piping carrying radioactive material.

e. The piping tunnel connection from the yard tanks to the AB is designed and constructed to have above-ground building entrance and penetrations, therefore minimizing underground piping penetrations. This design approach minimizes potential for the infiltration of water and the spread of contamination to the environment.

Adequate and Early Leak Detection

a. The CVCS is equipped with instrumentation to assist in the detection of: RCS leakage, VCT level, RDT level, EDT level, letdown flow rate, and charging flow rate.

b. The VCT, RDT, EDT, and CVCS processing equipment are designed with sufficient capacity to provide temporary holding of primary coolant for normal operation, including anticipated operational occurrences. The tanks are equipped with level indicating and control instruments to prevent overflow and provide reasonable assurance of a timely processing, thus minimizing interruption of normal processing operation, the spread of contamination, and waste generation.

c. The cubicles in which the CVCS tanks are located are designed with leak detection instruments to initiate alarms for operator actions in the event of leakage or overflow. The leak detection design has the capability to detect a small quantity of leakage to provide early warning to operators.

d. The piping connecting the outside tanks to the SSCs that are inside the AB is routed through a pipe tunnel. The piping tunnel is epoxy coated and has a sump with a level switch to detect piping leakage and infiltrated water. In the event that liquid is detected, the level switch sends a signal to the MCR for operator action. This design approach minimizes contamination of the environment.

Reduction of Cross-Contamination, Decontamination, and Waste Generation

a. The SSCs are designed with life-cycle planning through the use of nuclear industry-proven materials compatible with the chemical, physical, and radiological environment, thus minimizing waste generation.

b. The primary coolant purity is maintained with chemical injection for optimum reactor operation. Boric acid is added to compensate for reactivity changes, fuel burnup, and xenon variations, and to provide shutdown margin. Lithium hydroxide is added for pH control, and hydrogen is added in order to minimize the occurrence of radiolysis. The addition of chemicals helps to minimize the generation of contaminated waste.

c. Boric acid in the letdown flow is recovered for reuse to the maximum extent possible. In the event that the boric acid concentrate contains an abnormal quantity of radioactivity, the concentrate is sent to the liquid waste management system (LWMS) for neutralization, treatment, and release. The boric acid concentrator operates automatically to the desired boron concentration and sends the concentrate to the BAST for reuse. This design approach minimizes waste generation.

d. The holdup tank, BAST, and the RMWT are located outside in a tank house to prevent the infiltration of rainwater and the spread of contamination. The tank house is designed with a sloped floor that is coated with epoxy to facilitate draining and cleaning and is equipped with a sump that has level switch instrumentation to detect leakage and overflows. In the event that leakage is detected, the level switch sends a signal to the MCR for operator action. This design approach minimizes the spread of contamination and waste generation.

e. The process piping containing contaminated fluids is properly sized to facilitate flow with sufficient velocities to prevent the settling of solids. The piping is designed to reduce fluid traps, thus reducing the decontamination needs and waste generation. Decontamination fluid is collected and routed to the LWMS for processing and release.

f. Utility connections are designed with a minimum of two barriers to prevent the spread of contamination to clean systems.

Decommissioning Planning

a. The SSCs are designed with decontamination capabilities. Design features, such as integrated component packages, utilized welding techniques, and surface finishes are included to minimize the need for decontamination and the resulting waste generation.

b. The SSCs are designed for the full service life of the plant and are fabricated as individual assemblies for easy removal to the maximum extent practicable.

c. The CVCS is designed with minimum embedded and buried piping. Piping between buildings is equipped with piping sleeves such that leakage is directed back to the building for collection, thus preventing unintended contamination.

Operations and Documentation

a. The CVCS is designed for automated operation with manual initiation. Boron injection is controlled by the makeup subsystem to maintain the desired boron concentration. Adequate instrumentation, including level, flow, and pressure elements, as well as process sampling, is provided to monitor and control the CVCS operations to prevent undue interruption, thus minimizing the spread of contamination and waste generation.

b. Leak detection instruments are provided to detect individual tank leakage. Adequate space is provided around the equipment to enable prompt assessment and responses when required.

c. Operational procedures and maintenance programs as related to leak detection and contamination control are to be prepared by the COL applicant (COL 9.3(1)). Procedures and maintenance programs are to be completed before fuel is loaded for commissioning.

d. Complete documentation of system design, construction, design modifications, field changes, and operations is to be maintained by the COL applicant (COL 9.3(2)). Documentation requirements are included as a COL information item.

Site Radiological Environmental Monitoring

a. The CVCS is part of the overall plant and is included in the site radiological environmental monitoring program for monitoring of facility and environmental contamination. The program includes sampling and analysis of boric acid and contaminated fluid leakage from the BAST, RMWT, holdup tank, and piping tunnel, meteorological conditions, hydrogeological parameters, and potential migration pathways of radioactive contaminants. The program is included as a COL information item (COL 9.3(3)).

9.3.4.3 Safety Evaluation

The design of the CVCS is based on the GDC and NRC RGs listed in Section 3.1 and Subsection 1.9.1, respectively.

The CVCS is designed in accordance with the requirements of 10 CFR 50, Appendix A, GDC 1, 2, 14, 33, 60, and 61.

The equipment classification for the CVCS is contained in Section 3.2.

The protection of safety-related portions of CVCS against natural phenomena and missiles is addressed in the following sections:

a. Section 3.3 for wind and tornado loadings

b. Section 3.4 for water level (flood) design

c. Section 3.5 for missile protection

d. Section 3.6 for pipe rupture protection

e. Section 3.7 for seismic design

f. Section 3.11 for environmental qualification of mechanical and electrical equipment

9.3.4.3.1 Availability and Reliability

Reasonable assurance of functional reliability is provided by standby components and by fail-safe responses for the most probable modes of failure.

Redundancy is provided as follows:

Component	Redundancy
Purification and deborating ion exchangers	Three mechanically identical components
Charging pumps	One operating, one in standby
Charging control valves	One operating, one in parallel standby
Letdown control valves	One operating, one in parallel standby
Boric acid makeup pumps	Two identical pumps in parallel; one operates on demand, one in standby
Gas stripper package	Gas stripper package includes redundant standby pumps
Seal injection filters	Two identical filters in parallel; one operating, one in standby
Purification filters	Two identical filters in parallel; one operating, one in standby
Reactor makeup water pumps	Two identical pumps in parallel; one operates on demand, one in standby
Boric acid concentrator	The concentrator package includes redundant standby pumps

In addition to component redundancy, it is possible to operate the CVCS in a manner so that some components are bypassed. It is possible to transfer boric acid to the charging pump suction header bypassing the VCT. The letdown filter and purification and deborating ion exchangers can be bypassed. Controlled bleedoff flow can be routed to the RDT rather than the charging pump mini-flow heat exchanger or the VCT.

Independent and redundant gravity-feed provisions from the BAST to the charging pump suction are provided to provide reasonable assurance of makeup.

The ACP is provided to provide reasonable assurance of the reliability and availability of seal injection.

9.3.4.3.2 Accident Response

The letdown line is isolated on receipt of a safety injection actuation signal (SIAS). A containment isolation actuation signal (CIAS) isolates the letdown line, resin sluice supply header (RSSH) line to the RDT, makeup line to the IRWST, and reactor drain pump suction line from the RDT.

A CIAS (or SIAS) does not isolate the charging line, RCP seal injection line, or RCP controlled bleedoff line, and does not stop the charging pump. A sufficient volume of fluid exists in the VCT to provide ample time to align alternate feed lines from the BAST to the charging pump suction header. Maintaining charging flow following a CIAS continues to provide seal injection to the reactor coolant pump seals.

The letdown line break analysis described in Subsection 15.6.2 assumes that 30 minutes after the letdown line break, the operator isolates the letdown line, thereby terminating any further release of primary flow to outside of containment. This is achieved by closing at least one of three isolation valves (CV-515, CV-516, or CV-522) in the letdown line within containment.

For a LOOP, the charging pump can be operated to provide RCP seal injection. If two charging pumps are unavailable, the ACP provides RCP seal injection. The APR1400 design includes an onsite alternate ac (AAC) power source to cope with a station blackout (SBO). During an SBO, the AAC power source provides power to the ACP to provide

RCP seal injection. Even if CVCS normal seal injection is lost, the ACP being aligned to the AAC power source provides RCP seal injection. It provides a diverse and dedicated means of seal injection for RCP seal cooling. In particular, the ACP provides enhanced coping capability during an SBO.

A containment spray actuation signal (CSAS) isolates the RCP controlled bleedoff line. The diversion of the controlled bleedoff to the RDT via CV-507 on receipt of a CSAS supports continuous RCP seal cooling operation.

9.3.4.3.3 Leakage Detection and Control

Components in the CVCS are provided with welded connections wherever possible to minimize leakage to the atmosphere. However, flanged connections are provided on pump suction and discharge lines, on relief valve inlet and outlet connections, and on some flow-measuring devices to permit removal for maintenance. All valves larger than 5.08 cm (2 in) and all actuator-operated valves are provided with double-packing, lantern rings, and leak-off connections unless the valves are diaphragm (packless) valves. Diaphragm valves are used around the VCT gas space and boron recovery system to minimize activity release due to valve leakage.

The CVCS is also used to monitor the total RCS water inventory. If there is no RCS or CVCS leakage, the level in the VCT and pressurizer will remain constant during steady-state operation. Therefore, a decreasing level in the VCT alerts the operator of a possible leak somewhere in the system. An increase in RDT or EDT levels may also be indicative of reactor coolant leakage.

During refueling shutdowns, the reactor makeup water piping is monitored to detect leakage past isolation valve CV-195, which is locked closed during refueling shutdown. If leakage occurs, an alarm is annunciated in the control room.

9.3.4.3.4 Prevention for Wall Inward Buckling and Failure in Tanks

The VCT is designed to withstand vacuum conditions to prevent wall inward buckling and failure. The reactor makeup water tank is provided with vacuum breakers to prevent a vacuum condition and relief valve to prevent overpressure. The holdup tank and boric

acid storage tank are provided with sufficient air ingression lines to prevent vacuum condition.

9.3.4.3.5 Failure Modes and Effects Analysis

Because the CVCS does not perform an accident mitigation or safe shutdown function, a detailed failure modes and effects analysis is not performed.

9.3.4.3.6 Radiological Evaluation

Frequently used, manually operated valves located in high radiation areas or inaccessible areas are provided with extension stem handwheels that terminate in low radiation, accessible control areas. Manually operated valves are provided with locking provisions if unauthorized operation of the valve is considered a potential hazard to plant operation or personnel safety. Refer to Section 12.3 for further information.

9.3.4.4 Inspection and Testing Requirements

Each component is inspected and cleaned prior to installation into the CVCS. A high-velocity flush using demineralized water is used to flush particulate material and other potential contaminants from all lines in the system.

Instruments are calibrated during preoperational testing. Automatic controls are tested for actuation at the proper setpoints, and alarm functions are checked for operability and proper setpoints. The relief valve settings are checked and adjusted as required. All sections of the CVCS are operated and tested initially with regard to flow paths, flow capacity, and mechanical operability. Pumps are tested to demonstrate head and capacity.

The CVCS is tested for integrated operation with the RCS during hot functional testing. Testing of the proper control of the letdown orifice isolation valves and charging control valves by the pressurizer level error program is included. The charging line is checked to provide reasonable assurance that the piping is free of excessive vibration. Response of the makeup portion of the CVCS in the automatic, dilute, and borate modes is verified. Any defects in operation that could affect plant safety are corrected before fuel loading.

As part of normal plant operation, tests, inspections, data tabulation, and instrument calibrations are made to evaluate the condition and performance of CVCS equipment and instrumentation. Data are taken periodically during normal plant operations to confirm heat transfer capabilities and purification efficiency. Pump and valve leakage is monitored.

Appropriate vents, drains, and test connections are provided to permit inservice testing of valves. Inservice inspection and testing of ASME Code Classes 2 and 3 components are addressed in Section 6.6. Active safety-related CVCS valves are listed in Table 3.9-4. These valves are inservice tested per Subsection 3.9.6.

9.3.4.5 Instrumentation Requirements

9.3.4.5.1 Temperature Instrumentation

a. Holdup tank and reactor makeup water tank temperature

   The temperature of the contents of these tanks is indicated in the MCR. An alarm annunciates in the MCR to warn the operator of low temperature in either tank.

b. Boric acid storage tank temperature

   Two temperature indicators are installed on the BAST. One provides a temperature indication in the MCR, and the other provides local indication. An abnormally low tank temperature alarms the operator in the MCR.

c. Boric acid batching tank temperature

   The boric acid batching tank temperature measurement channel controls the tank's electric immersion heaters. Local indication and control are provided to facilitate batching operations.

d. Letdown HX inlet temperature

A temperature indicator is provided to monitor the letdown flow temperature at the letdown HX inlet, and is indicated in the MCR and RSR. An abnormally high letdown flow temperature alarms the operator in the MCR.

e. Letdown HX outlet temperature

Temperature instrumentation is provided at the letdown HX outlet to control the component cooling water flow through the letdown HX to maintain proper letdown temperature for purification system operation. The letdown HX outlet temperature is indicated in the MCR. This instrument provides a close signal for letdown isolation valve (CV-515) on high-high temperature. This valve is manually reset to restore normal letdown flow.

f. Purification ion exchanger, process radiation monitor, and boronometer inlet temperature

Temperature instrumentation is provided upstream of letdown control valves (CV-201P/Q). This temperature instrument actuates valves in which letdown flow is bypassed around the purification and deborating ion exchangers, the process radiation monitor and boronometer on high temperature. In addition, the letdown flow through letdown orifices is restricted to minimum letdown flow by closing CV-110Y and CV-110Z on high temperature. Flow to the ion exchangers is manually restored when the temperature decreases below the high alarm setpoint. Temperature indication is provided in the MCR and RSR. High and high-high temperature alarms are annunciated in the MCR.

g. Volume control tank temperature

The VCT is provided with temperature instrumentation with an indication in the MCR. An abnormally high water temperature alarms the operator in the MCR.

h. Charging temperature

Temperature instrumentation is provided to monitor the charging flow temperature at the regenerative HX outlet. The regenerative HX outlet temperature (shell side)

is indicated in the MCR. This indication is used to monitor HX performance and verify that auxiliary spray initiation conditions are satisfied.

i. Pre-holdup ion exchanger inlet temperature

Temperature instrumentation is provided to monitor the letdown flow temperature at the inlet of the pre-holdup ion exchanger. The temperature is indicated in the MCR. A high temperature alarm annunciates in the MCR and flow is diverted to bypass the pre-holdup ion exchanger to preclude resin damage.

j. Reactor drain tank temperature

The reactor drain tank is provided with temperature instrumentation with indication in the MCR. An abnormally high water temperature and the need for cooling the tank alarm the operator in the MCR.

k. Equipment drain tank temperature

The equipment drain tank is provided with temperature instrumentation with indication in the MCR. An abnormally high water temperature and the need for cooling the tank alarm the operator in the MCR.

l. Charging pump mini-flow HX inlet temperature

The charging pump mini-flow HX inlet temperature instrument is used to control the component cooling water flow through the charging pump mini-flow HX to maintain adequate charging pump heat removal. Indication and high alarm are provided in the MCR.

9.3.4.5.2 Pressure Instrumentation

a. Letdown pressure

A pressure controller upstream of the letdown control valves measures letdown pressure. Indication is provided locally, in the MCR and RSR, and high and low

alarms are annunciated in the MCR. This instrument also controls the letdown control valve position to maintain preset upstream pressure regardless of flow variations.

Another pressure instrument is provided downstream of the letdown control valves. This instrument provides indication, high-high, high, and low alarms in the MCR. High-high alarm is to provide information to the operator that operating pressure is exceeding the design pressure. When high-high pressure is sensed, the operator takes action to terminate an intersystem LOCA (ISLOCA) manually by preventing any further pressure communication upstream of the letdown control valve.

b. Purification filter, ion exchanger, and letdown strainer differential pressure

Differential pressure instruments are provided to indicate pressure loss. One instrument is provided across the purification filters, and the other is provided across the ion exchangers and the letdown strainer. Both differential pressure indicators have local readouts and provide high differential pressure alarms in the MCR. Periodic monitoring of these instruments indicates any progressive loading of the units.

c. Volume control tank pressure

A pressure indicator is provided to indicate VCT pressure in the MCR. High and low pressures are annunciated in the MCR.

d. Charging pump suction pressures

A pressure switch on each charging pump suction stops the associated charging pump on low suction pressure, thus preventing pump damage due to cavitation.

A pressure sensor with indication and high alarm in the MCR is provided to warn the operator in the MCR when high pressure is sensed. The operator can take action to terminate an ISLOCA by preventing any further pressure communication upstream of the containment isolation valve.

e. Boric acid makeup pump discharge pressures

The discharge pressure of each boric acid makeup pump is indicated locally and in the MCR. Low pressure alarms are provided in the MCR. If the pump has been manually turned off by the operator, the discharge pressure alarm is suppressed. A low discharge pressure stops the operating pump and starts the standby pump.

f. Boric acid filter differential pressure

A differential pressure instrument with local readout is provided to indicate the pressure loss across the boric acid filter. A high pressure alarm is provided in the MCR.

g. Charging pressure

A pressure instrument is installed upstream of charging line containment isolation valve (CV-524). The charging pressure is indicated in the MCR and RSR. A low pressure alarm is provided in the MCR. A low pressure alarm during normal operation is indicative of charging pump failure.

h. RCP seal injection filter differential pressure

A differential pressure instrument with local indication and high differential pressure annunciation in the MCR is provided to determine the pressure loss across the seal injection filters. Periodic readings of this instrument indicate any progressive loading of the operating filter.

i. Reactor coolant pump controlled bleedoff header pressure

A pressure measurement channel is provided to measure the pressure at the reactor coolant pump controlled bleedoff header. Indication is provided in the MCR, and the measuring device is designed for RCS design pressure as a means of overpressure protection. High and high-high alarms are annunciated in the MCR. The high alarm indicates that a valve in the line to the mini-flow heat exchanger or

VCT has been closed. The high-high alarm indicates that the controlled bleedoff flow has been isolated.

j. Equipment drain tank pressure

A pressure indicator is provided at the outlet line from EDT to GWMS. This instrument indicates the EDT pressure, and high pressure alarm is annunciated in the MCR. This instrument actuates valves to automatically isolate the EDT line to the gas analyzer in the GWMS, the recycle drain header inlet line to the tank, and the outlet line to the reactor drain pumps when the tank pressure exceeds the high pressure alarm setpoint.

k. Reactor drain tank pressure

A pressure instrument located on the RDT provides tank pressure indication and high pressure alarm in the MCR. The high alarm is used to alert the operator that the tank has received a discharge from one or more relief valves inside the containment. In order to prevent a potential radioactive release outside the containment, the instrument closes the isolation valve to GWMS and the inside containment isolation valve on high pressure condition.

l. Reactor drain pump discharge pressure

Each pump’s discharge pressure is indicated locally and in the MCR to monitor pump performance.

m. Reactor drain filter, pre-holdup ion exchanger, and strainer differential pressures

Differential pressure instruments are provided to indicate the pressure loss across these components. Both differential pressures are indicated locally. High differential pressure alarms are annunciated in the MCR.

n. Holdup pump discharge pressure

Individual pump discharge pressures are indicated locally to monitor pump performance.

n. Boric acid condensate ion exchanger and strainer differential pressure

A local differential pressure indicator with a high alarm is provided. Periodic readings of this instrument indicate any progressive loading of the operating unit.

o. Reactor makeup water pump discharge pressure

A pressure indicator is provided at the discharge of the reactor makeup water pump and indicates the pressure locally and in the MCR. A low pressure alarm annunciates in the MCR. Low pressure at the discharge of the operating pump stops that pump and starts the standby pump. If the pump has been manually turned off by the operator, the low discharge pressure alarm is suppressed.

p. Reactor makeup water filter differential pressure

A differential pressure instrument, with local readout and a high differential pressure alarm in the MCR, is provided to indicate excessive loading of the reactor makeup water filter.

q. Auxiliary charging pump suction pressure switch

The pressure switches on the auxiliary charging pump suction stop the pump on low suction pressure, thus preventing damage due to cavitation.

r. Reactor makeup water tank pressure

A pressure indicator is provided on the RMWT to indicate gas pressure inside the tank with high alarm in the MCR. High pressure alarm is provided to alert the operator that cover gas pressure is out of normal operation range.

9.3.4.5.3 Level Instrumentation

a. Holdup tank level

Level indication and alarms for the holdup tank are provided in the MCR. On low level in the holdup tank, the operating pump is automatically stopped. A high level alarm in the holdup tank indicates that tank processing needs to be initiated. A high-high level alarm in the holdup tank indicates that filling of the tank needs to be secured.

b. Reactor makeup water tank level

Level indication and alarms for the RMWT is provided locally and in the MCR. On low-low level in the RMWT, the operating pump is automatically stopped. A low level alarm in the RMWT indicates that filling of tank needs to be commenced. A low level alarm for the RMWT alerts the operator that the tank has reached the minimum volume. A high level alarm in the RMWT indicates that filling of the tank needs to be secured.

c. Volume control tank level

Redundant, independent, differential pressure type level instruments provide volume control tank level indication in the MCR. Two channels are provided with channel selection switch.

Two indicators display volume control tank level in the MCR, and a deviation alarm is provided to warn the operator of any deviation between two channels. A selected channel controls the starting and stopping of the automatic makeup system on low and high levels and automatically diverts letdown flow on high level to the gas stripper via the pre-holdup ion exchanger. On low-low level, both channels redundantly isolate the volume control tank after realigning charging pump suction to the boric acid storage tank. Redundant, independent, high, low, and low-low level alarms are provided in the MCR. Level from the selected channel is recorded in the MCR. One of two instruments provides redundant level indication in the RSR.

Additional differential pressure type local level instruments are provided.

d. Equipment drain tank and reactor drain tank level

Differential pressure type level instruments indicate level for each tank in the MCR. The transmitters also activate high and low level alarms in the MCR and automatically stop the reactor drain pump on low level.

e. Boric acid storage tank level

Two instruments are provided with indication in the MCR and RSR. They provide high, low, and low-low level alarms in the MCR. One of them stops the boric acid makeup pumps on low-low level. A low level alarm in the boric acid storage tank indicates that filling of tank needs to be initiated. Low-low level alarm for the boric acid storage tank alerts the operator that the tank has reached the minimum volume. Local indication is also provided.

9.3.4.5.4 Flow Instrumentation

a. Letdown flow

An orifice-type flow meter indicates letdown flow in the MCR and RSR. This channel actuates a high flow alarm in the MCR. Local indication is also provided.

b. Boronometer flow

A flow meter located downstream of the boronometer is used to adjust the flow rate through the unit. Local indication is provided, and a low flow alarm is annunciated in the MCR.

c. Process radiation monitor flow

A flow meter located downstream of the process radiation monitor is used to control the flow rate through the boronometer and the process radiation monitor. Indication and high and low alarms are provided in the MCR.

d. Charging flow

A charging flow instrument is provided with indication and alarms. Indication is provided in the MCR and RSR. High-high, high, low, and low-low flow alarms are provided in the MCR. High-high flow signal closes the charging restricting valve to limit excess charging flow. Low-low flow signal diverts the RCP controlled bleedoff flow from the mini-flow heat exchanger to the VCT. Charging flow is recorded in the MCR.

e. RCP seal injection flow

Orifice-type flow meters indicate seal injection flow to each reactor coolant pump. These instruments control the seal injection flow control valves to maintain the desired flow to each pump. Indication and high, high-high, and low flow alarms are provided in the MCR.

f. Volume control tank hydrogen and nitrogen gas flow

Local indications of nitrogen and hydrogen gas flow to the VCT are provided. The nitrogen flow meter is used during VCT purging operations. The hydrogen flow meter is used during operations where a hydrogen overpressure is desired in the VCT.

g. Reactor makeup water flow

An orifice-type flow meter is provided to measure the reactor makeup water flow rate to the VCT makeup blending tee. The flow instrument is provided with indication, record, and alarms. The total quantity of reactor makeup water added is indicated in the MCR. This channel controls the reactor makeup water control valve (CV-210X) to obtain a preset flow rate. If there is any deviation between the measured flow rate and a preset flow rate, a high, low, high-high, or low-low flow deviation alarm is provided in the MCR. The high-high or low-low flow deviation alarm stops the makeup operation in auto mode. The flow deviation alarms are delayed to allow the set flow rate to become established. A high-high

flow signal is provided to avoid exceeding the design flow of the reactor makeup water filter. The high-high flow signal closes CV-512 or CV-527.

h. Boric acid flow

An ultrasonic flow meter is provided to measure the boric acid flow rate to the VCT makeup blending tee. The flow instrument is provided with indication, record, and alarms. The total quantity of boric acid added is indicated in the MCR. This channel controls the boric acid makeup control valve (CV-210Y) to obtain a preset flow rate. If there is any deviation between the measured flow rate and a preset flow rate, a high, low, high-high or low-low flow deviation alarm is provided in the MCR. The high-high or low-low flow deviation alarm stops the makeup operation in auto mode. The flow deviation alarms are delayed to allow the set flow rate to become established. A high-high flow signal is provided to avoid exceeding design flow of the boric acid filter. The high-high flow signal closes CV-512 or CV-527.

i. Reactor makeup water flow switch

A flow switch located downstream of the reactor makeup water flow indicator is used to alert the operator in the MCR if demineralized water flow occurs during refueling operations. During normal operation, the flow switch is not operational.

j. Boric acid batching flow

The boric acid batching flow instrument indicates locally the flow of boric acid from the boric acid batching tank to the boric acid batching eductor.

k. Ion exchanger drain header flow switch

A flow switch is provided with local indication of flow. A light indication goes on whenever draining is in progress. The light goes off when an ion exchanger draining operation is complete. When refilling an ion exchanger after changing resin, the light indicates overflow from the vent line drain and completion of the filling operation.

l. Resin sluice supply header air flow

The resin sluice supply header air flow instrument provides a local indication of air flow to the resin sluice supply header.

m. Reactor makeup water flow to resin sluice supply header

This instrument provides a local indication of reactor makeup water flow to the resin sluice supply header.

9.3.4.5.5 Radiation Monitoring Instrumentation

9.3.4.5.5.1 Gas Stripper Effluent Radiation Monitor

The gas stripper effluent radiation monitor provides continuous recording in the MCR of the gross gamma activity leaving the gas stripper and entering the holdup tank. A high radiation alarm indicates improper operation of upstream purification equipment. Normally, however, an increasing activity trend allows the operator to take corrective measures (replace ion exchanger resin or filter cartridges) before significant activity increases in the holdup tank. The radiation monitor consists of a logarithmic ratemeter that processes pulses from a shielded scintillation detector.

9.3.4.5.5.2 Process Radiation Monitor

The process radiation monitor provides continuous recording in the MCR of reactor coolant gross gamma radiation and specific fission product gamma activity, thus providing a measure of fuel cladding integrity. A high radiation alarm is annunciated in the MCR. Local and remote samples in the CVCS provide the primary means for determining RCS activity. The process radiation monitor serves only as a trending device to alert the operator of possible fuel cladding failure.

9.3.4.5.6 Boronometer

The boronometer provides indication and a continuous recording in the MCR of reactor coolant boron concentration. High and low alarms warn the operator of deviations from

the required boron concentration in the reactor coolant. The principle of operation is neutron absorption. The unit is provided with shielding as required to limit the maximum external radiation level from its source to a low value. All portions of the unit that contact reactor coolant are constructed of austenitic stainless steel. Refer to Subsection 7.7.1.1 for further information on the boron control system.

9.3.5 Combined License Information

COL 9.3(1) The COL applicant is to provide operational procedures and maintenance programs as related to leak detection and contamination control.

COL 9.3(2) The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.

COL 9.3(3) The COL applicant is to prepare the site radiological environmental monitoring program.

COL 9.3(4) The COL applicant is to provide the supply systems of the nitrogen gas subsystem, the hydrogen subsystem, the carbon dioxide subsystem, and the breathing air systems.

9.3.6 References

1. 10 CFR 50.63, "Station Blackout Rule."

2. ANSI/ISA-S7.3-1975 (R1981), "Quality Standard for Instrument Air."

3. 10 CFR 50, Appendix A, GDC 5, "Sharing of Structures, Systems, and Components."

4. 10 CFR 50, Appendix A, GDC 56, "Primary Containment Isolation," U.S. Nuclear Regulatory Commission.

5. 10 CFR 50, Appendix A, GDC 2, "Design Bases for Protection against Natural Phenomena," U.S. Nuclear Regulatory Commission.

6. 10 CFR 50, Appendix A, GDC 4, "Environmental and Dynamic Effects Design Bases," U.S. Nuclear Regulatory Commission.

7. 10 CFR 50, Appendix A, GDC 60, "Control of Releases of Radioactive Materials the Environment," U.S. Nuclear Regulatory Commission.

8. NRC RG 1.45, "Reactor Coolant Pressure Boundary Leakage Detection System."

9. 10 CFR 20.1406, "Radiological Criteria for Unrestricted Use."

10. NRC RG 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning."

11. 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," U.S. Nuclear Regulatory Commission.

12. Specifications for Air. ANSI/CGA G-7.1, American National Standards Institute.

Table 9.3.1-1 (1 of 5)

Safety-Related Air-Operated Valves and HVAC Control Dampers

System	Quantity	Description	Normal Position	Safe Position	Failure Mode on Loss of Air Supply
Reactor Coolant System	2	Pressurizer spray line control	NC [(1)]	Closed	FC [(1)]
Chemical and Volume control System	1	Resin sluice supply header to reactor drain header isolation	NC	Closed	FC
	1	Letdown orifice bypass flow control	NC	N/A	FC
	1	Letdown control (bypass)	NC	N/A	FC
	1	Letdown control	Throttling	N/A	FC
	1	Process radiation monitor flow control	Throttling	N/A	FO [(1)]
	1	Boric acid makeup control	NC	N/A	FC
	2	Charging control	Throttling	N/A	FO
	1	Charging line back pressure control	NO [(1)]	N/A	FC
	4	Seal injection flow control	Throttling	N/A	FO
	1	Volume control tank (VCT) inlet diversion (3-way)	TO VCT	N/A	TO VCT
	2	RCP controlled bleedoff containment isolation (inside/outside)	NO	Closed	FC
	1	RCP controlled bleedoff diversion	To the charging pump mini-flow HX	N/A	TO VCT
	1	Boric acid makeup pump recirculation	NC	N/A	FC

Table 9.3.1-1 (2 of 5)

System	Quantity	Description	Normal Position	Safe Position	Failure Mode on Loss of Air Supply
Chemical and Volume control System	1	VCT makeup supply isolation	NC	N/A	FC
	1	VCT vent	NC	N/A	FC
	2	Letdown isolation	NO	Closed	FC
	1	Purification ion exchanger bypass (3-way)	To the purification ion exchanger	N/A	TO VCT
	1	Process radiation monitor (PRM) and boronometer (BM) bypass	To the boronometer	N/A	Bypassing the PRM and boronometer
	2	Letdown containment isolation (inside/outside)	NO	Closed	FC
	1	VCT makeup bypass	NC	N/A	FC
	1	Boric acid storage tank discharge isolation	NO	N/A	FO
	2	Reactor drain tank effluent containment isolation (inside/outside)	NC	Closed	FC
Steam Generator Blowdown System	2	Steam generator blowdown line containment isolation	NO	Closed	FC
Component Cooling Water System	4	Essential chiller condenser outlet control (3-way)	NO	Open	FO

Table 9.3.1-1 (3 of 5)

System	Quantity	Description	Normal Position	Safe Position	Failure Mode on Loss of Air Supply
Radioactive Drain System	1	Reactor containment Bldg sump to LRS floor drain tank line containment isolation	NO	Closed	FC
Safety injection shutdown cooling system	2	Hot leg injection to IRWST isolation	NC	Closed	FC
	4	Safety injection tank fill and drain isolation	NC	Closed	FC
	8	Safety injection tank nitrogen supply isolation	NC	Closed	FC
	4	Safety injection tank check valve leakage isolation	NC	Closed	FC
	2	Safety injection tank to reactor drain tank isolation	NC	Closed	FC
	1	Safety injection tank to IRWST isolation	NC	Closed	FC
Main steam system	4	Main steam drip leg isolation	NO	Closed	FC
	2	AF turbine steam supply	NC	Open	FO
	2	AF turbine warmup	NO	Open	FO
Auxiliary Feedwater Pump Turbine System	2	AFPT steam drip leg level control	NC	Open	FO
	2	AF turbine steam isolation	NC	Open	FO
Feedwater System	8	Main feedwater isolation	NO	Closed	FC
	2	Feedwater chemical injection isolation	NC	Closed	FC
Service Air System	1	Service air containment isolation	NC	Closed	FC
Instrument Air System	1	Instrument air containment isolation	NC	Closed	FC

Table 9.3.1-1 (4 of 5)

System	Quantity	Description	Normal Position	Safe Position	Failure Mode on Loss of Air Supply
Reactor Containment Bldg Purge System	4	LV purge supply fan to R/F pool supply containment isolation	NC	Closed	FC
Plant Chilled Water system	2	Containment isolation plant chilled water supply	NO	Closed	FC
Nitrogen system	1	N2 supply containment isolation	NO	Closed	FC
Fire Protection System	1	Fire water containment isolation	NC	Closed	FC
Process Sampling System	2	Blowdown hot leg sample line containment isolation (secondary sample)	NO	Closed	FC
	2	Blowdown cold leg sample line containment isolation	NC	Closed	FC
	2	Downcomer Sample line containment isolation	NO	Closed	FC
	2	Blowdown hot leg sample line containment isolation (Normal primary sample)	NC	Closed	FC
Control Room HVAC System	4	Control room supply AHU isolation control damper	NO	Closed	FC
	2	Control room return line isolation control damper	NC	Open	FO
	2	Control room kitchen/toilet exhaust fan inlet isolation control damper	NO	Closed	FC
	2	Control room smoke removal fan discharge isolation control damper	NC	Closed	FC

Table 9.3.1-1 (5 of 5)

System	Quantity	Description	Normal Position	Safe Position	Failure Mode on Loss of Air Supply
Elect and I&C Equipment Area HVAC System	2	Fuel handling area supply AHU inlet isolation control damper	NO	Closed	FC
	2	Fuel handling area exhaust outlet isolation control damper	NO	Closed	FC
	2	Aux. Bldg controlled area supply isolation control damper	NO	Closed	FC
Auxiliary Bldg Controlled Area HVAC System	4	Aux. Bldg controlled area exhaust ACU inlet isolation control damper	NO	Open	FO

(1) NC - Normally Closed
NO - Normally Open
FC - Fail Closed
FO - Fail Open

Table 9.3.1-2 (1 of 2)

Component Design Data

Instrument Air System

Air Compressors	
Quantity Type Capacity (each) Design Pressure	2 Rotary screw 600 scfm 10.5 kg/cm^2 G (150 psig)
Air Receivers	
Quantity Type Capacity (each) Design Pressure Design Code Material	2 Vertical cylinder type 15,574 L (550 ft^3) 10.5 kg/cm^2 G (150 psig) ASME Section VIII Carbon Steel
Air Dryer	
Quantity Type Capacity (each) Design Pressure Design Code Outlet dew point	2 Desiccant / Dual chamber 680 scfm 10.5kg/cm^2 G (150 psig) ASME Section VIII -40 °C (-40 °F) or less at 8.8 kg/cm^2 G (125 psig)
Prefilter / Afterfilter	
Quantity per Unit Type Capacity per filter Particle removal rating	2 Disposable cartridge 680 scfm Prefilter: 99.5 % of the particle 0.9 microns Afterfilter:100 % of the particle 0.9 microns

Table 9.3.1-2 (2 of 2)

Service Air System

Air Compressors	
Quantity Type Capacity (each) Design Pressure	1 Rotary screw 600 scfm 10.5 kg/cm^2 G (150 psig)
Air Receivers	
Quantity Type Capacity (each) Design Pressure Design Code Material	1 Vertical cylinder type 14,158 L (500 ft^3) 10.5 kg/cm^2 G (150 psig) ASME Section VIII Carbon Steel
Closed Loop Cooling System	
Quantity Type Capacity Designed coolant type	1 Self-contained fluid cooling 1950 L/min (515 gpm) TGBCCW

Table 9.3.2-1 (1 of 5)

Process Sample Requirements during Normal Operation

Sample Origin	Pressurized Sample Capability	Continuous Online Analysis Provided	Method of Sample Removal	Off-line Analysis
Primary sampling (liquid only)				
Hot leg loop 1	Yes	None	Remote	pH, Dissolved Oxygen, Dissolved Nitrogen, Dissolved Hydrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Silica, Conductivity, Sulfate, Boron, Suspended Solids and Radioactivity
Pressurizer steam space	No	None	Remote	Dissolved Fission Gases and Hydrogen
Shutdown cooling system mini-flow HX inlet lines	No	None	Remote	pH, Dissolved Hydrogen, Dissolved Nitrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Sulfate, Boron and Suspended Solids
Containment spray mini-flow HX inlet lines	No	None	Remote	pH, Dissolved Hydrogen, Dissolved Nitrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Sulfate, Boron and Suspended Solids
Safety injection pump mini-flow lines	No	None	Remote	pH, Dissolved Hydrogen, Dissolved Nitrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Sulfate, Boron and Suspended Solids
Safety Injection Tank Fill Line	No	None	Remote	pH, Dissolved Hydrogen, Dissolved Nitrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Sulfate, Boron and Suspended Solids

Table 9.3.2-1 (2 of 5)

Sample Origin	Pressurized Sample Capability	Continuous Online Analysis Provided	Method of Sample Removal	Off-line Analysis
Primary sampling (liquid only)				
Purification filter inlet	No	None	Remote	pH, Dissolved Oxygen, Dissolved Nitrogen, Dissolved Hydrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Silica, Conductivity, Sulfate, Boron, Suspended Solids and Radioactivity
Purification filter outlet Ion exchanger inlet	No	None	Remote	pH, Dissolved Oxygen, Dissolved Nitrogen, Dissolved Hydrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Silica, Conductivity, Sulfate, Boron, Suspended Solids and Radioactivity
Purification ion exchanger outlet	No	None	Remote	pH, Lithium, Boron, Chloride, Sulfate, Fluoride and Radioactivity
Pressurizer surge line	No	None	Remote	Boron, pH, Chloride, Sulfate, Fluoride and Dissolved Oxygen
Reactor drain pump discharge before filter	No	None	Local	pH, Dissolved Hydrogen, Dissolved Nitrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Sulfate and Boron
Reactor drain pump discharge afterfilter	No	None	Local	pH, Dissolved Hydrogen, Dissolved Nitrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Sulfate and Boron

Table 9.3.2-1 (3 of 5)

Sample Origin	Pressurized Sample Capability	Continuous Online Analysis Provided	Method of Sample Removal	Off-line Analysis
Primary sampling (liquid only)				
Pre-holdup ion exchanger outlet	No	None	Local	pH, Dissolved Hydrogen, Dissolved Nitrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Sulfate and Boron
Holdup tank inlet	No	None	Local	pH, Dissolved Hydrogen, Dissolved Nitrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Sulfate and Boron
Boric acid condensate ion exchanger inlet	No	None	Local	pH, Suspended Solids, Chloride, Fluoride, Boron, Ammonia and Sulfate
Boric acid condensate ion exchanger outlet	No	None	Local	pH, Suspended Solids, Chloride, Fluoride, Boron, Ammonia and Sulfate
Reactor makeup water pump discharge before filter	No	None	Local	pH, Dissolved Oxygen, Boron, Chloride, Sulfate, Fluoride, Total solids, Aluminum, Calcium, Magnesium, Reactive Silica, and Conductivity
Reactor makeup water pump discharge afterfilter	No	None	Local	pH, Dissolved Oxygen, Boron, Chloride, Sulfate, Fluoride, Total solids, Aluminum, Calcium, Magnesium, Reactive Silica, and Conductivity
Boric acid makeup pump discharge before filter	No	None	Local	pH, Conductivity, Chloride, Fluoride, Suspended Solids, Silica and Sulfate
Boric acid makeup pump discharge afterfilter	No	None	Local	pH, Conductivity, Chloride, Fluoride, Suspended Solids, Silica and Sulfate
Boric acid batching tank outlet	No	None	Local	Boron, Suspended Solids, Chloride and Fluoride

Table 9.3.2-1 (4 of 5)

Sample Origin	Pressurized Sample Capability	Continuous Online Analysis Provided	Method of Sample Removal	Off-line Analysis
Primary sampling (liquid only)				
Reactor makeup water to volume control tank	No	None	Local	pH, Conductivity, Chloride, Fluoride, Suspended Solids, Silica and Sulfate
Volume control tank drain outlet	No	None	Local	Boron, Chloride, Sulfate, Fluoride, Dissolved Oxygen, Dissolved Hydrogen and Dissolved Nitrogen
Safety injection tanks	No	None	Remote	pH, Dissolved Hydrogen, Dissolved Nitrogen, Hydrazine, Ammonia, Chloride, Lithium, Fluoride, Sulfate, Boron and Suspended Solids
Spent fuel pool	No	None	Local	pH, Boron, Chloride, Sulfate, Fluoride, Ammonia, Lithium and Turbidity
Boric Acid Storage Tank and In-containment Refueling Water Storage Tank	No	None	Local	pH, Boron, Chloride, Sulfate, Fluoride, Gamma Isotopes, Aluminum, Calcium, Magnesium and Turbidity

Table 9.3.2-1 (5 of 5)

Sample Origin	Pressurized Sample Capability	Continuous Online Analysis Provided	Method of Sample Removal	Off-line Analysis
Gas sampling (part of primary sampling)				
GWMS charcoal guard bed	Yes	H_2, O_2	Remote	N/A
GWMS charcoal adsorber	Yes	H_2, O_2	Remote	N/A
Gas stripper	Yes	H_2, O_2	Remote	N/A
Volume control tank	No	H_2, O_2	Remote	N/A
Equipment drain tank	No	H_2, O_2	Remote	N/A
Reactor drain tank	No	H_2, O_2	Remote	N/A
Containment atmosphere	No	Radioactivity	Remote	N/A
Containment purge exhaust	No	Radioactivity	Remote	N/A
Plant vent	No	Radioactivity	Remote	N/A
Radioactive and conventional waste system	No	Radioactivity	Remote	N/A

Table 9.3.2-2 (1 of 2)

Secondary Sampling System Sample Points

Sample Origin	Pressurized Sample Capability	Continuous Online Analysis Provided	Method of Sample Removal	Off-line Analysis
Hotwell	No	Yes, cation conductivity and sodium	Remote	Cation conductivity and sodium
Condensate pump discharge	No	Yes, cation and specific conductivity, dissolved oxygen, sodium	Remote	None
Condensate polishing demineralizers discharge	No	Yes, cation and specific conductivity, sodium	Remote	None
Heater drains	No	None	Local	Cation and specific conductivity
Moisture separator	No	None	Local	Cation and specific conductivity
Feedwater (HP heaters outlets)	No	Yes, pH, dissolved oxygen, sodium, cation and specific conductivity, and hydrazine	Remote	None
Steam generator blowdown mixed-bed demineralizer outlet	No	Yes, cation conductivity and sodium	Remote	None
Condenser tube tray	No	None	Remote	Sodium
Reheater drain tank	No	None	Remote	Cation and specific conductivity
Deaerator Storage tank outlet	No	None	Local	Specific conductivity and dissolved oxygen

Table 9.3.2-2 (2 of 2)

Sample Origin	Pressurized Sample Capability	Continuous Online Analysis Provided	Method of Sample Removal	Off-line Analysis
Deaerator Inlet	No	None	Local	Specific conductivity and dissolved oxygen
AUX. Steam Condensate Receiver Tank Discharge	No	Yes, cation and specific conductivity	Remote	None
SG 1 and 2 blowdown hotleg (1)	No	Yes, cation and specific conductivity, pH, sodium	Remote	None
SG 1 and 2 blowdown coldleg (1)	No	None	Remote	Hydrazine, Chloride, Sulfate and Total Iron
SG 1 and 2 downcomer (1)	No	Yes, cation conductivity, pH, radioactivity, sodium	Remote	None
SG 1 and 2 main steam	No	Yes, cation conductivity, sodium	Remote	None

(1) Secondary sampling system permits continuous chemistry monitoring of any 2 of these sample points for each steam generator, and continuous radiation monitoring of any1 of these sample points for each steam generator.

Table 9.3.2-3

Post-Accident Sampling System (PASS) Sample Points

Sample Origin	Pressurized Sample Capability	Continuous Online Analysis	Sample Removal Method	Off-line Analysis
Hot leg loop 1	Yes	Dissolved oxygen, dissolved hydrogen, pH, conductivity	Remote	Boron, dissolved gas, chloride, radioactivity gamma spectrum and suspended solids
IRWST (upstream of SI, SC and CS pump mini-flow line)	Yes	Dissolved oxygen, dissolved hydrogen, pH, conductivity	Remote	Boron, dissolved gas, radioactivity gamma spectrum and suspended solids
Containment air (upper compartment area in the containment)	No	N/A	Remote	Radioactivity gamma spectrum and suspended solids, and hydrogen concentration

Table 9.3.2-4

Environmentally Qualified Post-Accident Valves

Valve Tag No.	Function
9-491-V-001	Containment isolation valve inside the containment on sample from RCS hot leg loop
9-491-V-0041	Containment isolation valve inside the containment on sample from containment air
9-491-V-1005	Containment isolation valve inside the containment on post-accident liquid sample return to containment sump

Table 9.3.2-5 (1 of 4)

Secondary Sampling System Failure Modes and Effects Analysis

Name/Valve No.	Potential Failure Mode	Plant Condition	Symptoms and Local Effect Including Dependent Failure	Method of Detection	Inherent Compensating Provision	Remark and Other Effects
1. Steam Generator Blowdown Hot Leg V-257 V-258	a. Fails to open on demand	Receipt of high radiation signal to valve 031, 0.32, 033, 034, 035, 036	No safety-related impact on plant.	Valve information: Valve position indication in MCR.	-	Normally closed, fail closed air-operated valve
	b. Fails to close on demand	Loss of electrical Power Loss of feedwater Steam generator tube rupture Safe shutdown Loss-of-coolant accident	No safety-related impact on plant. Radiation protection and shielding equipment is provided. The valves are provided for manual close of the sample line in the primary sample cooler rack and primary sample sink.		Radiation protection and shielding equipment is provided. The manual valves are provided in the primary sample cooler rack and primary sample sink.	

Table 9.3.2-5 (2 of 4)

Name/Valve No.	Potential Failure Mode	Plant Condition	Symptoms and Local Effect Including Dependent Failure	Method of Detection	Inherent Compensating Provision	Remark and Other Effects
2. Steam Generator Blowdown Hot Leg V-031 V-032	a. Fails to close on demand	Loss of electrical Power Loss of feedwater Steam generator tube rupture Safe shutdown	No safety-related impact on plant. Secondary sample is returned to condenser in the closed loop.	Valve information: Valve position indication in MCR.	Secondary side is formed in the closed loop.	Normally opened, fail closed air-operated valve
		Loss-of-coolant accident				
		Receipt of high radiation signal from the steam generator secondary side samples	No safety-related impact on plant. - The valves are provided for manual close of the sample line in the secondary sample cooler rack and secondary continuous sample sink.		The manual valves are provided in the secondary sample cooler rack and secondary continuous sample sink.	

Table 9.3.2-5 (3 of 4)

Name/Valve No.	Potential Failure Mode	Plant Condition	Symptoms and Local Effect Including Dependent Failure	Method of Detection	Inherent Compensating Provision	Remark and Other Effects
3. Steam Generator Downcomer V-033 V-034	a. Fails to close on demand	Loss of electrical Power Loss of feedwater Steam generator tube rupture Safe shutdown	No safety-related impact on plant. - Secondary sample is returned to condenser in the closed loop.	Valve information: Valve position indication in MCR	Secondary side is formed in the closed loop.	Normally opened, fail closed air-operated valve
		Loss-of-coolant accident				
		Receipt of high radiation signal from the steam generator secondary side samples	No safety-related impact on plant. - The valves are provided for manual close of the sample line in the secondary sample cooler rack and secondary continuous sample sink.		The manual valves are provided in the secondary sample cooler rack and secondary continuous sample sink.	

Table 9.3.2-5 (4 of 4)

Name/Valve No.	Potential Failure Mode	Plant Condition	Symptoms and Local Effect Including Dependent Failure	Method of Detection	Inherent Compensating Provision	Remark and Other Effects
4. Steam Generator Cold Leg V-035 V-036	a. Fails to open on demand	Loss of electrical Power	No safety-related impact on plant.	Valve information: Valve position indication in MCR	-	Normally closed, fail closed air-operated valve
	b. Fails to close on demand	Loss of electrical Power Loss of feedwater Steam generator tube rupture Safe shutdown	No safety-related impact on plant. - Secondary sample is returned to condenser in the closed loop.		Secondary side is formed in the closed loop.	
		Loss-of-coolant accident				
		Receipt of high radiation signal from the steam generator secondary side samples	No safety-related impact on plant. - The valves are provided for manual close of the sample line in the secondary sample cooler rack and secondary continuous sample sink.		The manual valves are provided in the secondary sample cooler rack and secondary continuous sample sink.	

Table 9.3.4-1A

Reactor Coolant Plant Shutdown Operation Specifications [1]

Analysis	Plant Shutdown (including Refueling)
pH at 25 °C (77 °F)	3.8-8.4
Chloride, ppm	≤ 0.15
Fluoride, ppm	≤ 0.15
Boron, ppm	≤ 4,400
Ammonia, ppm[2]	≤ 2.0
Hydrogen, cc (STP)/kg H_2O	< 5 [3]
Suspended solids, ppm[4]	≤ 0.35
Sulfate, ppm	≤ 0.15

(1) The parameters and values are subject to change based on technical evaluation as the water chemistry technology is developed.

(2) This parameter is used for problem diagnosis.

(3) Hydrogen should be less than 5 cc (STP)/kg (H_2O) prior to cold shutdown.

(4) The abnormal condition of 0.35 to 2.0 ppm is permitted for up to 14 hours to allow for crud burst conditions.

Table 9.3.4-1B

Reactor Coolant Detailed Plant Startup Operation Specifications [1]

Analysis	Range			
		Action Level		
	Normal	1	2	3
pH at 25 °C (77 °F)	4.6-7.3	—	< 4.6, > 7.3	—
Hydrazine, ppm	≥ 1.5 × O_2 ppm (max. 20 ppm)	—	—	—
Ammonia, ppm[2]	≤ 2.0	—	—	—
Lithium, ppm	0.2 – 2.2[3]	—	—	—
Hydrogen, cc (STP)/kg H_2O	15-25	—	—	—
Dissolved oxygen, ppm[6]	≤ 0.1[4]	—	> 0.1	> 1.0
Suspended solids, ppm	≤ 0.35 [5]	—	—	—
Chloride, ppm[6]	≤ 0.15	—	> 0.15	> 1.5
Fluoride, ppm[6]	≤ 0.15	—	> 0.15	> 1.5
Boron, ppm	≤ 2,500	—	—	—
Sulfate, ppm[6]	≤ 0.15	—	> 0.15	> 1.5

(1) The parameters and values are subject to change based on technical evaluation as the water chemistry technology is developed.

(2) This parameter is used for problem diagnosis.

(3) During heatup operation, lithium concentration can be increased up to 3.5 ppm.

(4) This dissolved oxygen concentration is applicable when reactor coolant temperature is ≥ 121.1 °C (250 °F). Hydrazine is added if O_2 > 0.1 ppm prior to increasing primary coolant temperature. The dissolved specification is set at 0.1 ppm based on stress corrosion cracking concerns.

(5) The abnormal condition of 0.35 to 2.0 ppm is permitted for up to 14 hours to allow for crud burst conditions.

(6) Sampling frequency should be at least once in 72 hr.

Table 9.3.4-1C

Reactor Coolant Detailed Power Operation Specifications [1]

Analysis	Range			
	Normal	Action Level		
		1	2	3
pH at 25 °C (77 °F)	6.0-7.3	—	< 6.0, > 7.3	—
Conductivity, μS/cm	(2)	(2)	(2)	(2)
Lithium, ppm	0.2 - 2.2(3)	—	—	—
Hydrogen, cc (STP)/kg H_2O	25-50	< 25, > 50	≤ 15	≤ 5
Dissolved oxygen, ppm(4)	≤ 0.005	> 0.005	> 0.1	> 1.0
Chloride, ppm(4)	≤ 0.05	> 0.05	> 0.15	> 1.5
Fluoride, ppm(4)	≤ 0.05	> 0.05	> 0.15	> 1.5
Boron, ppm	< 2,500	—	—	—
Sulfate, ppm(4)	≤ 0.05	> 0.05	> 0.15	> 1.5

(1) The parameters and values are subject to change based on technical evaluation as the water chemistry technology is developed.

(2) Consistent with pH additive concentrations.

(3) Consistent with plant lithium management program. Lithium concentration can be increased up to 3.5 ppm.

(4) Sampling frequency should be at least once in 72 hours

Table 9.3.4-2 (1 of 16)

Principal Component Data Summary

Regenerative HX	
Quantity	1
Type	Shell and tube, vertical
Code (tube and shell side)	ASME Section III, Class 2
Tube side (letdown)	
Fluid	Reactor coolant, 2.5 wt% boric acid, maximum
Design pressure	174.7 kg/cm^2 G (2,485 psig)
Design temperature	343.3 °C (650 °F)
Materials	Austenitic stainless steel
Normal flow	302.8 L/min (80 gpm)
Design flow	530.0 L/min (140 gpm)
Pressure loss	3.31 kg/cm^2 at 530.0 L/min and 48.9 °C (47.1 psid at 140 gpm and 120 °F)
Shell side (charging)	
Fluid	Reactor coolant, 2.5 wt% boric acid, maximum
Design pressure	212.7 kg/cm^2 G (3,025 psig)
Design temperature	287.8 °C (550 °F)
Materials	Austenitic stainless steel
Normal flow	251.3 L/min (66.4 gpm)
Design flow	486.8 L/min (128.6 gpm)
Pressure loss	2.47 kg/cm^2 at 486.8 L/min and 48.9 °C (35.1 psid at 128.6 gpm and 120 °F)
Letdown HX	
Quantity	1
Type	Shell and tube, horizontal

Table 9.3.4-2 (2 of 16)

Letdown HX (cont.)	
Tube side (letdown)	
Fluid	Reactor coolant, 2.5 wt% boric acid, maximum
Design pressure	174.7 kg/cm^2 G (2,485 psig)
Design temperature	287.8 °C (550 °F)
Materials	Austenitic stainless steel
Normal flow	302.8 L/min (80 gpm)
Design flow	530.0 L/min (140 gpm)
Pressure loss	0.86 kg/cm^2 at 530.0 L/min and 48.9 ºC (12.2 psid at 140 gpm and 120 °F)
Code	ASME Section III, Class 2
Shell side (cooling water)	
Fluid	Component cooling water
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Materials	Carbon steel
Normal flow	601.9 L/min (159 gpm)
Design flow	5,678L/min (1,500 gpm)
Pressure loss	1.05 kg/cm^2 at 5,678 L/min and 35 °C (15 psid at 1,500 gpm and 95 °F)
Code	ASME Section III, Class 3
Charging Pumps	
Quantity	2
Type	Centrifugal
Design pressure	225.0 kg/cm^2 G (3,200 psig)
Design temperature	93.3 °C (200 °F)
Rated flow	586.7 L/min (155 gpm) without mini-flow
Rated head	1,844 m (6,050 ft)
Normal suction pressure	2.67 kg/cm^2 at 586.7 L/min (38 psig at 155 gpm)

Table 9.3.4-2 (3 of 16)

Charging Pumps (cont.)	
Normal temperature of pumped fluid	48.9 °C (120 °F)
NPSH required	9.0 m at 757.1 L/min (29.5 ft at 200 gpm)
Materials in contact with pumped fluid	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum
Code	ASME Section III, Class 3
Charging Pump Mini-flow HX	
Quantity	1
Type	Shell and tube, horizontal
Tube side (charging)	
Fluid	Reactor coolant, 2.5 wt% boric acid, maximum
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Materials	Austenitic stainless steel
Normal flow	299.0 L/min (79 gpm)
Design flow (mechanical)	416.4 L/min (110 gpm)
Pressure loss	0.7 kg/cm^2 at 299.0 L/min and 48.9 °C (10 psid at 79 gpm and 120 °F)
Code	ASME Section III, Class 3
Shell side (cooling water)	
Fluid	Component cooling water
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Materials	Carbon steel
Normal flow	984.2 L/min (260 gpm)
Design flow	1,703 L/min (450 gpm)
Pressure loss	0.7 kg/cm^2 at 1,703 L/min and 35 °C (10 psid at 450 gpm and 95 °F)
Code	ASME Section III, Class 3

Table 9.3.4-2 (4 of 16)

Auxiliary Charging Pump	
Quantity	1
Type	Positive displacement, air cooled
Design pressure	234.1 kg/cm^2 G (3,329 psig)
Design temperature	93.3 °C (200 °F)
Design flow	166.5 L/min (44 gpm)
Design head	234.1 kg/cm^2 G (3,329 psig)
Normal suction pressure	2.67 kg/cm^2 G (38 psig)
Normal temperature of pumped fluid	48.9 °C (120 °F)
NPSH required	7.32 m at 166.5 L/min (24 ft at 44 gpm)
Materials in contact with pumped fluid	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum
Code	ASME Section III, Class 3
Boric Acid Makeup Pumps	
Quantity	2
Type	Centrifugal
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Rated head	80.8 m (265 ft)
Rated flow	719.2 L/min (190 gpm)
Normal operating temperature	15.6 to 48.9 °C (60 to 120 °F)
NPSH required	2.5 m (8.2 ft)
Fluid	2.5 wt% boric acid, maximum
Material in contact with liquid	Austenitic stainless steel
Code	ASME Section III, Class 3

Table 9.3.4-2 (5 of 16)

Reactor Makeup Water Pumps	
Quantity	2
Type	Centrifugal
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Rated head	80.8 m (265 ft)
Rated flow	719.2 L/min (190 gpm)
Normal operating temperature	15.6 to 48.9 °C (60 to 120 °F)
NPSH required	10.4 m (34 ft)
Material in contact with pumped fluid	Austenitic stainless steel
Fluid	Demineralized water
Code	None
Holdup Pumps	
Quantity	2
Type	Centrifugal
Design pressure	7.0 kg/cm^2 G (100 psig)
Design temperature	93.3 °C (200 °F)
Rated head	44.2 m (145 ft)
Rated flow	189.3 L/min (50 gpm)
Normal operating temperature	4.4 to 48.9 °C (40 to 120 °F)
NPSH required	2.5 m (8.2 ft)
Materials in contact with pumped fluid	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum
Code	None

Table 9.3.4-2 (6 of 16)

Reactor Drain Pumps	
Quantity	2
Type	Centrifugal
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Rated head	44.2 m (145 ft)
Rated flow	189.3 L/min (50 gpm)
Normal operating temperature	48.9 °C (120 °F)
NPSH required	2.5 m (8.2 ft)
Materials in contact with pumped fluid	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum
Code	None
Volume Control Tank	
Quantity	1
Type	Vertical, cylindrical
Internal volume	25,362 L (6,700 gal)
Design pressure, internal	5.27 kg/cm^2 G (75 psig)
Design pressure, external	1.05 kg/cm^2 G (15 psig)
Normal operating temperature	48.9 °C (120 °F)
Normal operating pressure	1.41 to 3.52 kg/cm^2 G (20 to 50 psig)
Blanket gas (during plant operation)	Hydrogen
Fluid	2.5 wt% boric acid, maximum
Material	Austenitic stainless steel
Code	ASME Section III, Class 3
Boric Acid Batching Tank	
Quantity	1
Internal volume	2,385 L (630 gal), minimum
Design pressure	Atmospheric

Table 9.3.4-2 (7 of 16)

Boric Acid Batching Tank (cont.)	
Design temperature	93.3 °C (200 °F)
Normal operating temperature	68.3 °C (155 °F)
Type heater	Electric immersion
Heater capacity, minimum	45 kW
Material	Austenitic stainless steel
Fluid	12 wt% boric acid, maximum
Normal operating pressure	Atmospheric
Code	None
Equipment Drain Tank	
Quantity	1
Type	Horizontal, cylindrical
Internal volume	35,961 L (9,500 gal)
Design pressure, internal	2.11 kg/cm^2 G (30 psig)
Design pressure, external	1.05 kg/cm^2 G (15 psig)
Design temperature	148.9 °C (300 °F)
Normal operating pressure	0.21 to 0.28 kg/cm^2 G (3 to 4 psig)
Normal operating temperature	48.9 °C (120 °F)
Fluid	2.5 wt% boric acid, maximum
Material	Austenitic stainless steel
Code	ASME Section VIII
Reactor Drain Tank	
Quantity	1
Type	Horizontal, cylindrical
Design pressure, internal	9.14 kg/cm^2 G (130 psig)
Design pressure, external	2.8 kg/cm^2 G (40 psig)
Design temperature	176.7 °C (350 °F)
Normal operating pressure	0.21 kg/cm^2 G (3 psig)
Normal operating temperature	48.9 °C (120 °F)

Table 9.3.4-2 (8 of 16)

Reactor Drain Tank (cont.)	
Internal volume	15,142 L (4,000 gal), minimum
Blanket gas	Nitrogen
Fluid	2.5 wt% boric acid, maximum
Material	Austenitic stainless steel
Code	ASME Section VIII
Holdup Tank	
Quantity	1
Type	Vertical (field fabricated)
Total useful volume	1,589,873 L (420,000 gal)
Design pressure	0.11 kg/cm^2 G (1.5 psig)
Design temperature	93.3 °C (200 °F)
Operating pressure	Atmospheric
Operating temperature	4.4 to 48.9 °C (40 to 120 °F)
Fluid	2.5 wt% boric acid, maximum
Material	Austenitic stainless steel
Code	API-650
Reactor Makeup Water Tank	
Quantity	1
Type	Vertical (field fabricated)
Total useful volume	1,495,238 L (395,000 gal)
Design pressure	0.56 kg/cm^2 G (8 psig)
Design temperature	93.3 °C (200 °F)
Operating pressure	0.14 ~ 0.35 kg/cm^2 G (2 ~ 5 psig)
Operating temperature	15.6 to 48.9 °C (60 to 120 °F)
Fluid	2.5 wt% boric acid, maximum
Material (wetted)	Austenitic stainless steel
Code	API-620

Table 9.3.4-2 (9 of 16)

Boric Acid Storage Tank	
Quantity	1
Type	Vertical (field fabricated)
Total useful volume	946,353 L (250,000 gal)
Design pressure	0.11 kg/cm^2 G (1.5 psig)
Design temperature	93.3 °C (200 °F)
Operating pressure	Atmospheric
Operating temperature	15.6 to 48.9 °C (60 to 120 °F)
Fluid	2.5 wt% boric acid, maximum
Material (wetted)	Austenitic stainless steel
Code	ASME Section III, Class 3
Purification and Deborating Ion Exchangers	
Quantity	3
Type	Flushable
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Normal operating temperature	48.9 °C (120 °F)
Resin volume, each (useful)	906 L (32.0 ft^3) (minimum required)
Normal flow	302.8 L/min (80 gpm)
Design flow	567.8 L/min (150 gpm)
Retention screen size	80 U.S. mesh
Material	Austenitic stainless steel
Resin	Cation/anion mixed bed for purification; Anion bed or cation/anion mixed bed for deborating
Fluid	2.5 wt% boric acid, maximum
Code for vessel	ASME Section VIII

Table 9.3.4-2 (10 of 16)

Pre-Holdup Ion Exchanger	
Quantity	1
Type	Flushable
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Normal operating temperature	48.9 °C (120 °F)
Resin volume, each (useful)	906 L (32.0 ft^3) (minimum required)
Normal flow	302.8 L/min (80 gpm)
Design flow	567.8 L/min (150 gpm)
Retention screen size	80 U.S. mesh
Material	Austenitic stainless steel
Resin	Cation/anion mixed bed
Fluid	2.5 wt% boric acid, maximum
Code for vessel	ASME Section VIII
Boric Acid Filter	
Quantity	1
Type elements	Replaceable cartridge
Removal efficiency (β ratio [(1)])	$\beta^{0.45} > 5,000$
Normal operating temperature	15.6 to 48.9 °C (60 to 120 °F)
Design temperature	93.3 °C (200 °F)
Design pressure	14.1 kg/cm^2 G (200 psig)
Design flow	946.3 L/min (250 gpm)
Materials	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum
Code for vessel	ASME Section III, Class 3

Table 9.3.4-2 (11 of 16)

Reactor Makeup Water Filter	
Quantity	1
Type elements	Replaceable cartridge
Removal efficiency (β ratio)	$\beta^{0.45} > 5{,}000$
Normal operating temperature	15.6 to 48.9 °C (60 to 120 °F)
Design temperature	93.3 °C (200 °F)
Design pressure	14.1 kg/cm^2 G (200 psig)
Design flow	946.3 L/min (250 gpm)
Materials	Austenitic stainless steel
Fluid	Demineralized water
Code for vessel	ASME Section VIII
Reactor Drain Filter	
Quantity	1
Removal efficiency (β ratio)	$\beta^{0.45} > 5{,}000$
Type elements	Replaceable cartridge
Normal operating temperature	48.9 °C (120 °F)
Design temperature	93.3 °C (200 °F)
Design pressure	14.1 kg/cm^2 G (200 psig)
Design flow	378.5 L/min (100 gpm)
Materials	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum
Code for vessel	ASME Section VIII
Seal Injection Filter	
Quantity	2
Type elements	Replaceable cartridge
Removal efficiency (β ratio)	$\beta^{0.45} > 5{,}000$
Normal operating temperature	48.9 °C (120 °F)

Table 9.3.4-2 (12 of 16)

Seal Injection Filter (Cont'd)	
Design pressure	212.7 kg/cm^2 G (3,025 psig)
Design temperature	93.3 °C (200 ºF)
Design flow	166.6 L/min (44 gpm)
Normal flow	99.9 L/min (26.4 gpm)
Materials	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum
Code for vessel	ASME Section III, Class 3
Boric Acid Condensate Ion Exchanger	
Quantity	1
Type	Flushable
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Normal operating temperature	48.9 °C (120 °F)
Resin volume (useful)	906 L (32.0 ft^3) (minimum required)
Normal flow	75.7 L/min (20 gpm)
Design flow	378.5 L/min (100 gpm)
Retention screen size	80 U.S. mesh
Material	Austenitic stainless steel
Resin	Anion
Fluid	10 ppm boron, maximum
Code for vessel	ASME Section VIII
Purification Filter	
Quantity	2
Type elements	Replaceable cartridge
Removal efficiency (β ratio)	$\beta^{0.45} > 5,000$
Normal operating temperature	48.9 °C (120 °F)
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)

Table 9.3.4-2 (13 of 16)

Purification Filter (Cont'd)	
Design flow	567.8 L/min (150 gpm)
Normal flow	302.8 L/min (80 gpm)
Material	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum
Code for vessel	ASME Section III, Class 3
Boric Acid Concentrator	
Quantity	1
Maximum distillate effluent concentration	10 ppm boron
Rated flow	75.7 L/min (20 gpm)
Component cooling water flow	2,650 L/min (700 gpm) (maximum)
Steam required	6,396 kg/hr at 3.66 kg/cm^2 G (14,100 lb/hr at 52 psig)
Code	ASME Section VIII
Gas Stripper	
Quantity	1
Design DF	10^3
Rated flow (process)	567.8 L/min (150 gpm)
Component cooling water flow	1,893 L/min (500 gpm) (maximum)
Steam required	4,586 kg/hr at 3.51 kg/cm^2 G (10,110 lb/hr at 50 psig)
Code	ASME Section VIII
Chemical Addition Tank	
Quantity	1
Internal volume	26.4 to 28.4 L (7 to 7.5 gal)
Design pressure	Atmospheric
Design temperature	93.3 °C (200 °F)
Normal operating temperature	15.6 to 48.9 °C (60 to 120 °F)
Material	Austenitic stainless steel
Fluid	N_2H_4 or Li^7OH solution

Table 9.3.4-2 (14 of 16)

Chemical Addition Pump	
Quantity	1
Type	Positive displacement, variable capacity
Design pressure	14.1 kg/cm^2 G (200 psig)
Design temperature	93.3 °C (200 °F)
Normal operating temperature	15.6 to 48.9 °C (60 to 120 °F)
Capacity	0 to 3.79 L/min (0 to 60 gph)
Fluid	N_2H_4 or Li^7OH solution
Material in contact with fluid	Austenitic stainless steel
Code	None

Table 9.3.4-2 (15 of 16)

Letdown Orifices			
Quantity	No. 1	No. 2	No. 3
	1	1	1
Design pressure, kg/cm^2 G (psig)	174.7 (2,485)	174.7 (2,485)	174.7 (2,485)
Design temperature, °C (°F)	93.3 (200)	93.3 (200)	93.3 (200)
Rated flow, L/min at 48.9 °C (gpm at 120 °F)	151.4 (40)	155.2 (41)	249.8 (66)
Normal operating temperature, °C (°F)	48.9 (120)	48.9 (120)	48.9 (120)
Normal operating pressure, kg/cm^2 G (psig)	130.1–163.1 (1,850–2,320)	130.1–162.4 (1,850–2,310)	130.1–159.6 (1,850–2,270)
Rated differential pressure, kg/cm^2 (psid) at rated flow	112.5 (1,600)	105.5 (1,500)	84.4 (1,200)
Materials	Austenitic stainless steel	Austenitic stainless steel	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum	2.5 wt% boric acid, maximum	2.5 wt% boric acid, maximum
Code	ASME Section III, Class 2	ASME Section III, Class 2	ASME Section III, Class 2

Table 9.3.4-2 (16 of 16)

Charging Restricting Orifice		
	No. 1	No. 2
Quantity	1	1
Design pressure, kg/cm^2 G (psig)	225.0 (3,200)	225.0 (3,200)
Design temperature,°C (°F)	93.3 (200)	93.3 (200)
Rated flow, L/min at 48.9 °C (gpm at 120°F)	681.4 (180)	567.8 (150)
Normal operating temperature,°C (°F)	48.9 (120)	48.9 (120)
Normal operating pressure, kg/cm^2 G (psig)	184.9 (2,630)	83.0 (1,180)
Rated diff. pressure, kg/cm^2 (psid) at rated flow	140.6 (2,000)	57.7 (820)
Materials	Austenitic stainless steel	Austenitic stainless steel
Fluid	2.5 wt% boric acid, maximum	2.5 wt% boric acid, maximum
Code	ASME Code Section III, Class 2	ASME Code Section III, Class 2

(1) Beta ratio: Number of upstream challenge particles greater than 0.45μm divided by the number of downstream particles greater than 0.45μm.

Table 9.3.4-3

Chemical and Volume Control System Parameters

Parameter	Value
Normal letdown and purification flow	302.8 L/min (80 gpm)
Normal charging flow (to RCS charging nozzle)	251.4 L/min (66.4 gpm)
Normal charging mini-recirculation flow	170.3 L/min (45 gpm)
Normal seal injection flow	99.9 L/min (26.4 gpm)
Reactor coolant pump controlled bleedoff (4 pumps)	48.5 L/min (12.8 gpm)
Normal letdown temperature at loop	290.6 °C (555 °F)
Normal charging temperature at loop	240.2 °C (464.3 °F)
Ion exchanger operating temperature	48.9 °C (120 °F)

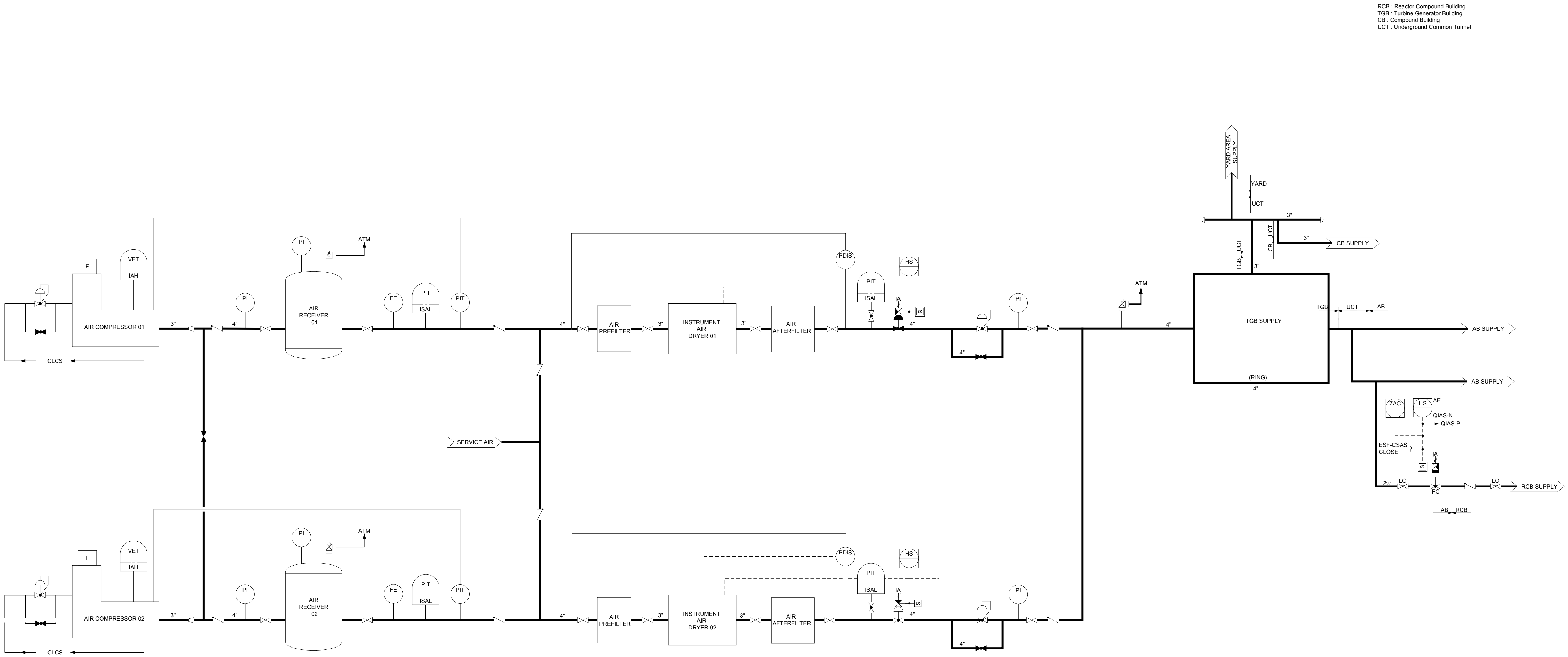


Figure 9.3.1-1 Instrument Air System Flow Diagram

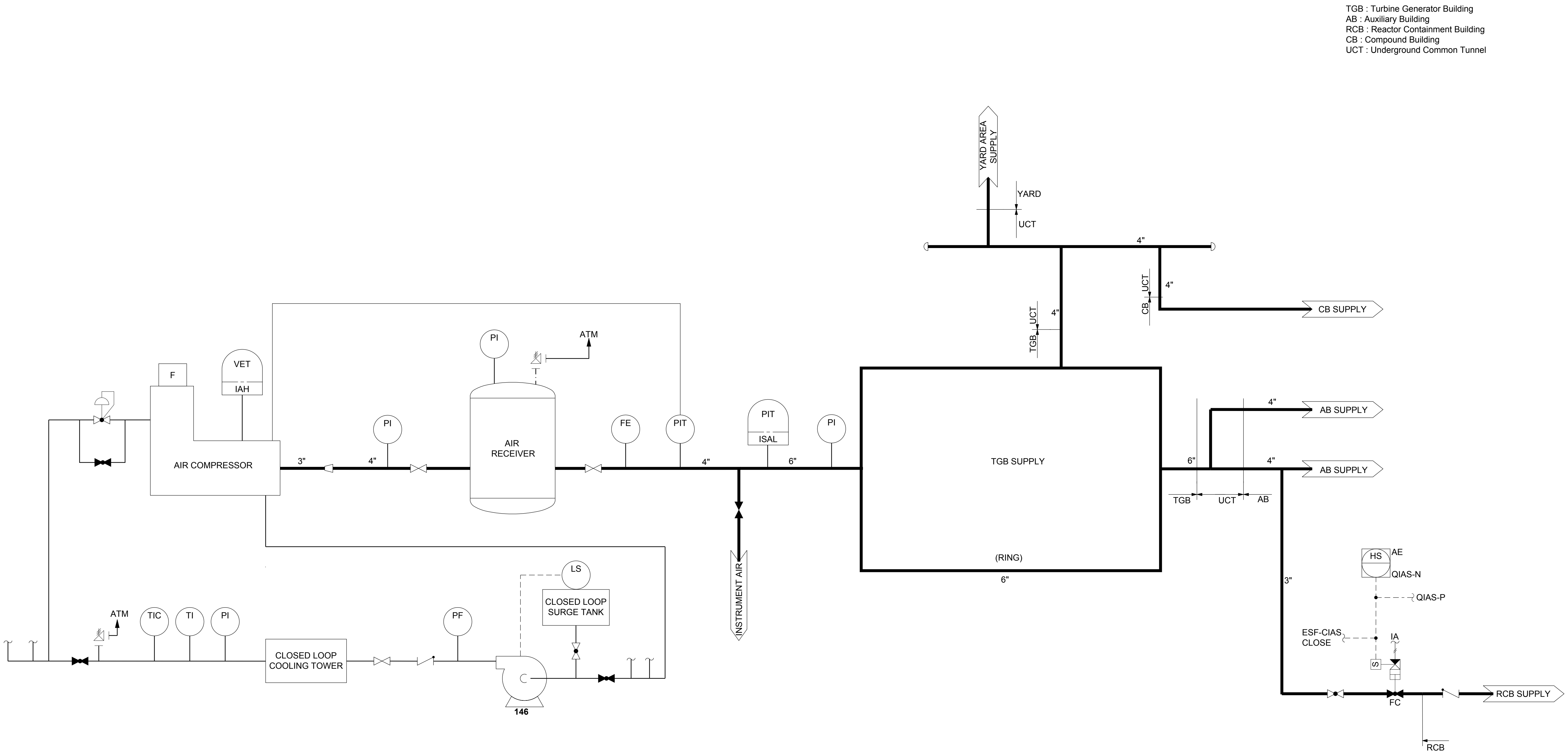


Figure 9.3.1-2 Service Air System Flow Diagram

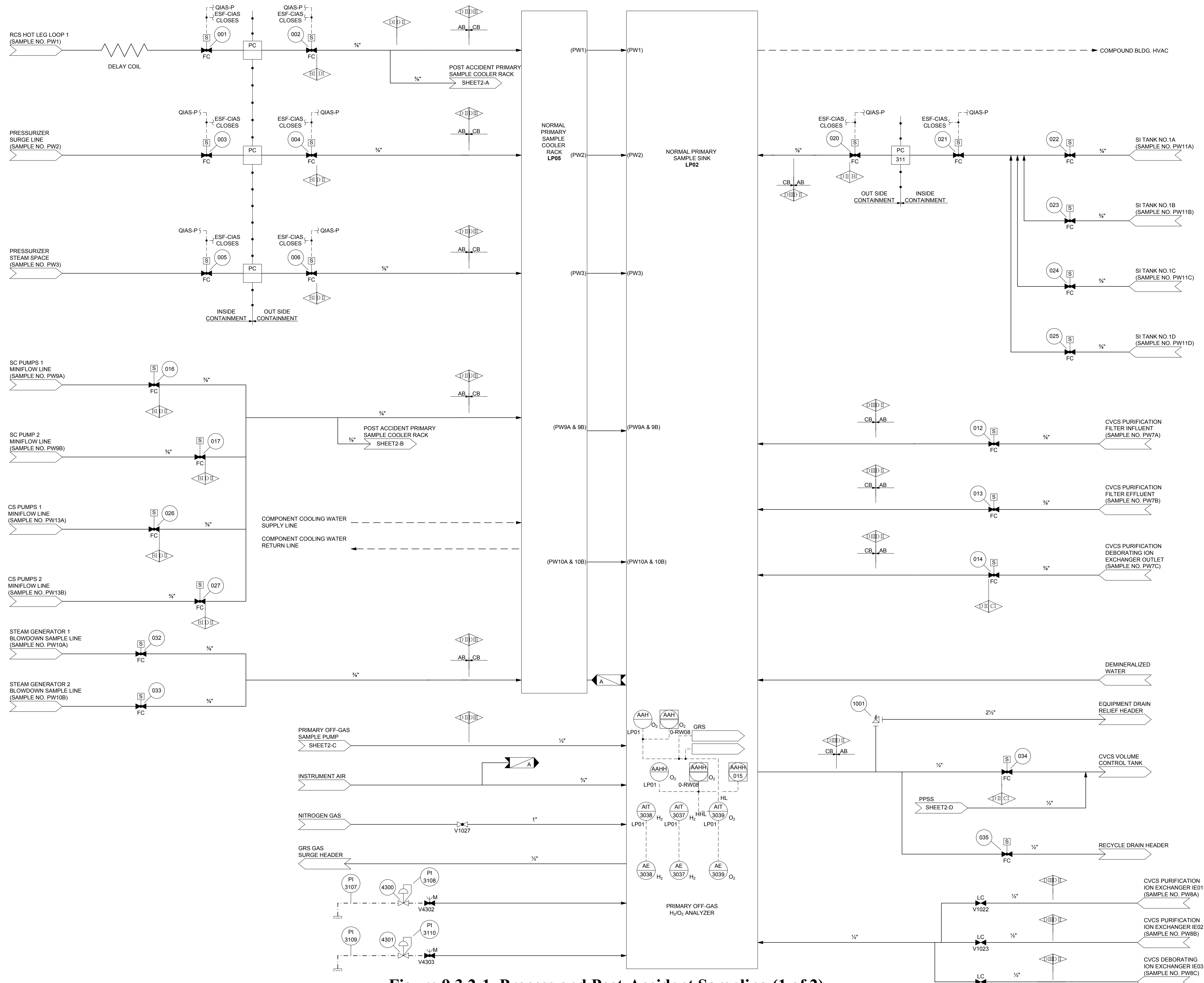


Figure 9.3.2-1 Process and Post-Accident Sampling (1 of 2)

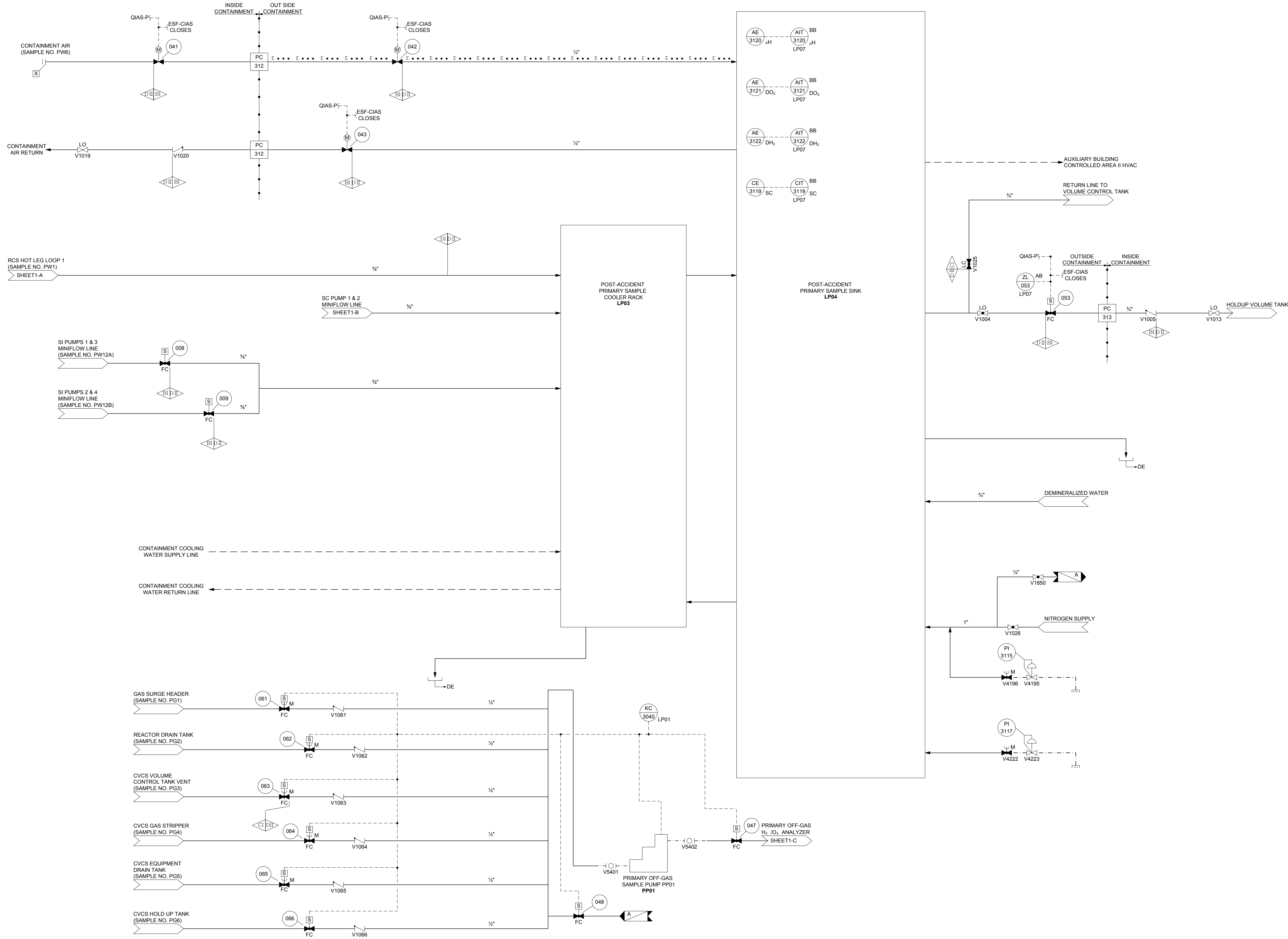
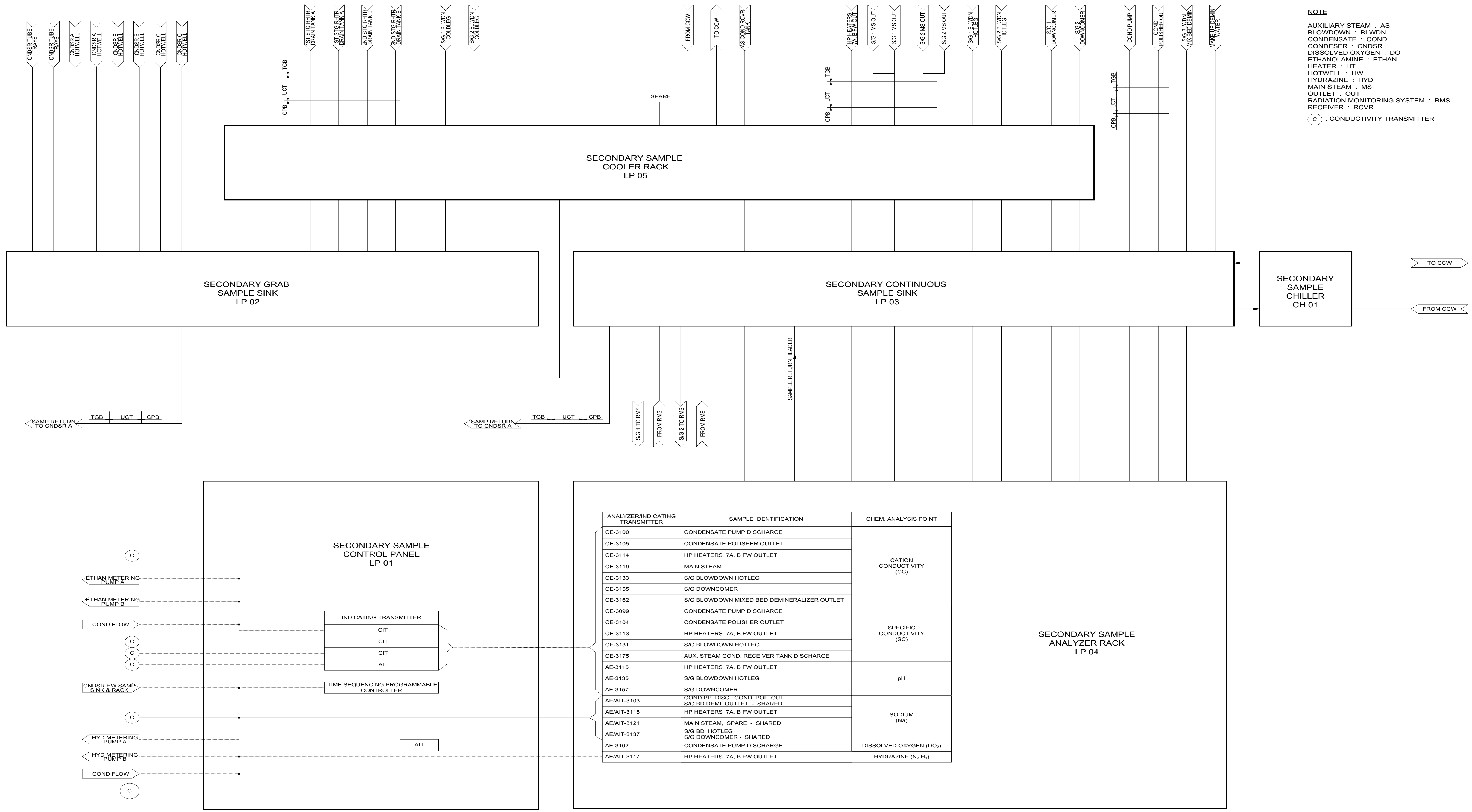


Figure 9.3.2-1 Process and Post-Accident Sampling (2 of 2)



ANALYZER/INDICATING TRANSMITTER	SAMPLE IDENTIFICATION	CHEM. ANALYSIS POINT
CE-3100	CONDENSATE PUMP DISCHARGE	CATION CONDUCTIVITY (CC)
CE-3105	CONDENSATE POLISHER OUTLET	
CE-3114	HP HEATERS 7A, B FW OUTLET	
CE-3119	MAIN STEAM	
CE-3133	S/G BLOWDOWN HOTLEG	
CE-3155	S/G DOWNCOMER	
CE-3162	S/G BLOWDOWN MIXED BED DEMINERALIZER OUTLET	
CE-3099	CONDENSATE PUMP DISCHARGE	SPECIFIC CONDUCTIVITY (SC)
CE-3104	CONDENSATE POLISHER OUTLET	
CE-3113	HP HEATERS 7A, B FW OUTLET	
CE-3131	S/G BLOWDOWN HOTLEG	
CE-3175	AUX. STEAM COND. RECEIVER TANK DISCHARGE	
AE-3115	HP HEATERS 7A, B FW OUTLET	pH
AE-3135	S/G BLOWDOWN HOTLEG	
AE-3157	S/G DOWNCOMER	
AE/AIT-3103	COND.PP. DISC., COND. POL. OUT. S/G BD DEMI. OUTLET - SHARED	SODIUM (Na)
AE/AIT-3118	HP HEATERS 7A, B FW OUTLET	
AE/AIT-3121	MAIN STEAM, SPARE - SHARED	
AE/AIT-3137	S/G BD HOTLEG S/G DOWNCOMER - SHARED	
AE-3102	CONDENSATE PUMP DISCHARGE	DISSOLVED OXYGEN (DO_2)
AE/AIT-3117	HP HEATERS 7A, B FW OUTLET	HYDRAZINE (N_2H_4)

Figure 9.3.2-2 Process Sampling System Flow Diagram (1 of 6)

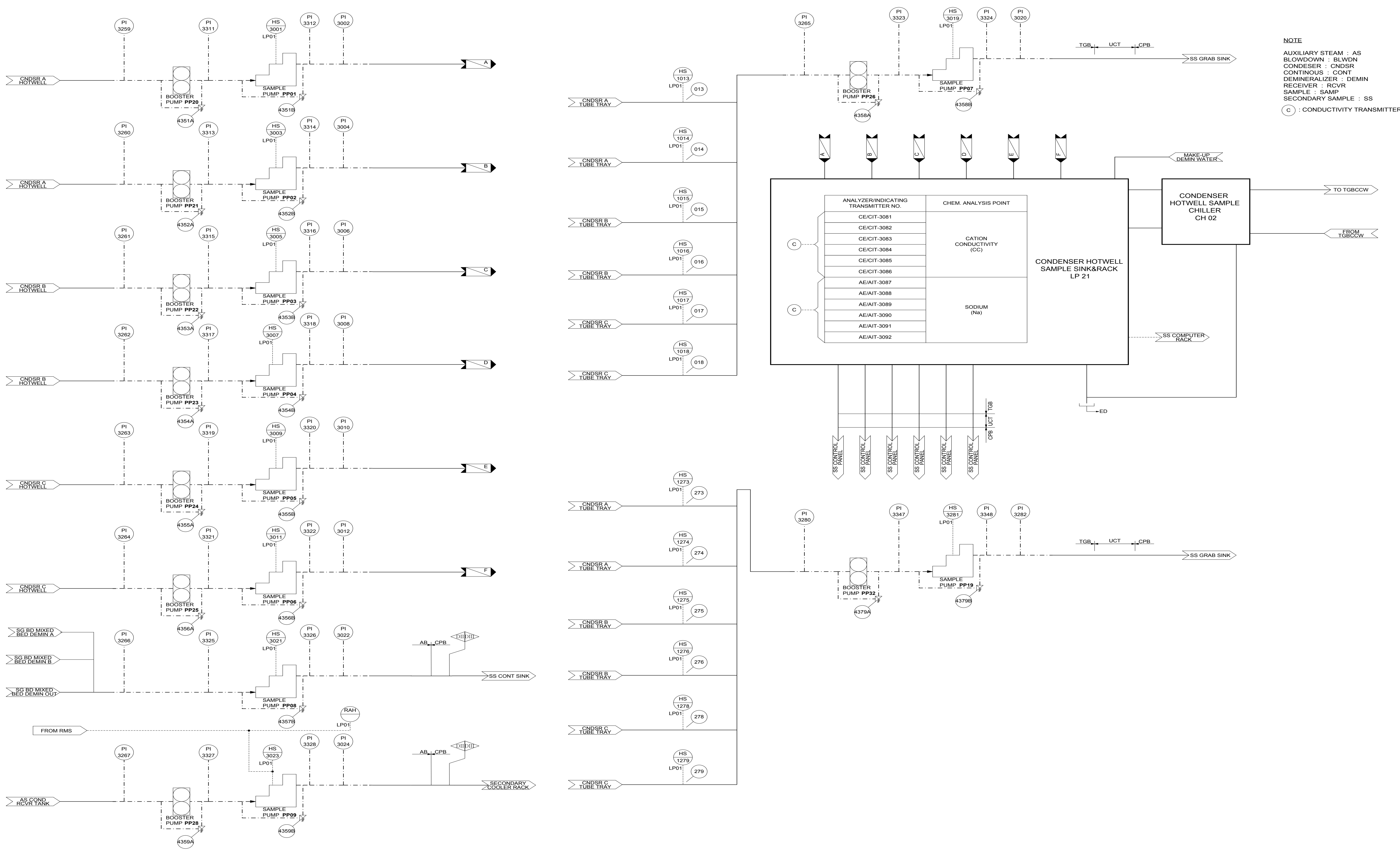


Figure 9.3.2-2 Process Sampling System Flow Diagram (2 of 6)

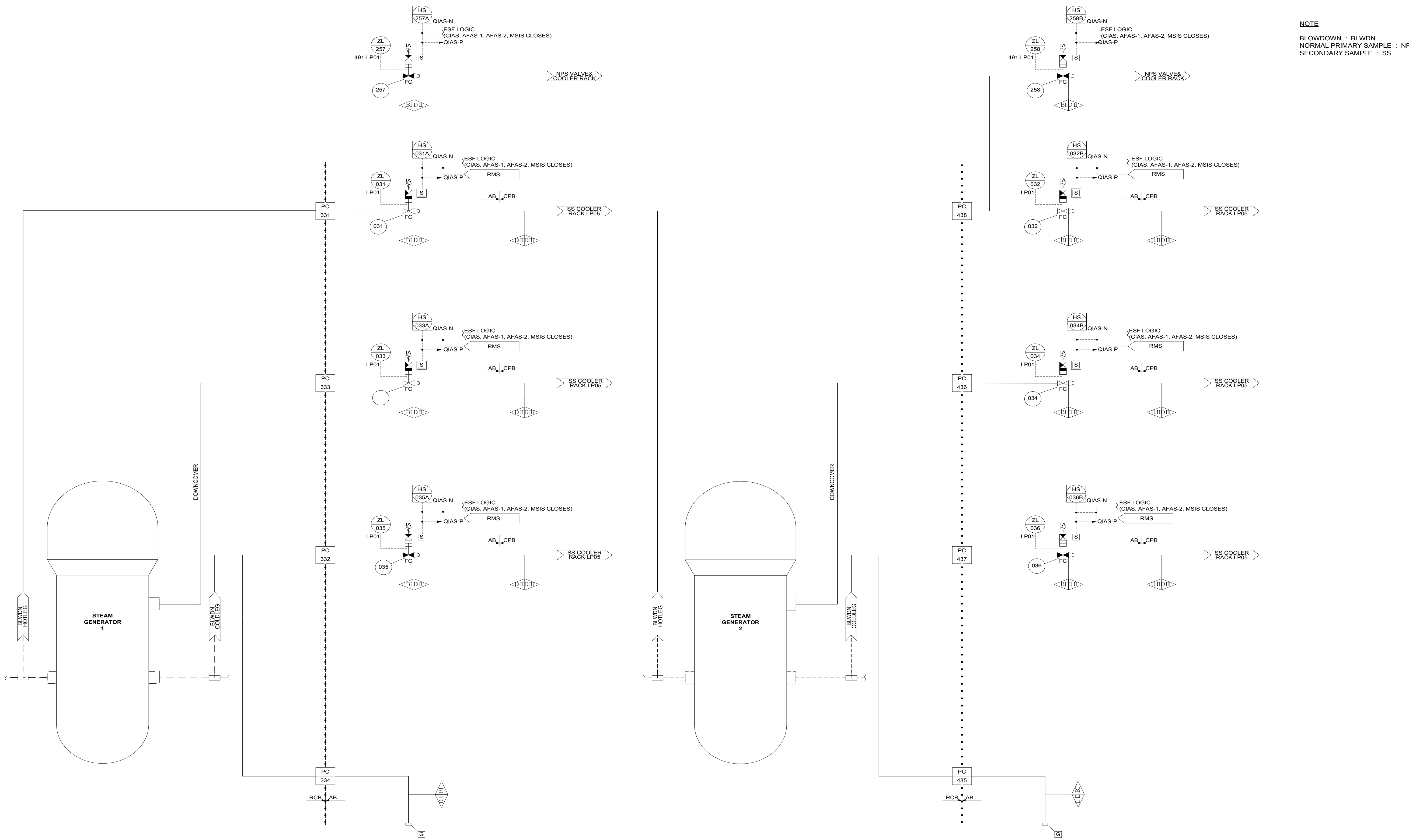


Figure 9.3.2-2 Process Sampling System Flow Diagram (3 of 6)

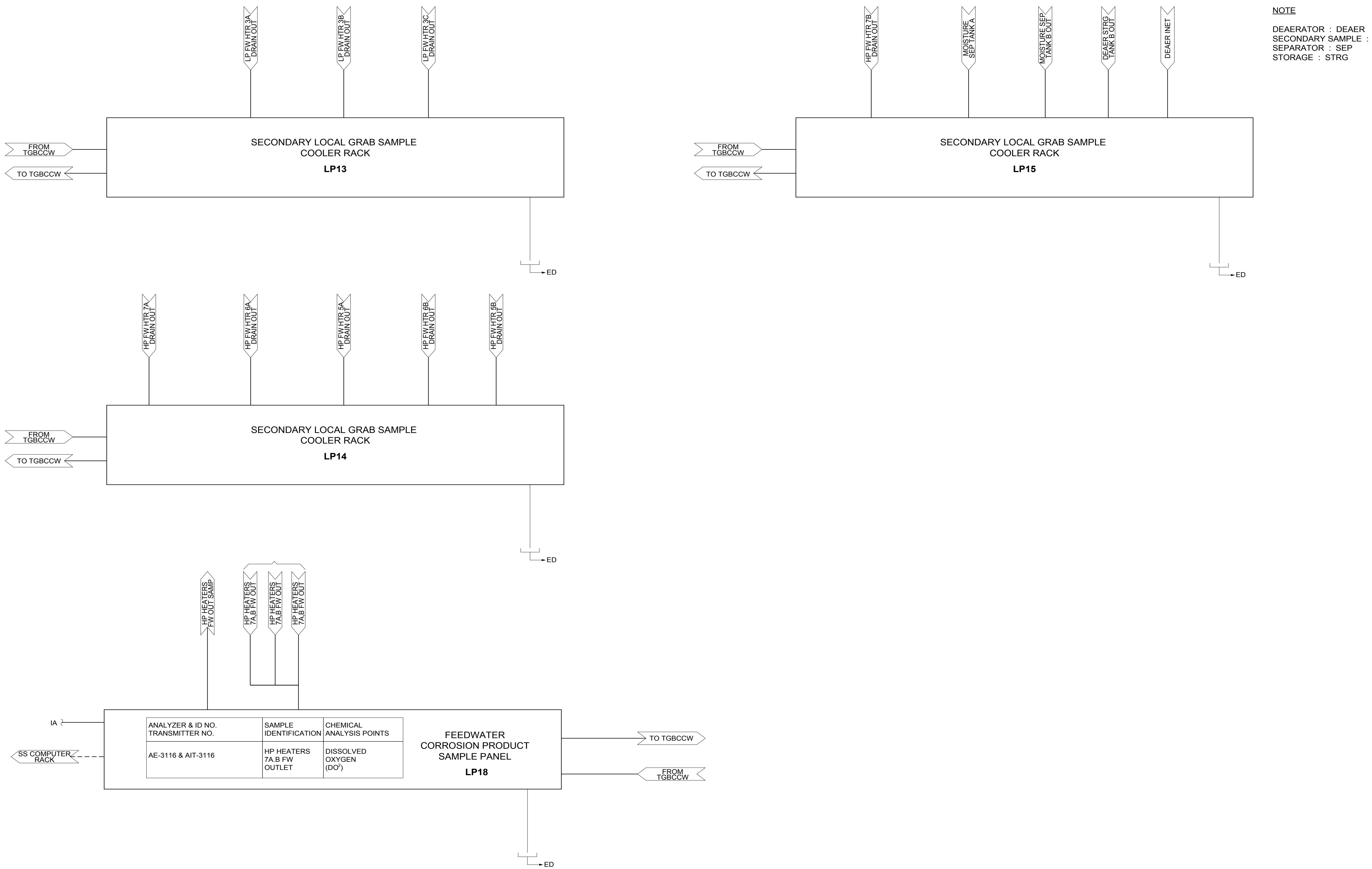


Figure 9.3.2-2 Process Sampling System Flow Diagram (4 of 6)

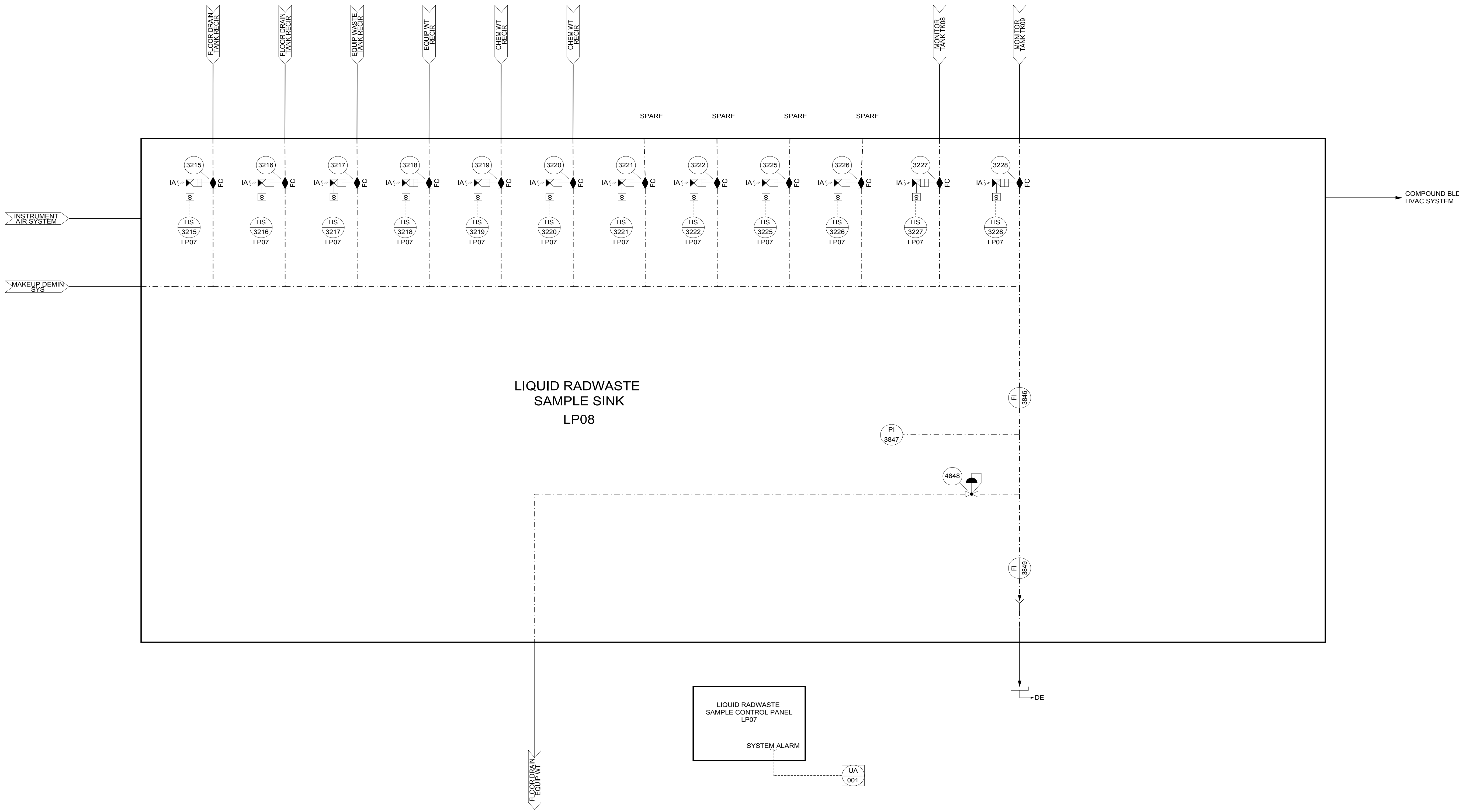


Figure 9.3.2-2 Process Sampling System Flow Diagram (5 of 6)

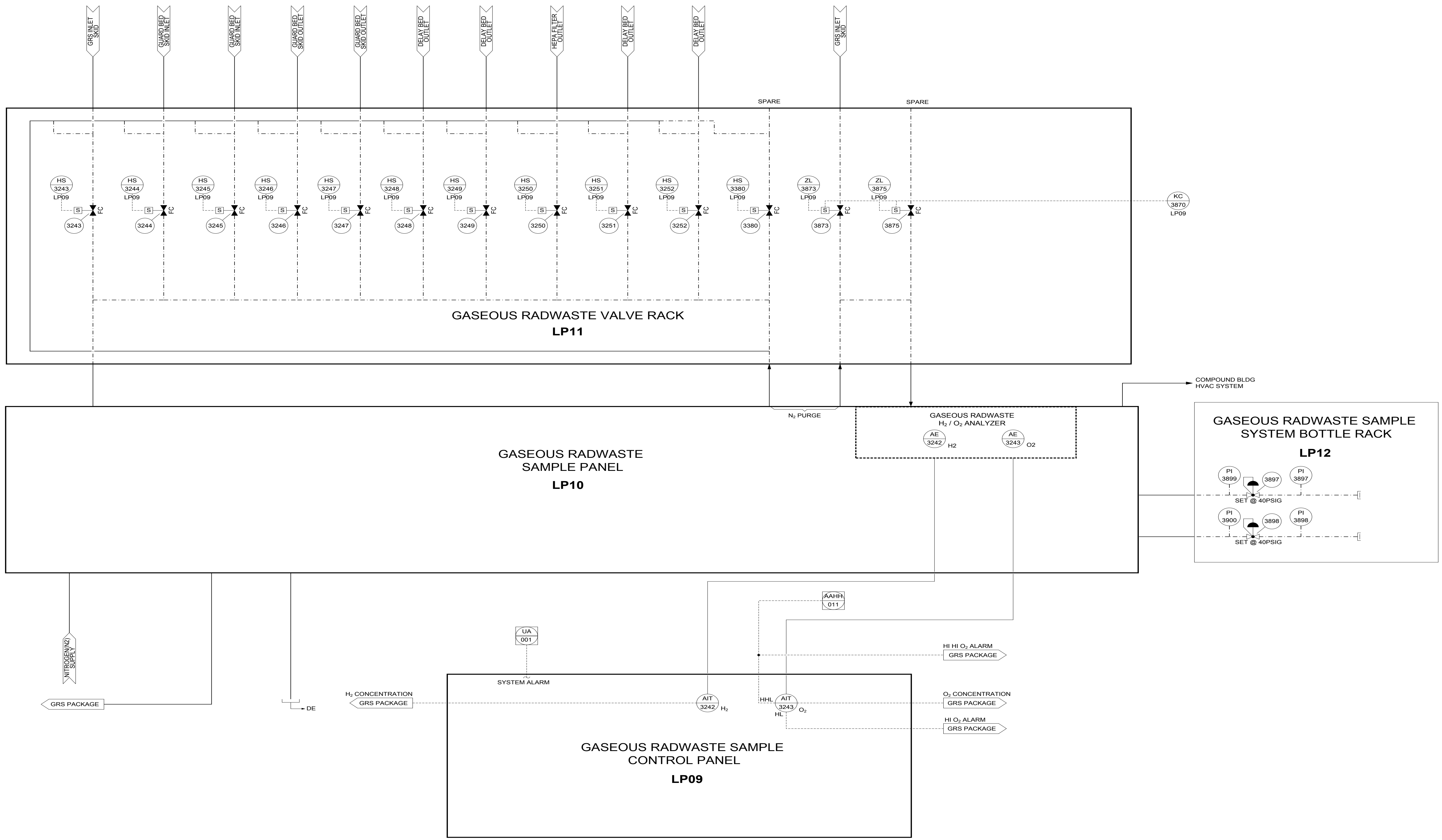


Figure 9.3.2-2 Process Sampling System Flow Diagram (6 of 6)

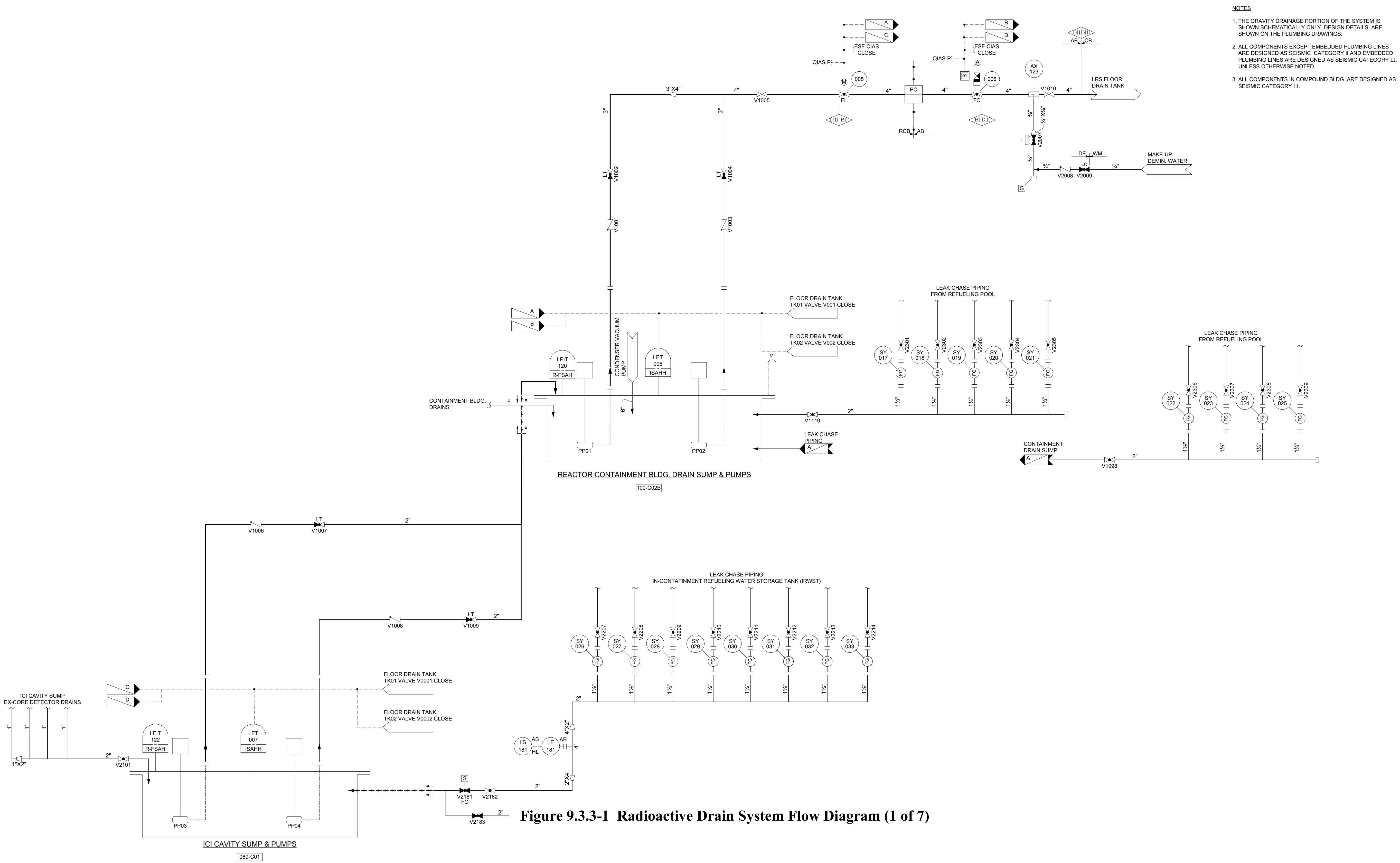


Figure 9.3.3-1 Radioactive Drain System Flow Diagram (1 of 7)

NOTES

1. THE GRAVITY DRAINAGE PORTION OF THE SYSTEM IS SHOWN SCHEMATICALLY ONLY. DESIGN DETAILS ARE SHOWN ON THE PLUMBING DRAWINGS.

2. ALL COMPONENTS EXCEPT ESF PUMP ROOM FLOOD LEVEL INSTRUMENTATION ARE DESIGNED AS SEISMIC CATEGORY II, UNLESS OTHERWISE NOTED.

3. THIS LEVEL INSTRUMENTATION IS SAFETY-RELATED AND DESIGNED AS SEISMIC CATEGORY I. THIS LEVEL SWITCH IS MOUNTED ON THE WALL OF EACH ESF PUMP ROOM.

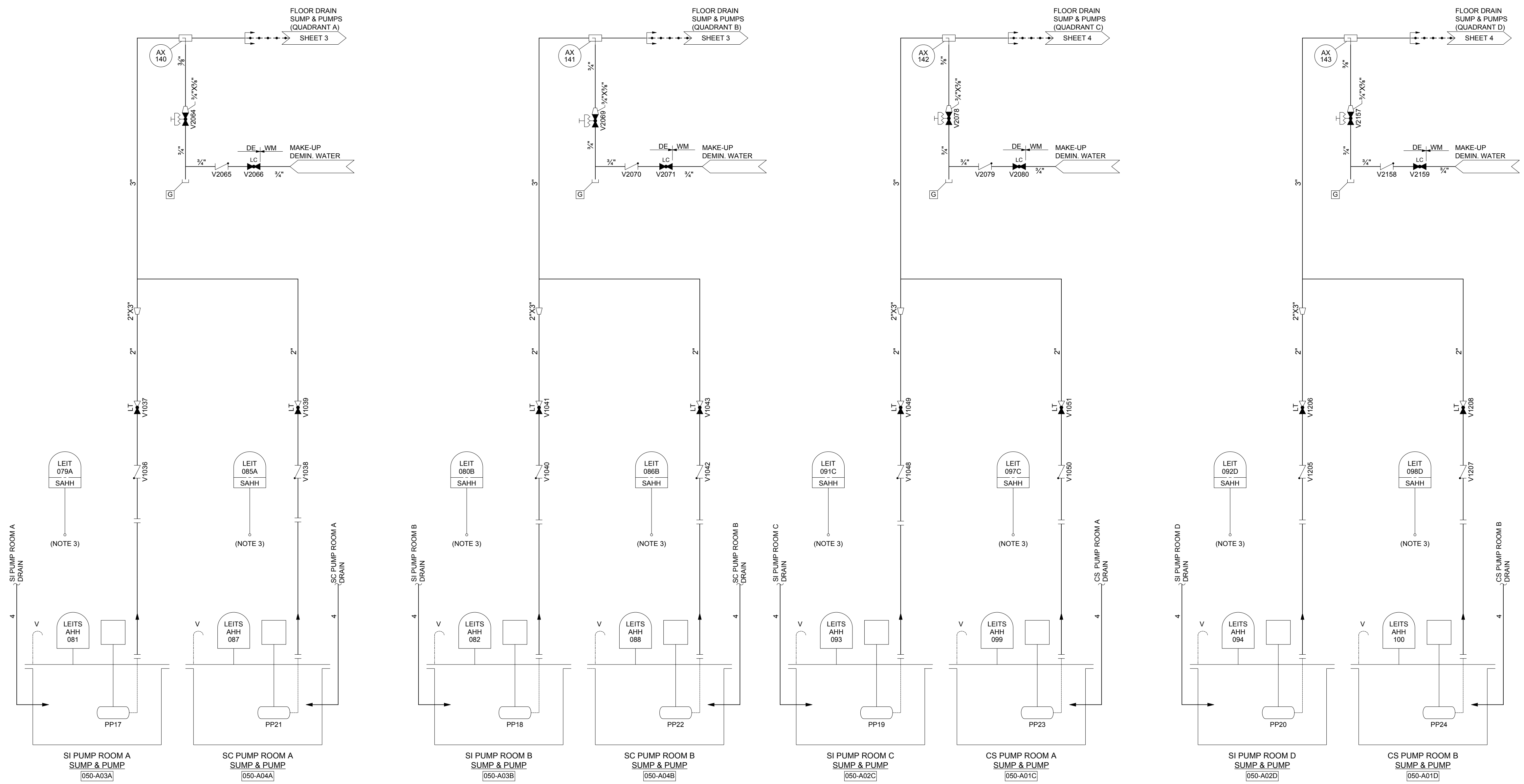


Figure 9.3.3-1 Radioactive Drain System Flow Diagram (2 of 7)

NOTES

1. THE GRAVITY DRAINAGE PORTION OF THE SYSTEM IS SHOWN SCHEMATICALLY ONLY. DESIGN DETAILS ARE SHOWN ON THE PLUMBING DRAWINGS.

2. ALL COMPONENTS ARE DESIGNED AS SEISMIC CATEGORY II, UNLESS OTHERWISE NOTED.

. THIS LEVEL INSTRUMENTATION IS SAFETY-RELATED AND DESIGNED AS SEISMIC CATEGORY I. THIS LEVEL SWITCH IS MOUNTED ON THE WALL OF QUADRANT A/B FLOOR (EL. 55'-0").

4. ALL COMPONENTS IN COMPOUND BLDG. ARE DESIGNED AS SEISMIC CATEGORY III.

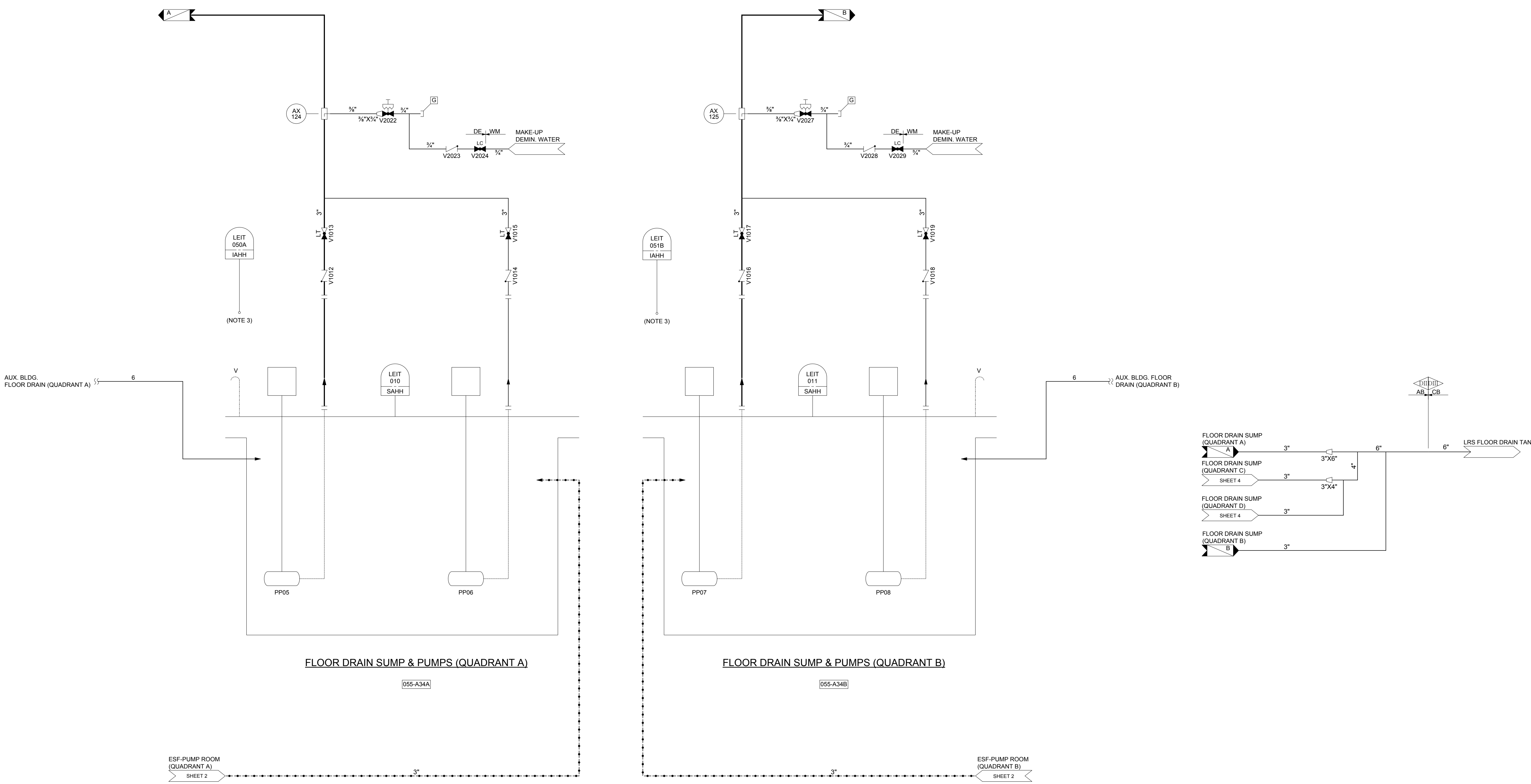


Figure 9.3.3-1 Radioactive Drain System Flow Diagram (3 of 7)

NOTES

1. THE GRAVITY DRAINAGE PORTION OF THE SYSTEM IS SHOWN SCHEMATICALLY ONLY. DESIGN DETAILS ARE SHOWN ON THE PLUMBING DRAWINGS.
2. ALL COMPONENTS ARE DESIGNED AS SEISMIC CATEGORY II, UNLESS OTHERWISE NOTED.
3. THIS LEVEL INSTRUMENTATION IS SAFETY-RELATED AND DESIGNED AS SEISMIC CATEGORY I. THIS LEVEL SWITCH IS MOUNTED ON THE WALL OF QUADRANT C/D FLOOR (EL. 55'-0").

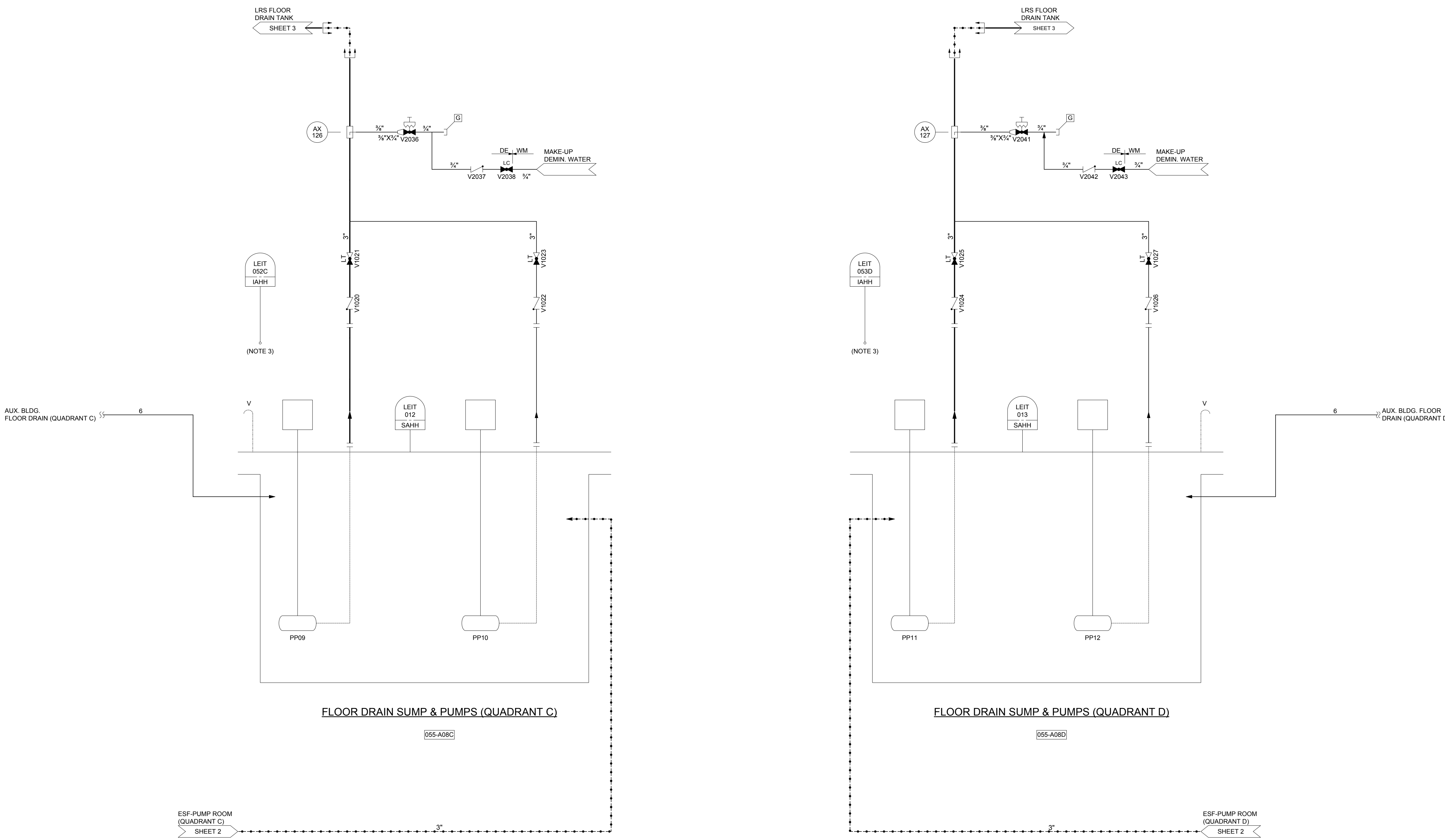


Figure 9.3.3-1 Radioactive Drain System Flow Diagram (4 of 7)

NOTES

1. THE GRAVITY DRAINAGE PORTION OF THE SYSTEM IS SHOWN SCHEMATICALLY ONLY. DESIGN DETAILS ARE SHOWN ON THE PLUMBING DRAWINGS.

2. ALL COMPONENTS ARE DESIGNED AS SEISMIC CATEGORY II, UNLESS OTHERWISE NOTED.

3. ALL COMPONENTS IN COMPOUND BLDG. ARE DESIGNED AS SEISMIC CATEGORY III.

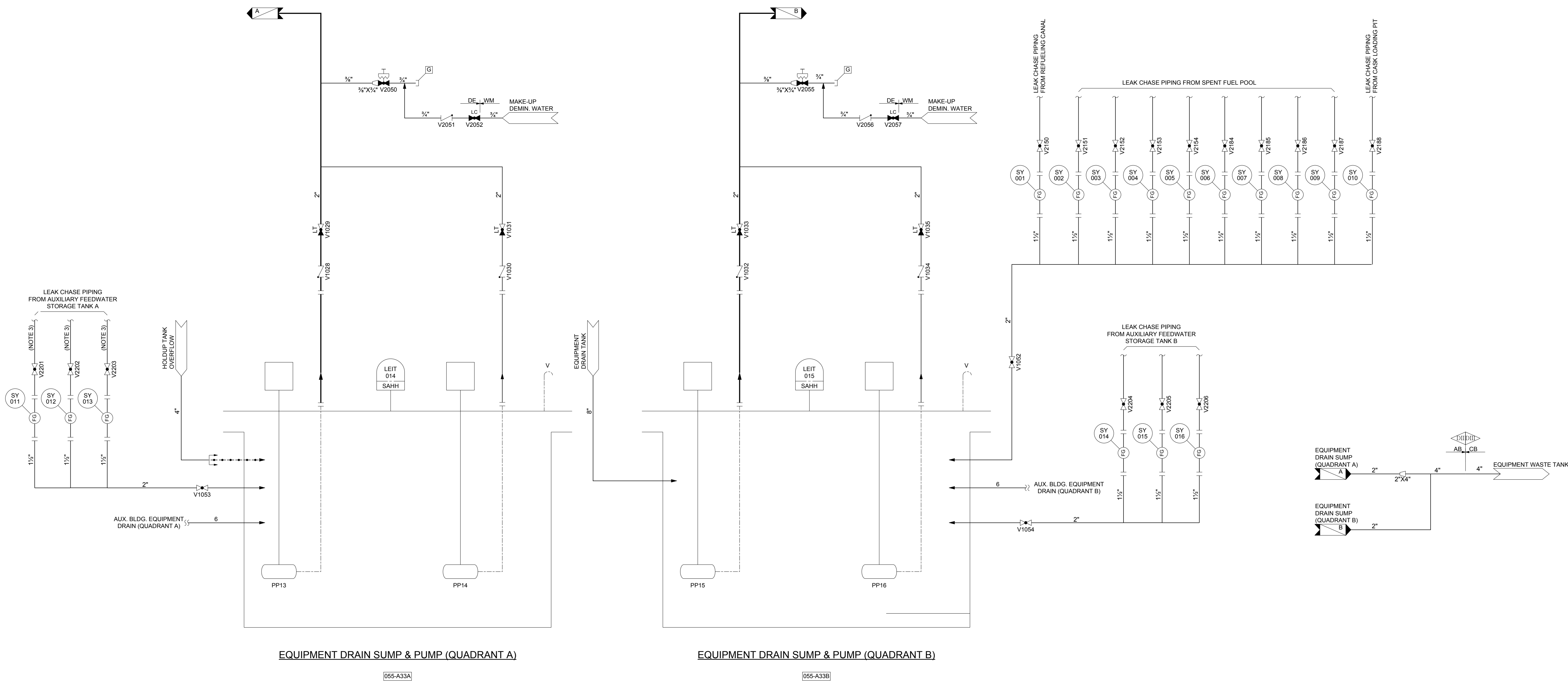


Figure 9.3.3-1 Radioactive Drain System Flow Diagram (5 of 7)

NOTES

1. THE GRAVITY DRAINAGE PORTION OF THE SYSTEM IS SHOWN SCHEMATICALLY ONLY. DESIGN DETAILS ARE SHOWN ON THE PLUMBING DRAWINGS.
2. ALL COMPONENTS ARE DESIGNED AS SEISMIC CATEGORY II, UNLESS OTHERWISE NOTED.
3. ALL COMPONENTS IN COMPOUND BLDG. ARE DESIGNATED AS SEISMIC CATEGORY III.

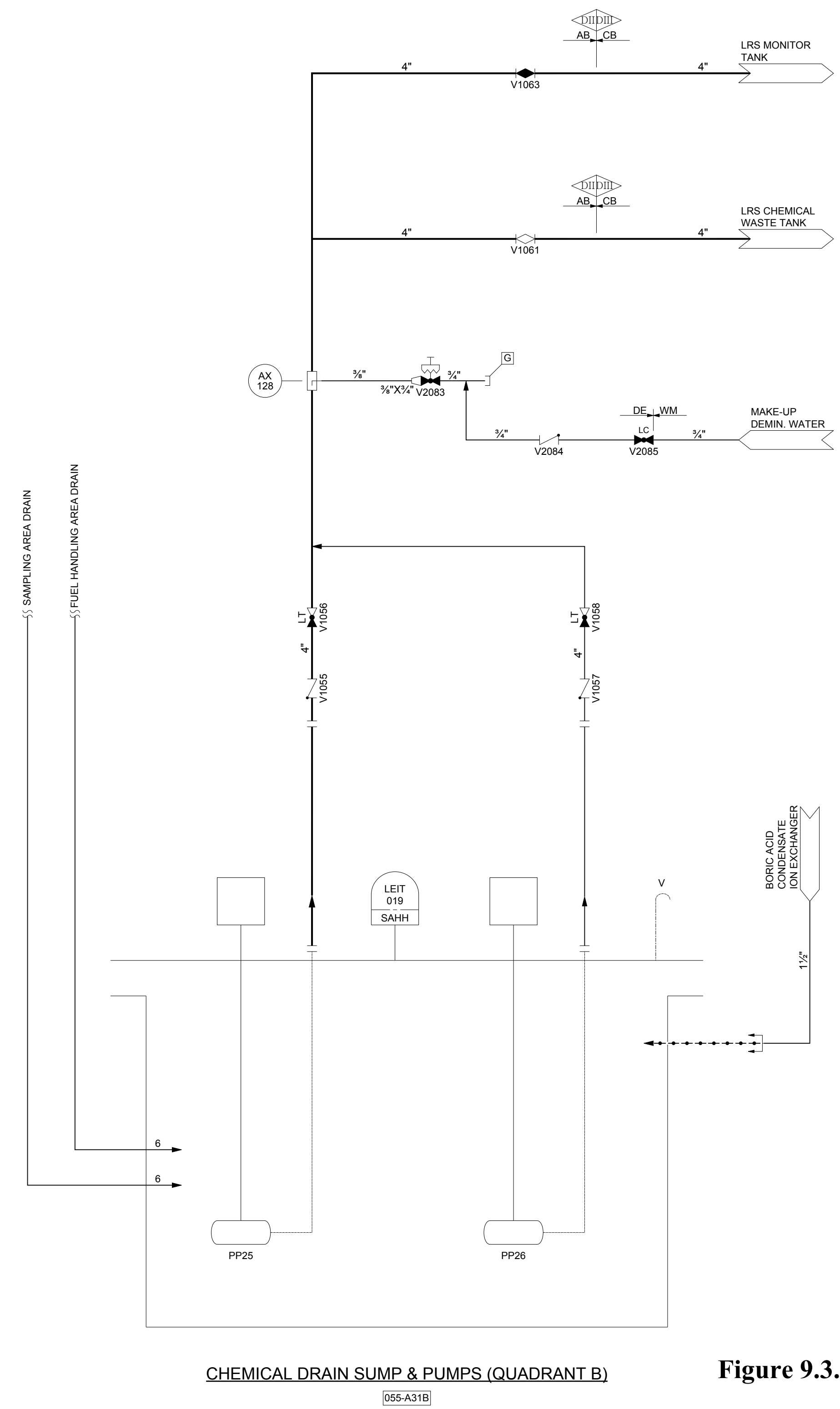


Figure 9.3.3-1 Radioactive Drain System Flow Diagram (6 of 7)

NOTE

1. THE GRAVITY DRAINAGE PORTION OF THE SYSTEM IS SHOWN SCHEMATICALLY ONLY. DESIGN DETAILS ARE SHOWN ON THE PLUMBING DRAWINGS.

2. ALL COMPONENTS ARE DESIGNED AS SEISMIC CATEGORY III, UNLESS OTHERWISE NOTED.

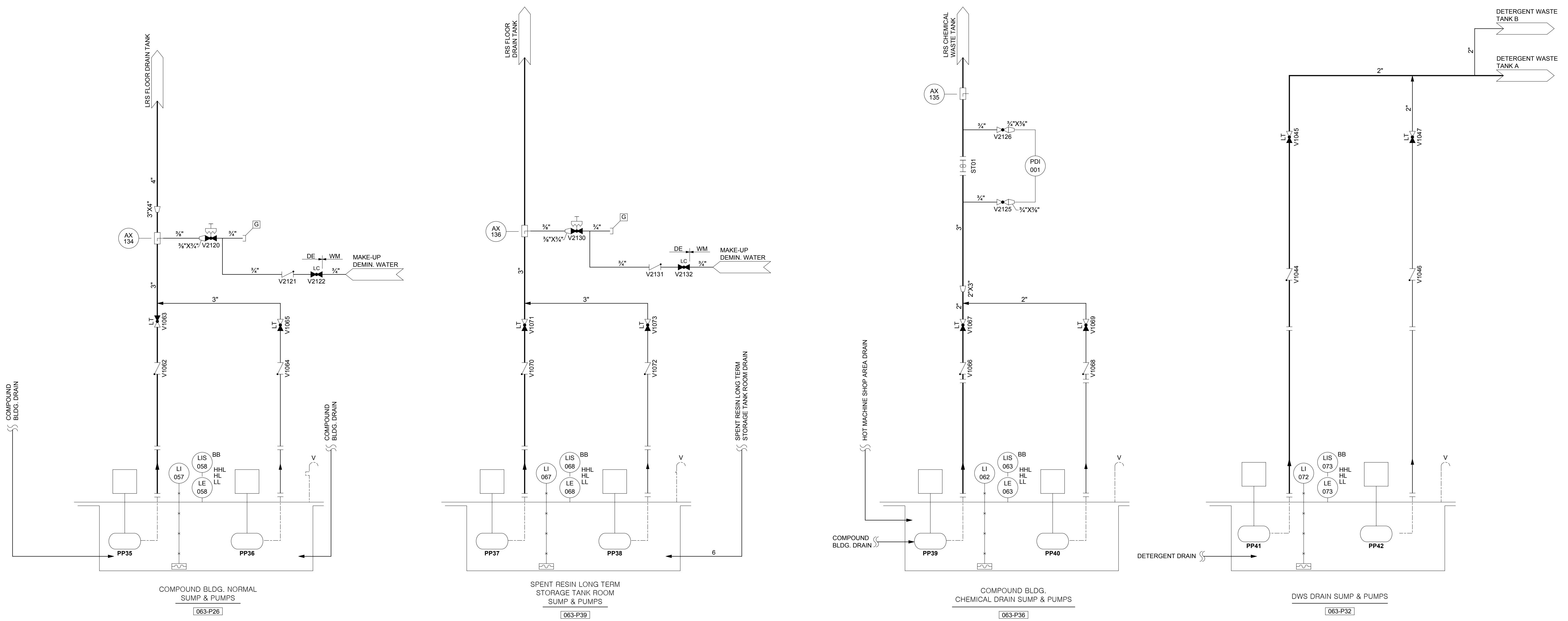


Figure 9.3.3-1 Radioactive Drain System Flow Diagram (7 of 7)

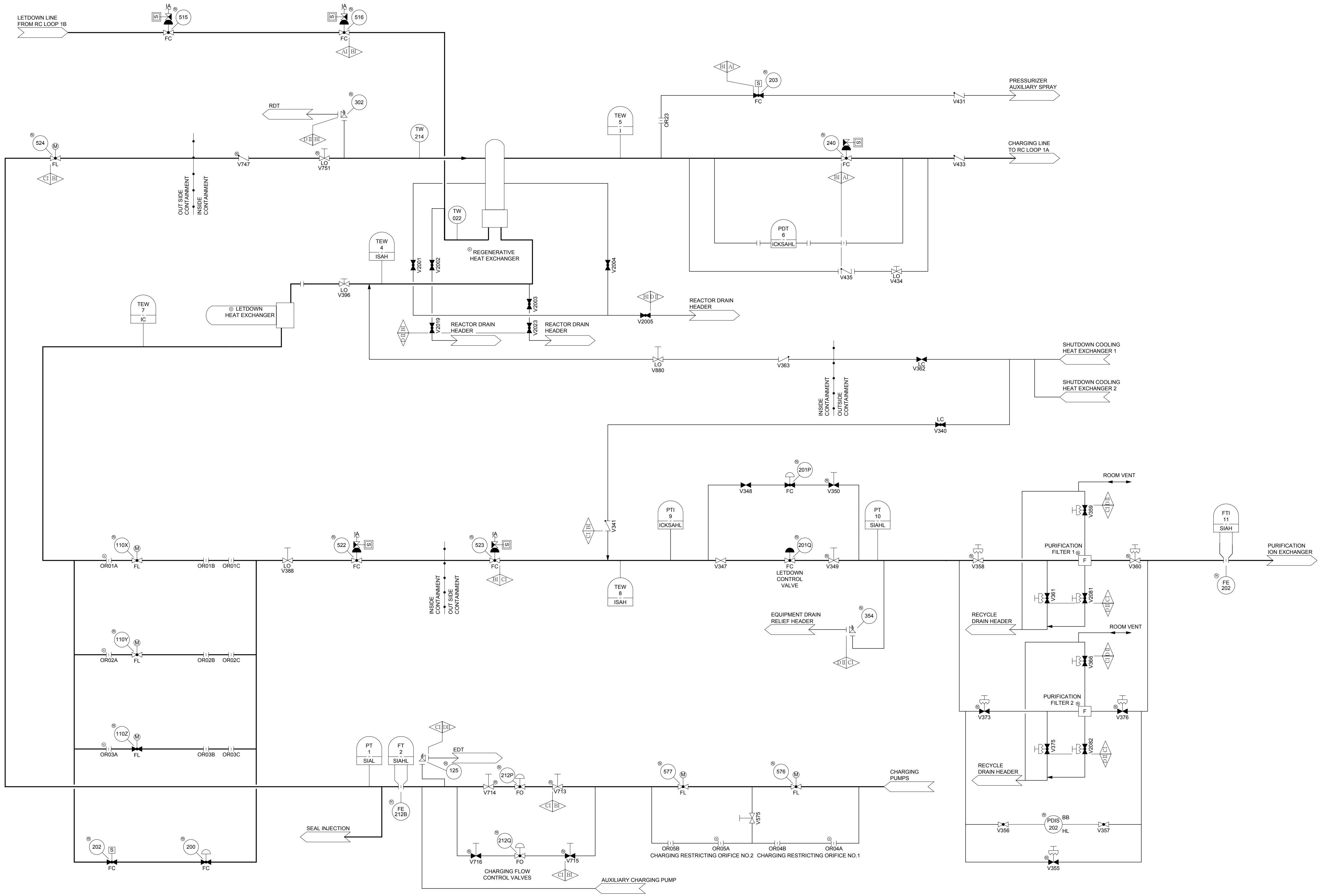


Figure 9.3.4-1 Chemical and Volume Control System Flow Diagram (1 of 7)

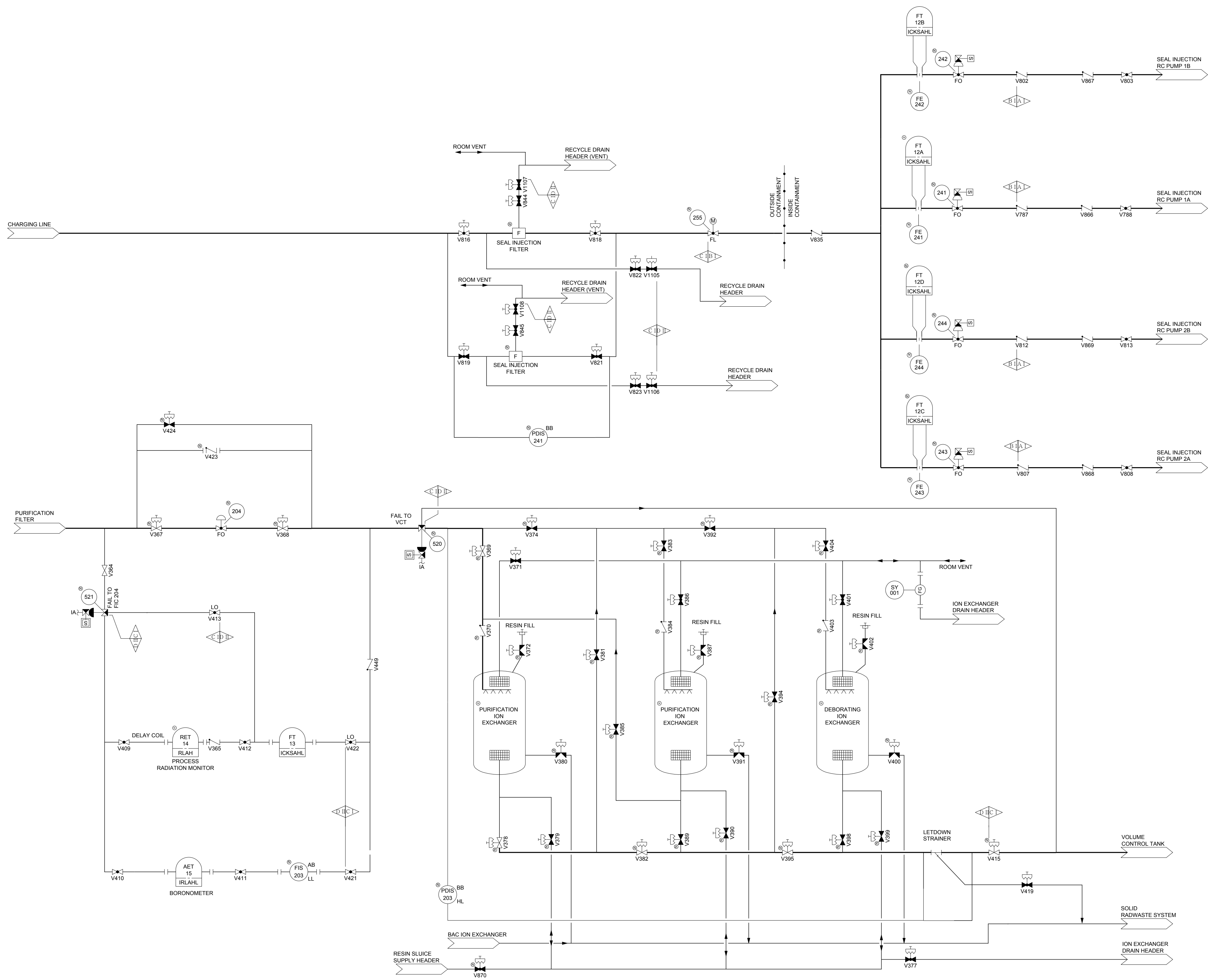


Figure 9.3.4-1 Chemical and Volume Control System Flow Diagram (2 of 7)

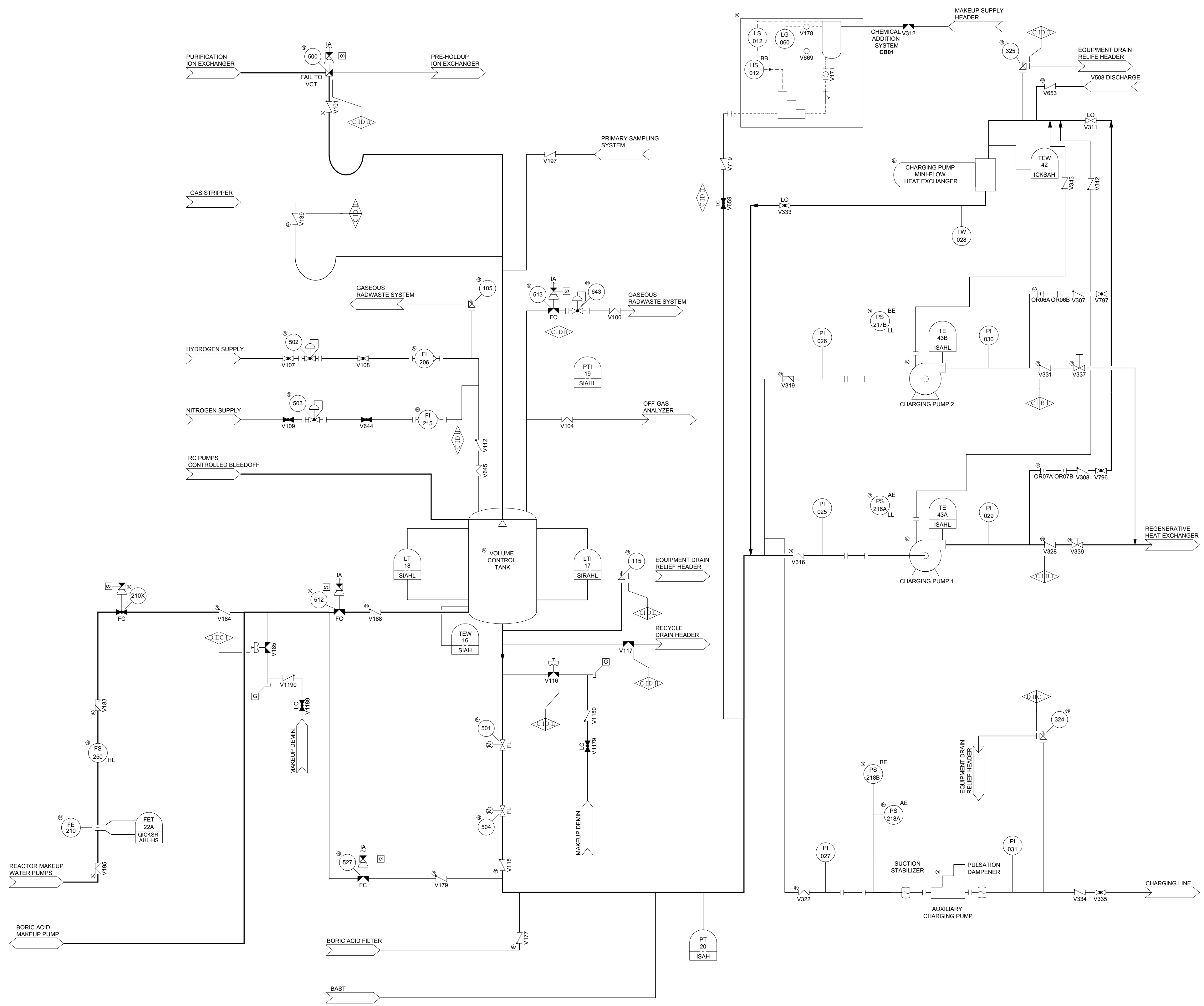


Figure 9.3.4-1 Chemical and Volume Control System Flow Diagram (3 of 7)

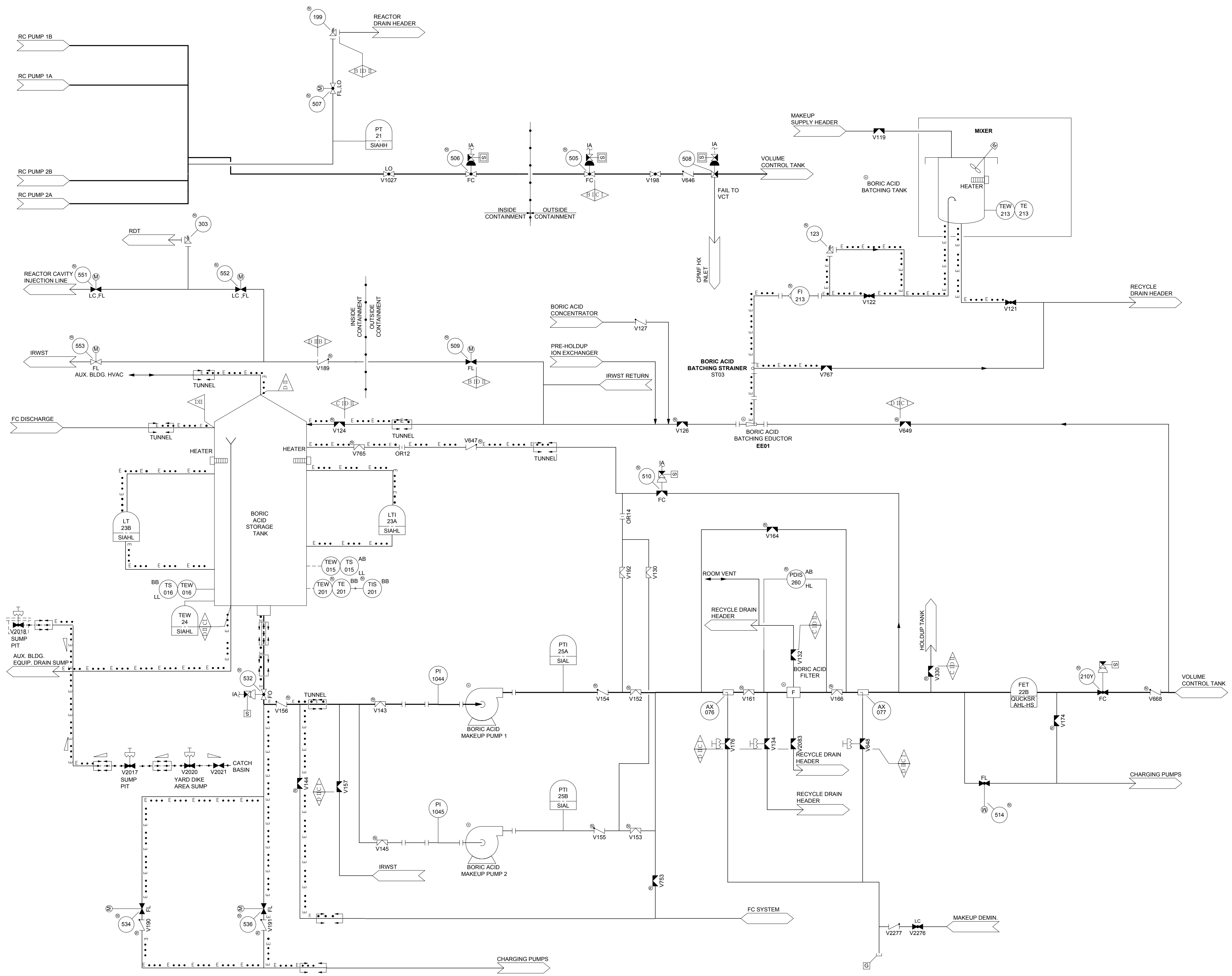


Figure 9.3.4-1 Chemical and Volume Control System Flow Diagram (4 of 7)

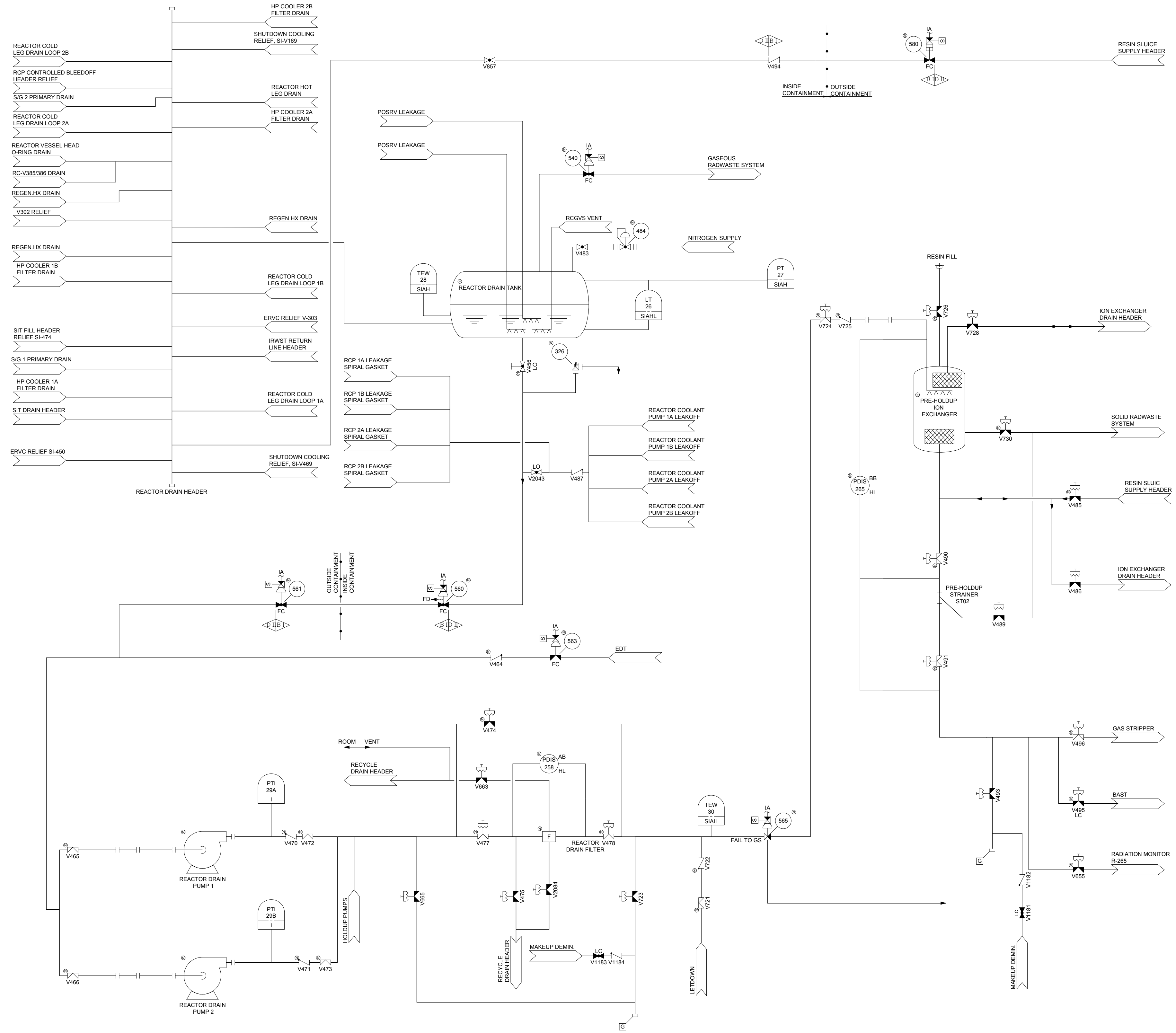


Figure 9.3.4-1 Chemical and Volume Control System Flow Diagram (5 of 7)

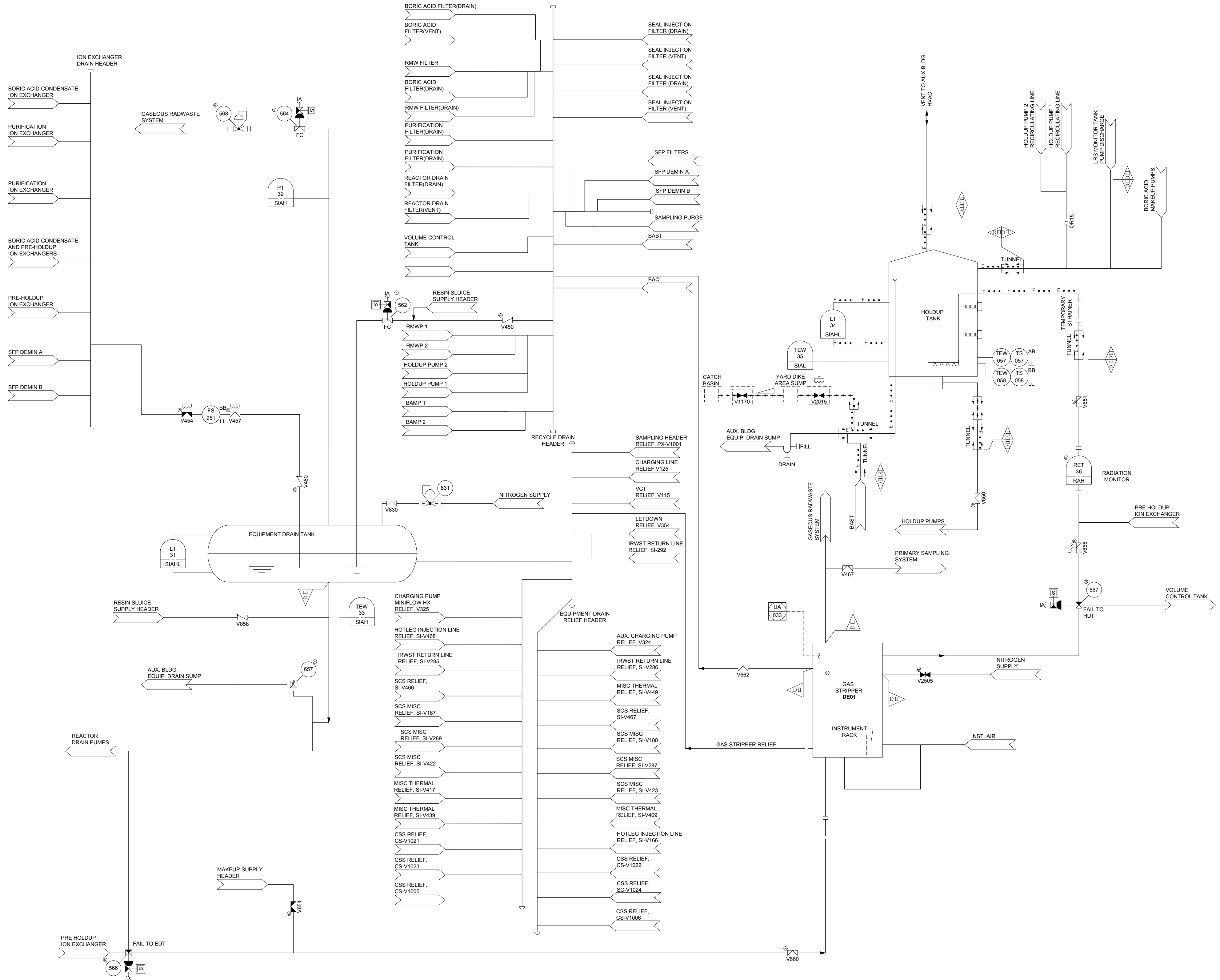


Figure 9.3.4-1 Chemical and Volume Control System Flow Diagram (6 of 7)

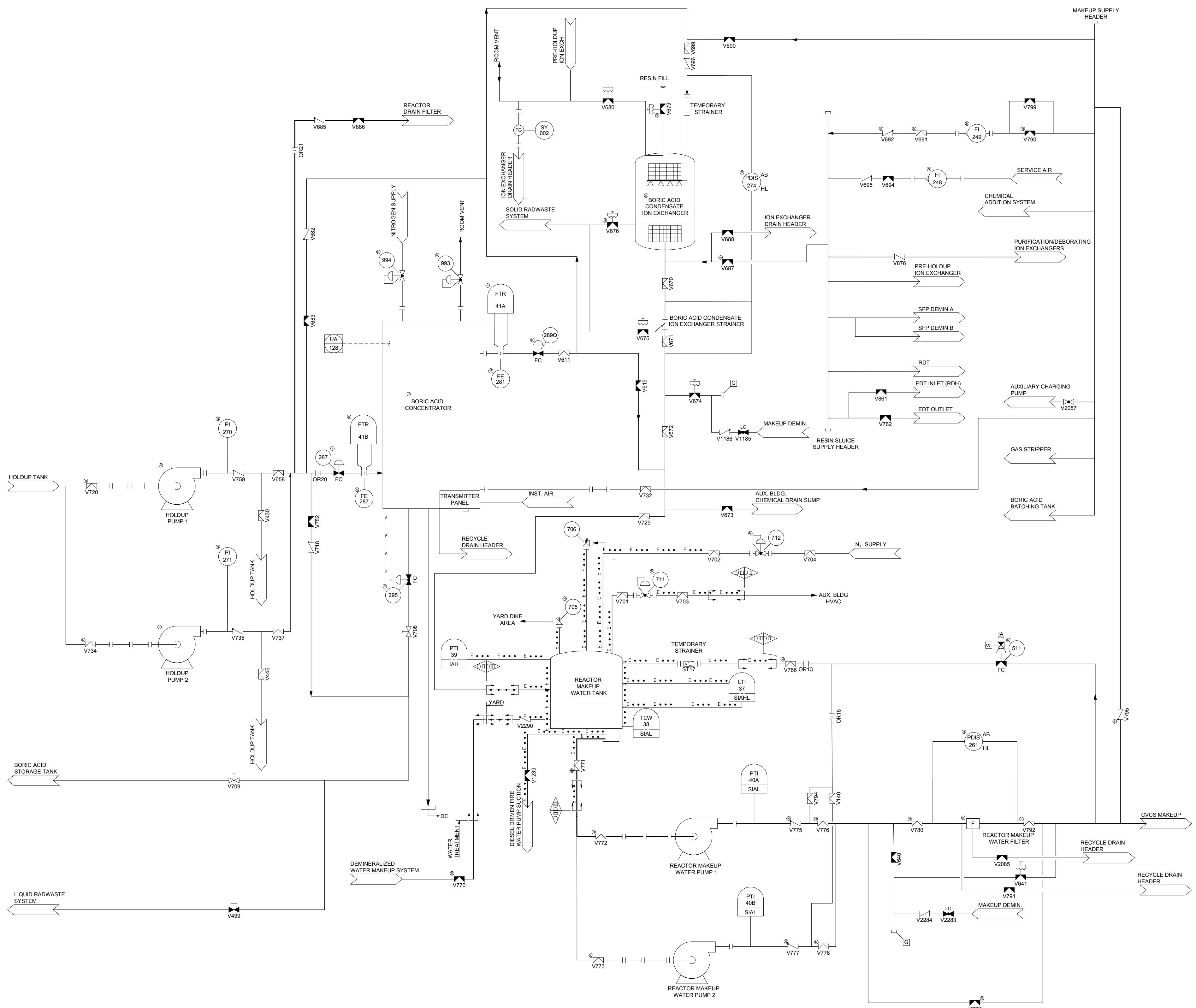


Figure 9.3.4-1 Chemical and Volume Control System Flow Diagram (7 of 7)

9.4 Heating, Ventilation and Air Conditioning Systems

The HVAC systems are provided as required throughout all areas for personal comfort, personnel safety protection, and equipment functional protection.

The reference subsections of HVAC systems and related systems are as follows:

a. Chilled water system (Subsection 9.2.7)

b. Control room HVAC system (Subsection 9.4.1)

c. Fuel handling area HVAC system (Subsection 9.4.2)

d. Auxiliary building clean area HVAC system (Subsection 9.4.3)

e. Turbine generator building HVAC system (Subsection 9.4.4)

f. Engineered safety feature (ESF) ventilation system (Subsection 9.4.5)

g. Reactor containment building HVAC system and purge system (Subsection 9.4.6)

h. Compound building HVAC system (Subsection 9.4.7)

The design conditions for the systems are given in the design bases of each system.

The flow diagrams for HVAC systems are shown on Figures 9.4.1-1 through 9.4.7-1. The HVAC outdoor air design temperature conditions are shown in Table 2.0-1.

The HVAC systems are designed such that fire or smoke in one divisional area containing safety-related equipment does not migrate through the ventilation ducts to the other areas containing safety-related equipment. Fire dampers are installed in fire-rated barriers and have the same fire resistance rating as a fire barrier. Further information regarding fire dampers is provided in Section 9.5.

9.4.1 Control Room HVAC System

The control room HVAC system serves the areas enclosed in the control room envelope (CRE). The CRE is defined in Section 6.4.

9.4.1.1 Design Bases

The control room HVAC system is designed to:

a. Withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods (GDC 2)

b. Protect against adverse environmental conditions and dynamic effects (GDC 4)

c. Provide adequate protection against airborne radioactivity, toxic gases, and smoke from the outside atmosphere, and limit the radiation exposure to the personnel in the CRE under accident condition (GDC 19)

d. Provide air cleaning units (ACUs) that comply with ASME AG-1 (Reference 1), ASME N509 (Reference 2) and with the recommendations of NRC RG 1.52 (Reference 22) (GDC 60)

e. Maintain suitable environmental conditions during a station blackout (SBO) event in accordance with the requirements of 10 CFR 50.63 and NRC RG 1.155 (Reference 26)

f. Meet the requirements of NRC RGs 1.29 (Reference 21), 1.52, and 1.78 (Reference 23)

The control room HVAC system is designed to maintain suitable environmental conditions for personnel comfort, health, safety, and proper function of equipment and controls located in the CRE. Further information regarding control room habitability is described in Section 6.4.

The MCR is designed to maintain approximately 21.1 °C to 25 °C (70 °F to 77 °F) and 40 percent to 60 percent relative humidity. Other support areas such as TSC, offices, computer room, and kitchen are designed to maintain approximately 18.3 °C to 26.7 °C (65 °F to 80 °F) and 40 percent to 60 percent relative humidity. The HVAC equipment rooms are designed to maintain approximately 10 °C to 40 °C (50 °F to 104 °F). These conditions are maintained continuously during all modes of plant operation including an SBO for the protection of the instrumentation and controls (I&C) and to provide reasonable assurance of adequate environmental conditions for operating staff to fulfill their duties.

The outside air intakes are monitored for the presence of radioactivity, and smoke. Isolation of the outside air intake occurs automatically upon indication of radioactivity or smoke in the outside air intake. Design characteristics in case of high concentration of smoke or radioactivity at both outside air intakes are addressed in Subsection 6.4.2.2. As described in Subsection 6.4.3, the COL applicant is to evaluate the impact of toxic gas on control room habitability and provide automatic or manual operational procedures for toxic gas protection.

The safety-related portion of the control room HVAC system is provided with redundancy to meet single failure criteria.

The control room HVAC system is safety-related and meets seismic Category I requirements with the exception of the humidifiers, kitchen & toilet exhaust fan, the smoke removal fan, and related ductwork, which are non-safety related and seismic Category II. The packaged air conditioning units (PACUs) for the computer room complex are classified as non-safety related and seismic Category III.

All safety-related HVAC equipment, ductwork, and supports are designed to withstand the safe shutdown earthquake (SSE). The safety-related components are located in a missile-protected structure. In addition, these equipment are protected from the effects of internally generated missiles, pipe breaks, and water spray.

All safety-related HVAC equipment are powered by independent Class 1E source. The equipment are able to perform required safety functions assuming single failure of an active component concurrent with a loss of offsite power (LOOP).

During an SBO, the safety-related equipment of the control room HVAC system is powered from the AAC source. The control room HVAC system is unavailable for 10 minutes until the alternate ac generator restores power after an SBO occurs. The design requirements to cope with an SBO event are addressed in Subsection 8.4.2.2.

9.4.1.2 System Description

The control room HVAC system includes two outside air intakes, dampers, two ACUs, four air handling units (AHUs), four humidifiers, one kitchen & toilet exhaust fan, one smoke removal fan, and two computer room PACUs. The design data for major components of the system is listed in Table 9.4.1-1. Major component descriptions are addressed in Subsection 6.4.2.2.

Each air intake is provided with redundant radiation monitoring devices and a smoke detector. Tornado dampers are provided to protect against instantaneous pressure changes caused by tornadoes at the outside air intakes, kitchen & toilet exhaust outlet, and smoke removal outlet.

The control room HVAC system consists of two redundant divisions. Each division has an outside air intake, dampers, an ACU, two AHUs, ductwork, and related I&C. Each AHU consists of a prefilter, an electric heating coil, a chilled water cooling coil, and a fan, along with ducts, dampers, and related instrumentation. The three-way valve to the chilled water cooling coil of the AHU is continuously modulated by the respective temperature-indicating controller to maintain the design temperature of the CRE. The chilled water is supplied from the ECWS. The COL applicant is to provide the capacity of heating coils as affected by site-specific conditions (COL 9.4(1)).

Each ACU consists of a moisture separator, two electric heating coils, a high-efficiency particulate air (HEPA) filter, a carbon adsorber, a postfilter, and two fans, along with ducts and dampers, and related instrumentation. The fans and electric heating coils within the single ACU are arranged in parallel or series to receive power from different Class 1E sources and the respective EDG. The isolation dampers are arranged in parallel to receive power from different Class 1E source and respective EDG.

During a loss of offsite power (LOOP), the safety-related portion of the control room HVAC system that was previously operating is re-energized and started automatically when the Class 1E diesel generator re-energizes the Class 1E switchgear.

In a LOOP, the computer room PACU operates with a power from a permanent non-safety source.

Normal Mode

During normal operation, makeup outside air is drawn into the system through a missile-protected outside air intake. The makeup air is mixed with return air. The makeup airflow rate is 6,286 cmh (3,700 cfm) and return airflow rate is 43,325 cmh (25,500 cfm). The mixed air is filtered, cooled, or heated through the supply AHU and distributed to the CRE to maintain suitable environmental conditions and to maintain a minimum 3.175 mm (0.125 in) water gauge of positive pressure with respect to the surrounding areas. The design airflow rate of this mode is 49,610 cmh (29,200 cfm). Electric steam humidifiers maintain the control room area humidity.

The toilets, kitchen & dining room, locker room, and shower room are exhausted to the atmosphere by a kitchen and toilet exhaust fan. The exhaust airflow rate from the CRE is 3,228 cmh (1,900 cfm). Two isolation dampers in the exhaust duct are opened. Two computer room packaged air conditioning units (PACUs) are provided for the computer room complex to maintain the suitable environmental conditions.

Upon energizing the designated AHU (HV01A) of four AHUs, the normal mode of control room HVAC system operates as follows:

a. The MCR outside intake dampers (Y0011A through Y0012B) open.

b. The selected supply AHU (HV01A) operates and the associated outside air normal makeup isolation dampers (Y0013A and Y0015A) and discharge airflow control damper (Y0021A) are opened.

c. The AHU supply air temperature is controlled by the MCR temperature controller that modulates the position of the essential chilled water control valve.

d. The electric heating coil of AHU is controlled by the heating coil outlet temperature controller that modulates the heating coil output. The heating coil is de-energized automatically upon loss of airflow through the coil.

e. The other AHUs (AH01B through AH01D) are kept in standby and the associated isolation dampers (Y0013C and Y0015C, Y0014B and Y0016B, and Y0014D and Y0016D) and discharge airflow control dampers (Y0021C, Y0022B, and Y0022D) are closed.

f. The kitchen & toilet exhaust fan continuously operates and the associated isolation dampers (Y0027 and Y0028) are opened.

g. Two isolation dampers (Y0029 and Y0030) for the smoke removal fan remain closed.

h. The non-safety related humidifiers are controlled by a humidity controller located in the MCR.

i. Damper fail positions are described in Table 9.4.1-2.

When the other AHUs (HV01B through HV01D) operate, the normal mode operation is the same as those for above AHU (HV01A) except the equipment and component numbers are different, as shown on Figure 9.4.1-1.

Emergency Mode

Upon receipt of an engineered safety feature actuation signal – safety injection actuation signal (ESFAS-SIAS) or an engineered safety feature actuation signal – control room emergency ventilation signal (ESFAS-CREVAS), all isolation dampers on the outside normal makeup air duct to the AHUs are automatically closed. Then the kitchen & toilet exhaust fan automatically stops and two isolation dampers on the exhaust duct to the outside are closed automatically. The emergency makeup ACU of the operating division starts automatically to filter the outside makeup air and part of the recirculated air. The ACU filters 6,286 cmh (3,700 cfm) of outside makeup air and 7,305 cmh (4,300 cfm) of recirculated air. The two isolation dampers on the exhaust duct to the outside for the

smoke removal fan remain closed, or automatically close to maintain CRE boundary integrity.

The design airflow rate of this mode is 49,610 cmh (29,200 cfm).

Upon failure of the designated ACU, the standby AHU and ACU of redundant division automatically start. The ACU filters particulates and potential radioactive iodine from all the return air and the makeup air, and delivers the filtered air to the inlet of the AHU. The control room is maintained at a minimum of 3.175 mm (0.125 in) water gauge positive pressure with respect to the surrounding areas. Additionally, one of the two sets of outside air intake isolation dampers automatically closes to isolate the higher radioactivity air supply from the two available outside air intakes.

Upon receipt of an ESFAS-SIAS or an ESFAS-CREVAS, the designated AHU (HV01A) and ACU (AU01A) of control room HVAC system operates as follows:

a. The outside air intake with the lower radioactive contamination is automatically selected, and the associated outside air intake isolation dampers (Y0011A and Y0011B or Y0012A and Y0012B, whichever have the lower radioactivity measurement) are opened.

b. The operating supply AHU continues to run and all outside air normal makeup isolation dampers (Y0013A and Y0015A, Y0013C and Y0015C, Y0014B and Y0016B, and Y0014D and Y0016D) are automatically closed upon receipt of an ESFAS-SIAS or an ESFAS-CREVAS.

c. The fan of the designated emergency ACU (AU01A) automatically starts upon receipt of an ESFAS-SIAS or an ESFAS-CREVAS, and the associated emergency makeup isolation damper (Y0017A) is opened. The return air isolation damper (Y0019A) and ACU discharge airflow control damper (Y0023A) are opened. The isolation dampers and ACU flow control damper are interlocked with the ACU fan. The AHU (HV01A) fan is running before ACU fan starts.

d. The other fan of the designated emergency ACU (AU01A) is kept in standby and the associated emergency makeup isolation damper (Y0017C), return air isolation damper (Y0019C), and ACU discharge flow control damper (Y0023C) are closed.

e. The standby ACU (AU01B) is also kept in standby and the associated emergency makeup isolation dampers (Y0018B and Y0018D), return air isolation dampers (Y0020B and Y0020D), and ACU discharge airflow control dampers (Y0024B and Y0024D) are closed.

f. The electric heating coil of the designated ACU (AU01A) is energized to maintain the relative humidity below 70 percent to provide reasonable assurance of the efficiency of the charcoal adsorber. The heating coil is interlocked with the ACU fan.

g. Two isolation dampers for the kitchen & toilet exhaust fan are automatically closed upon receipt of an ESFAS-SIAS or an ESFAS-CREVAS, and the exhaust fan stops.

h. Two isolation dampers for the smoke removal fan remain closed, or automatically close upon receipt of an ESFAS-SIAS or an ESFAS-CREVAS.

i. Upon failure of the designated ACU (AU01A), the standby AHU (HV01B) and ACU (AU01B) of redundant division automatically start.

j. Damper fail positions are described in Table 9.4.1-2.

When the other AHUs (HV01B through HV01D) and ACU (AU01B) operate, the emergency mode operation is the same as those for above AHU (HV01A) and ACU (AU01A) except the equipment and component numbers are different, as shown on Figure 9.4.1-1.

Recirculation Mode

Upon detection of smoke in the outside air intake, the smoke damper in the outside air intake duct that smoke is detected automatically closes to prevent the spread of smoke

throughout the CRE. In case of detection of smoke at both outside air intakes, the smoke dampers are automatically closed in the outside air intakes, and the operator manually places the system into recirculation mode without outside makeup air. In this mode, there is no pressurization of the CRE.

All isolation dampers to the outside are closed, and the ACUs and exhaust fan are stopped or remain in the shutdown status. The AHU operates continuously to maintain a suitable environmental condition. The design airflow rate of this mode is 43,325 cmh (25,500 cfm).

The recirculation mode is as follows:

a. Smoke dampers are automatically closed, upon detection of smoke at both of outside air intakes.

b. All outside air intake isolation dampers (Y0011A through Y0012B) manually close.

c. The operating supply AHU continues to run and all outside air normal makeup isolation dampers (Y0013A and Y0015A, Y0013C and Y0015C, Y0014B and Y0016B, and Y0014D and Y0016D) manually close.

d. The emergency ACUs stop and the associated all emergency makeup isolation dampers are automatically closed. All return isolation dampers and ACU discharge flow control dampers are automatically closed.

e. Two isolation dampers (Y0027 or Y0028) for the kitchen & toilet exhaust fan manually close and the exhaust fan stops.

f. Two isolation dampers (Y0029 or Y0030) for the smoke removal fan remain closed.

Damper fail positions are described in Table 9.4.1-2.

Smoke Removal

Upon smoke detection at the supply air duct to the control room, smoke dampers are automatically closed to maintain control room habitability. Additionally, smoke dampers are automatically closed on smoke detection in the return air duct to prevent the spread of smoke throughout the CRE.

During a fire, the fire dampers on the boundary of the fired room close automatically through the fusible link to restrict the passage of flame. Fire dampers are installed in fire-rated barriers in the CRE and have the same fire resistance rating as the fire barrier.

Following the suppression of a fire, smoke in the CRE is removed by the manual start of the smoke removal fan.

9.4.1.3 Safety Evaluation

The AHUs serving the CRE are composed of four completely redundant, independent, 100 percent capacity cooling and heating systems. Each AHU is powered from independent Class 1E power source, and chilled water is supplied from the essential chilled water system (ECWS). This provides reasonable assurance that a single failure does not impair the safety function of the system. The control room HVAC system FMEA is shown in the Table 9.4.1-2.

The physical separation of the redundant AHUs and the associated components provides reasonable assurance of the continuous operation of the control room HVAC system.

The control room HVAC system provides the conditioned air that is required to maintain the CRE temperature as specified in Subsection 9.4.1.1 during all plant operation conditions.

The system keeps the CRE at a positive pressure of 3.175 mm (0.125 in) water gauge at a minimum with respect to the surrounding area to provide habitability and to prevent uncontrolled incoming air leakage. The habitability of the CRE is addressed in Section 6.4.

The PACUs in the computer room complex are classified as non-safety related and are not seismically qualified.

The control room emergency makeup ACUs are composed of two redundant, independent, 100 percent capacity filtering systems. Each ACU is powered from a separate Class 1E source and is capable of providing the required cleanup effects. Upon receipt of an ESFAS-SIAS or an ESFAS-CREVAS, the emergency makeup ACU starts and associated isolation dampers open to direct flow through the ACU. The HEPA filter and carbon adsorber of the emergency makeup ACU have particle and iodine removal efficiency of 99 percent (based on 0.3-micron particle sizes) and 99 percent, respectively, to meet GDC 19. The radiation exposure of MCR operators in accident conditions as described in Chapter 15 does not exceed the occupational dose limit in GDC 19. The operator's radiological dose is calculated consistent with the methodology in NRC RG 1.183 (Reference 27). The dose assessment assumes the failure of one complete division of the control room HVAC system.

The outside air intakes are located approximately 3.9 m (13 ft) distance and 9.1 m (30 ft) below from the top of the closest EDG stack to protect the control room inhabitants from the effects of EDG exhaust.

The redundant outside air intakes can be isolated by the use of redundant isolation dampers, upon detection of high radiation or smoke at the outside air intakes.

Two radiation monitors are provided in each outside air intake to monitor the airborne radioactivity of outside makeup air. The radiation monitors are described in Subsection 11.5.3. The high radiation actuation signal causes automatic closure of normal makeup air source, and opening of emergency makeup air isolation dampers, as well as startup of the emergency makeup ACU to remove the airborne radioactivity.

Capacity and evaluation of the control room HVAC system are also based on complete failure of one division.

All safety-related components of the control room HVAC system are designed as seismic Category I equipment, and remain functional following an SSE.

All safety-related components are located in a missile-protected structure that is designed to withstand the effects of natural phenomena such as tornadoes, hurricanes, and floods. Intake and exhaust structures are protected from externally generated missiles, rain, or trash. The system is protected against instantaneous pressure changes caused by tornadoes. No components are subjected to flooding by virtue of the location within the control room area.

The fan housings within AHU and ACU are designed to withstand penetration by internally generated missiles. The control room HVAC system is not affected by a postulated piping failure, as addressed in Subsection 3.6.1. There are no high-energy lines routed within the CRE.

9.4.1.4 Inspection and Testing

The major components of the control room HVAC system are periodically checked and tested to provide reasonable assurance of design operation and performance.

The control room HVAC system is provided with proper instrumentation and devices capable of checking the design properties such as pressure drop, flow rate, and temperature. Controls, interlocks, and safety devices on the system are functionally checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation.

Preoperational testing of the control room HVAC system is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with the applicable test program and specifications.

The emergency makeup ACUs are factory inspected and tested for housing leakage, filter bypass leakage, and airflow performance. Periodically and subsequent to each filter or carbon adsorber replacement, the ACU is inspected and tested in-place in accordance with the requirements of ASME N510 (Reference 3), ASME AG-1, and NRC RG 1.52. The HEPA filters are periodically checked and the carbon adsorber samples are tested for iodine removal efficiency in an independent laboratory in accordance with NRC RG 1.52 and ASTM D 3803 (Reference 5).

The AHUs are factory inspected and tested in accordance with Air Movement and Control Association (AMCA) standards (References 12 and 13). Filters are inspected and tested in

accordance with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards (Reference 11). Cooling coils are hydrostatically tested in accordance with ASME AG-1. Cooling coil performance is rated in accordance with Air Conditioning, Heating, and Refrigeration Institute (AHRI) standards (References 14, 15, and 16).

Leak test of system ductwork is performed in accordance with ASME N511 (Reference 4) and ASME AG-1.

Inservice test and test interval requirements of the control room HVAC system are described in Subsection 3.7.11 and Subsection 5.5.11, ventilation filter testing program (VFTP) of Chapter 16, Technical Specifications. The unfiltered leakage test is performed in accordance with NRC RG 1.197 (Reference 28) and ASTM E741-2000 (Reference 8).

9.4.1.5 Instrumentation Requirements

The safety-related instrumentation of the control room HVAC system meets the requirements of IEEE Std. 323 (Reference 17), IEEE Std. 344 (Reference 18), and IEEE Std. 603 (Reference 19). The instrumentation, including indication and alarms of the control room emergency makeup ACU, is designed in accordance with the requirements of ASME N509.

The following instrumentation is provided in the MCR and RSR:

a. Indication and alarm of the control room envelope differential pressure

b. Indication and alarm of MCR temperature high

c. Indication of the isolation damper status of outside air intake, kitchen & toilet exhaust duct, and smoke removal duct

d. Indication of airflow rate of outside air intake

e. Indication of ACU inlet temperature

f. Indication of ACU electric heating coil outlet air temperature

g. Indication of ACU carbon adsorber outlet air temperature

h. Indication of ACU inlet airflow rate

i. Indication of AHU differential pressure high across a prefilter

j. Indication of AHU inlet air temperature

k. Indication of AHU outlet airflow rate

l. Alarm on smoke detection

m. Alarm on airborne radioactivity detection at the outside air intake

n. Alarm of ACU total differential pressure high from inlet of prefilter to outlet of carbon adsorber

o. Alarm of ACU outlet airflow rate low, high

p. Alarm of ACU carbon adsorber outlet air temperature high, high-high

q. Alarm of ACU electric heating coil outlet air temperature low, high, high-high

r. Alarm of ACU differential pressure high across filters

s. Alarm of AHU electric heating coil outlet temperature low, high-high

t. Alarm of AHU cooling coil outlet temperature high

u. Alarm of AHU outlet airflow rate low, high

9.4.2 Fuel Handling Area HVAC System

The fuel handling area HVAC system serves the fuel handling area including the spent fuel pool area in the auxiliary building.

9.4.2.1 Design Bases

The fuel handling area HVAC system is designed to:

a. Maintain a suitable environment for the operation, maintenance, and testing of equipment

b. Maintain a suitable access and working environment for personnel

c. Maintain the fuel handling and storage area at a negative pressure relative to the atmosphere to prevent outleakage

The fuel handling area HVAC system complies with 10 CFR 50 Appendix A, GDC 2, 60, and 61.

The fuel handling area HVAC system complies with NRC RGs 1.13 (Reference 20), 1.29, 1.52, 1.140 (Reference 25), and 4.21 (Reference 29).

The dose level at the site boundary is within the dose limits of 10 CFR 50.34 and is consistent with SRP 15.7.4.

The exhaust side of the fuel handling area HVAC system consists of one 100 percent capacity normal exhaust subsystem classified as non-safety related and two 100 percent capacity emergency exhaust subsystems classified as safety-related. Each emergency exhaust subsystem consists of one 100 percent capacity ACU with a fan. This meets the single failure criterion. The separation of electrical, instrumentation and control components for the emergency exhaust subsystem is maintained between trains.

The safety-related cubicle coolers maintain the ambient air temperature in the SFP cooling heat exchanger room at or below the maximum permissible temperature during all plant operating modes.

The fuel handling area emergency exhaust ACU starts automatically on receipt of an engineered safety feature actuation signal-fuel handling area emergency ventilation actuation signal (ESFAS-FHEVAS) or a high radiation signal. The emergency exhaust ACU has provisions to operate manually on a loss of offsite power (LOOP). The emergency exhaust ACU filters particulates and potential radioactive iodine from the exhaust air from the fuel handling area.

The safety-related isolation dampers installed upstream of the normal supply AHU and downstream of the normal exhaust ACU are isolated upon receipt of an ESFAS-FHEVAS or a high radiation signal.

The safety-related components required for the ventilation of the fuel handling area during accident conditions are powered by a Class 1E source and AAC power source during a station blackout (SBO). In order to control airborne activity, the ventilation air is generally supplied directly to the clean areas and exhausted from the potentially contaminated areas, creating a direction of airflow from the clean areas to the potentially contaminated areas.

The design temperature range for the fuel handling area is 10 °C to 40 °C (50 °F to 104 °F).

The safety-related components and ductwork are designed to meet seismic Category I requirements.

The design and construction of ACUs complies with ASME AG-1, ASME N509, and with the recommendations of NRC RGs 1.52 and 1.140.

9.4.2.2 System Description

The fuel handling area HVAC system consists of the following subsystems:

a. Fuel handling area normal HVAC subsystem

b. Fuel handling area emergency HVAC subsystem

The fuel handling area HVAC system is shown in Figure 9.4.2-1. The design data of major components are listed in Table 9.4.2-1.

The fuel handling area normal HVAC subsystem consists of one 100 percent capacity normal supply AHU and one 100 percent capacity normal exhaust ACU. The normal supply AHU consists of a prefilter, an electric heating coil, a chilled water cooling coil, and a fan, along with ducts and dampers, and related instrumentation. The chilled water is supplied from the plant chilled water system (PCWS). The three-way valve to the chilled water cooling coil of the AHU is continuously modulated by the respective temperature-indicating controller to maintain the design temperature downstream of the cooling coils. The COL applicant is to provide the heating coil and cooling coil capacities as affected by site-specific conditions (COL 9.4(1)). The normal exhaust ACU consists of a prefilter, a HEPA filter, and a fan, along with ducts and dampers, and related instrumentation.

The fuel handling area emergency HVAC subsystem consists of two 100 percent capacity emergency exhaust ACUs and two safety-related cubicle coolers. The two emergency ACUs and two cubicle coolers are powered by separated Class 1E power sources. Each of the ACUs consists of a moisture separator, an electric heating coil, a prefilter, a HEPA filter, a carbon adsorber, a postfilter, and a fan, along with ducts and dampers, and related instrumentation. The electric heating coil is located upstream of the carbon adsorber to maintain the relative humidity of air entering the carbon adsorber below 70 percent to provide reasonable assurance of the carbon adsorber efficiency.

Each of the SFP cooling heat exchanger rooms has one safety-related cubicle cooler. Each cubicle cooler consists of a chilled water cooling coil, a fan, instrumentation and controls. The source of water for the cubicle coolers is the ECWS.

The tornado dampers are provided to protect against instantaneous pressure changes caused by tornadoes at the air intake and common exhaust outlet.

During normal mode, the fuel handling area supply AHU and fuel handling area normal exhaust ACUs operate to maintain suitable temperature and ventilation. The filtered and conditioned air is supplied to the fuel handling area from the fuel handling area supply AHU and the exhaust air from the fuel handling area is filtered through the fuel handling

area normal exhaust ACU before it is released to the atmosphere. The fuel handling area is maintained under a slightly negative pressure with respect to the surrounding areas by exhausting more air than supply air. The supply airflow rate from the fuel handling area supply AHU is 46,638 cmh (27,450 cfm) and the exhaust air flow rate through the fuel handling area normal exhaust ACU is 48,337 cmh (28,450 cfm).

Upon receipt of an ESFAS-FHEVAS or high radiation signal, the intake and exhaust isolation dampers close and the fuel handling area supply AHU and normal exhaust ACU stop automatically. In addition, the fuel handling area emergency exhaust ACU starts automatically. The fuel handling area is maintained under a slightly negative pressure by exhausting air from the fuel handling area. The exhaust air from the fuel handling area is filtered prior to discharge into the atmosphere and the exhaust airflow of emergency exhaust ACU is 8,495 cmh (5,000 cfm). In case of failure of the operating normal exhaust ACU, the emergency exhaust ACU is operated manually.

Airborne radioactivity is monitored inside the downstream common duct of the normal and emergency ACUs. An alarm is actuated in the MCR when the radiation levels exceed a limited value.

The safety-related cubicle coolers operate automatically when the room temperature reaches the setpoint of the temperature switch to maintain the room temperature within the design limit during all operation modes.

9.4.2.3 Safety Evaluation

The fuel handling area emergency HVAC subsystem is an engineered safety features (ESF) system. Each redundant emergency ACU is powered from a separate train of the Class 1E power and switchable to the AAC power during an SBO. This provides reasonable assurance that a single failure does not impair the safety function of the system. The fuel handling area HVAC system FMEA is shown in the Table 9.4.2-2 and the FMEA shows that a single failure does not impair the safety function of the system.

The safety-related cubicle coolers are powered from independent Class 1E power and AAC power during an SBO and chilled water is supplied from the designated ECWS.

All safety-related components are physically separated and protected so that the damage to one system does not cause damage to the other system. They are not subjected to pipe break effects such as pipe whip or jet impingement. They are designed as seismic Category I equipment, and remain functional following an SSE.

Air exhausted from the fuel handling area is monitored by a radiation monitor that samples the air in the downstream common duct of the normal and emergency ACU. Indication of radioactivity above allowable limits automatically diverts the flow of air from the normal ACU through the emergency ACUs prior to discharge into the atmosphere.

The safety-related emergency exhaust ACU and cubicle cooler fan housings are designed to withstand penetration by internally generated missiles.

The system is protected against external missiles and instantaneous pressure changes caused by tornadoes.

Two safety-related isolation dampers are installed upstream of the fuel handling area supply AHU and two safety-related isolation dampers are installed downstream of the fuel handling area normal exhaust ACU. Each of the two safety-related isolation dampers are powered from independent Class 1E power source and these dampers are closed upon receipt of an ESFAS-FHEVAS or a high radiation signal.

The fuel handling area emergency HVAC subsystem is available following a LOOP instead of fuel handling area normal HVAC subsystem.

The fuel handling area normal HVAC subsystem is a non-safety related system and is not an ESF, and no credit is taken for its operation during an accident.

Fire dampers are installed in fire-rated barriers in the fuel handling area and have the same fire resistance rating as the fire barrier.

9.4.2.4 Inspection and Testing Requirements

The major components of the fuel handling area HVAC system are periodically checked and tested to provide reasonable assurance of design operation and performance.

The fuel handling area HVAC system is provided with proper instrumentation and devices capable of checking the design properties such as pressure drop, flow rate, and temperature. Controls, interlocks, and safety devices on the system are functionally checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation.

Preoperational testing of the fuel handling area HVAC system is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

ACUs are factory inspected and tested for housing leakage, filter bypass leakage, and airflow performance. Periodically and subsequent to each filter or carbon adsorber replacement, the unit is inspected and tested in-place in accordance with the requirements of ASME N510, ASME AG-1 and NRC RG 1.52 for safety-related ACUs, or NRC RG 1.140 for non-safety related ACUs. The HEPA filters are periodically checked and carbon adsorber samples are tested for iodine removal efficiency in an independent laboratory in accordance with NRC RG 1.52 and NRC RG 1.140 and ASTM D 3803.

AHUs and cubicle coolers are factory inspected and tested in accordance with AMCA standards (References 12 and 13). Filters are inspected and tested in accordance with ASHRAE standards (Reference 11). Cooling coils are hydrostatically tested in accordance with ASME AG-1 for safety-related equipment and ASME Section VIII (Reference 7) for non-safety related equipment. The cooling coil performance rating is developed in accordance with AHRI standards (References 14, 15, and 16).

Leak testing of system ductwork is performed in accordance with ASME N511 and ASME AG-1.

The safety-related isolation dampers are inspected periodically and the damper seats are replaced periodically or when required.

Inservice test and test interval requirements of the fuel handling area HVAC system are described in Subsections 3.7.13 and 5.5.11, ventilation filter testing program (VFTP) of Chapter 16, "Technical Specification."

9.4.2.5 Instrumentation Requirements

The safety-related instrumentation of the fuel handling area HVAC system meets the requirements of IEEE Std. 323, IEEE Std. 344, and IEEE Std. 603. The instrumentation, including indication and alarms of the ACUs in the fuel handling area HVAC system, is designed in accordance with the requirements of ASME N509.

The following instrumentation is provided in the MCR and RSR.

a. Indication of temperature for room served by safety-related cubicle cooler

b. Indication of the heating coil downstream temperature of AHU

c. Indication of the cooling coil downstream temperature of AHU

d. Indication of the AHU downstream airflow rate

e. Indication of the inlet air temperature of safety-related ACU

f. Indication of the heating coil downstream temperature of ACU

g. Indication of the carbon adsorber downstream temperature of ACU

h. Indication of the ACU downstream airflow rate

i. Alarm of temperature high-high for room served by cubicle cooler

j. Alarm of the heating coil temperature high-high and low of AHU

k. Alarm of the cooling coil temperature high of AHU

l. Alarm of AHU downstream airflow rate low

m. Alarm on smoke detection at the AHU downstream

n. Alarm of the heating coil temperature high-high, high and low of safety-related ACU

o. Alarm of the carbon adsorber temperature high-high and high of safety-related ACU

p. Alarm of the prefilter pressure differential high of safety-related ACU

q. Alarm of the HEPA filter pressure differential high of safety-related ACU

r. Alarm of the postfilter pressure differential high of safety-related ACU

s. Alarm of the filter total pressure differential high of safety-related ACU

t. Alarm on high radioactivity detection at the common inlet duct of ACUs

9.4.3 Auxiliary Building Clean Area HVAC System

The auxiliary building clean area HVAC system serves the auxiliary building clean area except the control room envelope and electrical and I&C equipment areas.

9.4.3.1 Design Bases

The safety-related components and ductwork are designed to meet seismic Category I requirements. The non-safety related components and ductwork are designed to meet seismic Category II requirements.

The safety-related portion of this system is designed in accordance with the requirements of 10 CFR 50 Appendix A, GDC 2 and 4, and NRC RG 1.29.

The safety-related cubicle coolers are provided to essential chiller rooms and motor-driven auxiliary feedwater pump rooms to maintain the ambient temperature in the rooms at or below the maximum permissible during all plant operating modes.

The safety-related cubicle coolers are connected to the Class 1E and SBO power.

The safety-related cubicle coolers perform the required safety function following an SSE and are able to withstand the effects of natural phenomena such as tornadoes, hurricanes, and floods.

The auxiliary building clean area HVAC system is designed to provide ventilation and heat removal for personnel access to the clean area of the auxiliary building. The room design temperature range for the auxiliary building clean area is 10 °C (50 °F) to 50 °C (122 °F) for motor-driven auxiliary feedwater pump rooms and main steam enclosure and 10 °C (50 °F) to 40 °C (104 °F) for other rooms including turbine-driven auxiliary feedwater pump rooms.

9.4.3.2 System Description

The auxiliary building clean area HVAC system consists of two divisionally separated auxiliary building clean area I and II HVAC subsystems, main steam valve room HVAC subsystem, main steam enclosure HVAC subsystem, and auxiliary building smoke removal HVAC subsystem.

The auxiliary building clean area HVAC system is shown in Figure 9.4.3-1. The design data of major components are noted in Table 9.4.3-1.

The auxiliary building clean area HVAC system consists of two 100 percent trains by division boundaries, auxiliary building clean area I and II HVAC subsystems.

9.4.3.2.1 Auxiliary Building Clean Area I and II HVAC Subsystem

Each of the auxiliary building clean area I and II HVAC subsystem consists of one 100 percent capacity auxiliary building clean area supply AHU, one 100 percent capacity auxiliary building clean area exhaust fan, one 100 percent capacity chiller room supply fan, one 100 percent capacity chiller room exhaust fan, and separate cubicle coolers serving the non-safety related turbine-driven auxiliary feedwater pump room and the safety-related motor-driven auxiliary feedwater pump rooms and the essential chiller rooms. Each of supply AHUs consists of a prefilter, an electric heating coil, a chilled water cooling coil, and a fan, instrumentation and controls. The chilled water for cooling coils is served from the plant chilled water system (PCWS). The three-way valve to the chilled water cooling

coil of the AHU is continuously modulated by the respective temperature-indicating controller to maintain the design temperature downstream of the cooling coils. The COL applicant is to provide the capacity of cooling coils and heating coils of the supply AHUs affected by site-specific conditions (COL 9.4(1)).

Each of cubicle coolers consists of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water for the motor-driven auxiliary feedwater pump room cubicle cooler cooling coils and the essential chiller room cubicle cooler cooling coils is served from the essential chilled water system (ECWS). The chilled water for the other cubicle cooler cooling coils is served from PCWS.

During normal operation, the auxiliary building clean area I and II supply AHUs, exhaust fans, and cubicle coolers operate to maintain the suitable temperature and ventilation condition in the auxiliary building clean area. Each of cubicle coolers operates automatically by respective temperature switch to provide additional cooling for the areas with high cooling load. The auxiliary building clean area I and II HVAC subsystems except motor-driven auxiliary feedwater pump room cubicle coolers and essential chiller room cubicle coolers are not required to operate during abnormal and accident conditions.

During abnormal and accident conditions, the motor-driven auxiliary feedwater pump room cubicle coolers and the essential chiller room cubicle coolers operate automatically according to the room temperature.

When the chiller room refrigerant concentration rises above a setpoint value, the chiller room supply fan and exhaust fan operate automatically to remove refrigerant, and the refrigerant gas high alarm is annunciated in the MCR. The ventilation system for chiller room is provided in accordance with ASHRAE 15 (Reference 10). The chiller room supply fan and exhaust fan operate manually after fire suppression when refrigerant is released due to a fire or an explosion in the chiller room. The chiller room supply fan and exhaust fan are not required to operate during abnormal and accident conditions.

9.4.3.2.2 Main Steam Valve Room HVAC Subsystem

The main steam valve room HVAC subsystem serves the main steam valve room, which contains main steam isolation and control valves. The main steam valve room HVAC

subsystem consists of one 100 percent capacity AHU per division. The AHU consists of a prefilter, a direct expansion cooling coil, and a fan.

During normal operation, the main steam valve room supply AHUs operate to maintain the suitable temperature and ventilation condition in the main steam valve room. The air from the main steam valve room is released to the atmosphere through the removable blowout panel. The main steam valve HVAC subsystem is not required to operate during abnormal and accident conditions.

9.4.3.2.3 Main Steam Enclosure HVAC Subsystem

The main steam enclosure HVAC subsystem serves the main steam enclosure where main steam and feed water pipes are passing through between the main steam valve room and the turbine generator building. The main steam enclosure HVAC subsystem consists of two main steam enclosure supply fans and one main steam enclosure low volume supply fan per division.

During normal operation, the main steam enclosure supply fans operate to maintain the suitable temperature and ventilation condition in the main steam enclosure. The air from the main steam enclosure is released to the atmosphere through the exhaust louvers. The main steam enclosure HVAC subsystem is not required to operate during abnormal and accident conditions.

9.4.3.2.4 Auxiliary Building Smoke Removal HVAC Subsystem

The auxiliary building smoke removal HVAC subsystem provides smoke removal of the auxiliary building except the control room envelope. The auxiliary building smoke removal HVAC subsystem consists of a smoke removal fan per division.

When a fire occurs in a division of the auxiliary building, the corresponding auxiliary building smoke removal fan operates manually to remove smoke after the fire has been suppressed.

9.4.3.3 Safety Evaluation

Safety-related cubicle coolers serve the motor-driven auxiliary feedwater pump rooms and the essential chiller rooms. The safety-related cubicle coolers are located in separate areas not subject to common hazards that would affect operation of the HVAC system. Each of the safety-related cubicle coolers is powered from independent Class 1E power sources. Chilled water for safety-related cubicle cooler cooling coils is served from the separated ECWS. At least one of two divisionally separate safety-related cubicle coolers operates to maintain the corresponding room design temperature assuming a single failure of an active component concurrent with a LOOP.

The auxiliary building clean area HVAC system FMEA is shown in Table 9.4.3-2 and the FMEA shows that a single failure does not impair the safety function of the system.

All safety-related components of the auxiliary building clean area HVAC system are designed as seismic Category I equipment, and remain functional following an SSE.

The safety-related cubicle cooler fan housings are designed to withstand penetration by internally generated missiles.

Fire dampers are installed in fire-rated barriers in the auxiliary building clean area and have the same fire resistance rating as the fire barrier.

9.4.3.4 Inspection and Testing Requirements

The major components of the auxiliary building clean area HVAC system are periodically checked and tested to provide reasonable assurance of design operation and performance.

The auxiliary building clean area HVAC system is provided with proper instrumentation and devices capable of checking the design properties such as pressure drop, flow rate, and temperature. Controls, interlocks, and safety devices on the system are functionally checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation.

Preoperational testing of the auxiliary building clean area HVAC system is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

AHUs and cubicle coolers are factory inspected and tested in accordance with AMCA standards (References 12 and 13). Filters are inspected and tested in accordance with ASHRAE standards (Reference 11). Cooling coils are hydrostatically tested in accordance with ASME AG-1 for safety-related or ASME Section VIII for non-safety related components. The cooling coil performance rating is developed in accordance with AHRI standards (References 14, 15, and 16).

Leak testing of system ductwork is performed in accordance with ASME AG-1.

9.4.3.5 Instrumentation Requirements

The safety-related instrumentation of the auxiliary building clean area HVAC system meets the requirements of IEEE Std. 323, IEEE Std. 344, and IEEE Std. 603.

The following instrumentation is provided in the MCR and RSR.

a. Indication of temperature for room served by safety related cubicle cooler

b. Indication of the heating coil downstream temperature of AHU

c. Indication of the cooling coil downstream temperature of AHU

d. Alarm of the heating coil temperature high-high and low of AHU

e. Alarm of the cooling coil temperature high of AHU

f. Alarm of temperature high-high for room served by cubicle cooler

9.4.4 Turbine Generator Building HVAC System

The turbine generator building HVAC system is designed to maintain the suitable environment for all equipment and personnel in the turbine generator building during plant normal operation and does not serve any safety related functions.

The turbine generator building HVAC system consists of the following subsystems:

a. Main building HVAC subsystem

b. Enclosed room HVAC subsystem

c. Repair shop and office area HVAC subsystem

9.4.4.1 Design Bases

The turbine generator building HVAC system is designed to:

a. Provide a suitable environment for the operation of equipment and personnel access as required for inspection, testing, and maintenance

b. Minimize hot spots in the general areas within the turbine generator building

c. Provide ventilation for the enclosed rooms and exhaust the air from these rooms to the atmosphere to limit oil fumes, toxic gases, and hydrogen concentration

The turbine generator building HVAC system is designed to maintain the following temperature for the areas serviced during normal operation modes:

Room	Temperature
Turbine generator building Switchgear room Chemical handling room Lube oil storage Condensate polishing area Turbine lube oil reservoir room	10 °C (50 °F) ~ 40 °C (104 °F)

Room	Temperature
Instrument repair office Electrical repair office	21 °C (70 °F) ~ 27 °C (80 °F)
Battery room	18 °C (65 °F) ~ 40 °C (104 °F)
Multiplexer (MUX) cabinet room Excitation control cubicle room Control panel room	10 °C (50 °F) ~ 27 °C (80 °F)
Others	10 °C (50 °F) ~ 40 °C (104 °F)

The turbine generator building HVAC system is non-safety related and seismic Category III.

9.4.4.2 System Description

The turbine generator building HVAC system is shown in Figure 9.4.4-1. The design data of major components are listed in Table 9.4.4-1.

9.4.4.2.1 Main Building HVAC Subsystem

The main building HVAC subsystem consists of roof exhaust fans, turbine generator building basement floor cubicle coolers, main steam stop valve area cubicle cooler, main feedwater pump control panel area cubicle cooler, supply fans, ground floor supply fans, gravity roof ventilators (GRVs), and intake louvers.

Outside air is drawn into the turbine generator building through intake louvers and supply fans located in the turbine generator building outside walls at individual floors and the air is exhausted through roof exhaust fans and GRVs.

The roof exhaust fans and the supply fans are automatically operated by temperature switches to maintain design temperature on the ground floor and operating floor in the turbine generator building. The ventilation air for basement floor in turbine generator building is supplied through the grating on the ground floor in the turbine generator building.

The main steam stop valve area cubicle cooler and turbine generator building basement floor cubicle coolers operate automatically by temperature switch to provide additional

cooling for the areas with high cooling load. The main feedwater pump control panel area cubicle cooler operates continuously during normal operation. Each cubicle cooler consists of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water of the cooling coil is supplied from the plant chilled water system (PCWS).

The GRVs are designed in accordance with NFPA 804 (Reference 30) for heat and smoke venting from the building.

9.4.4.2.2 Enclosed Room HVAC Subsystem

The enclosed room HVAC system serves switchgear rooms, battery room, exciter control cubicle room, mux cabinet room, control panel room, lube oil storage room, chemical handling room and condensate polishing area.

The enclosed room HVAC subsystem consists of cubicle coolers, supply fans, and exhaust fans. Each cubicle cooler consists of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water of the cooling coil is supplied from the PCWS. The cubicle coolers operate automatically by temperature switches to provide additional cooling for the areas with high cooling load.

One 100 percent supply fan and one 100 percent exhaust fan are provided to limit hydrogen concentration to less than one percent of total volume of the battery room based on NRC RG 1.128 (Reference 24).

One 100 percent exhaust fan is provided to prevent the potential toxic gas accumulation in the chemical handling room. One 100 percent exhaust fan is provided to prevent the accumulation of fumes in the lube oil storage room.

Smoke removal for the battery room, the chemical handling room, and the lube oil storage room is accomplished by using exhaust fans for each room.

9.4.4.2.3 Repair Shop and Office Area HVAC Subsystem

The repair shop and office area HVAC subsystem consists of one 100 percent supply AHU, one return fan, one exhaust fan, electric duct heaters (EDHs), associated ductwork, and duct accessories.

The AHU consists of a prefilter, a chilled water cooling coil, and a fan, along with ducts, dampers, and related instrumentation and controls. The chilled water of the cooling coil is supplied from the PCWS. The three-way valve to the chilled water cooling coil of the AHU is continuously modulated by the respective temperature-indicating controller to maintain the design temperature downstream of the cooling coils. The COL applicant is to provide the capacity of the cooling coil as affected by site-specific conditions (COL 9.4(1)).

The EDHs operate and stop automatically by the signal from the respective temperature switches.

A smoke detector is located at the downstream of the supply AHU. When a smoke detector detects smoke, the supply AHU fan is automatically stopped. The return fan does not operate unless the supply AHU fan is running.

9.4.4.3 Safety Evaluation

Since the turbine generator building HVAC system is non-safety related, no safety evaluation is provided.

9.4.4.4 Inspection and Testing Requirements

The major components of the turbine generator building HVAC system are periodically checked and tested to provide reasonable assurance of design operation and performance.

The turbine generator building HVAC system is provided with proper instrumentation and devices capable of checking the design properties such as pressure drop, flow rate, and temperature. Controls, interlocks, and safety devices on the system are functionally checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation.

Preoperational testing of the turbine generator building HVAC system is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

AHUs and cubicle coolers are factory inspected and tested in accordance with AMCA standards (References 12 and 13). Filters are inspected and tested in accordance with ASHRAE standards (Reference 11). Cooling coils are hydrostatically tested in accordance with ASME Section VIII. Performance ratings of cooling coils are developed in accordance with AHRI standards (References 14, 15, and 16).

Leak testing of system ductwork is performed in accordance with ASME AG-1.

9.4.4.5 Instrumentation Requirements

Indication of the fan operating status is provided on the local control panel. Failure of a running fan is alarmed on the local control panel. Instrumentation is provided with automatic or manual operation of the system from local control panels.

Temperature switches and temperature indicator switches are provided to the supply fans, exhaust fans, electric unit heaters, cubicle cooler fans, and electric duct heaters so that the turbine generator building HVAC system can maintain the predetermined temperatures at the associated process lines, ducts, and areas.

The turbine generator building HVAC system also provides instrumentation of differential pressure alarms and indications for the filters in the air handling units (AHUs). Fan differential pressure indication and alarms are also provided to the fans of the turbine generator building HVAC system.

Electrical failures, smoke, and high or high-high temperature alarms are provided at the local control panels. The alarms integrated at the local control panels are also provided with the MCR and RSR for operating personnel.

The following instrumentation is provided in the MCR and RSR.

a. Alarm of temperature high-high for exciter control cubicle room

b. Alarm of smoke detection in the duct downstream of the AHU

c. Alarm of hydrogen concentration high in the battery room

9.4.5 Engineered Safety Feature Ventilation System

The engineered safety feature (ESF) ventilation system includes:

a. Emergency diesel generator (EDG) area HVAC system

b. Electrical and I&C equipment areas HVAC system

c. Auxiliary building controlled area HVAC system

d. Essential service water (ESW) intake structure and component cooling water (CCW) heat exchanger building HVAC system

The COL applicant is to provide the system design information of ESW intake structure and CCW heat exchanger building HVAC system including flow diagram, if the ESW intake structure and CCW heat exchanger building requires the HVAC system (COL 9.4(3)).

9.4.5.1 Design Bases

9.4.5.1.1 Emergency Diesel Generator Area HVAC System

The emergency diesel generator area HVAC system serves four emergency diesel generator (EDG) areas. Two EDG areas are located in the auxiliary building and the other two EDG areas are located in the EDG building.

The emergency diesel generator area HVAC system consists of four 100 percent capacity redundant trains and each of four trains serves the corresponding EDG area. The four redundant trains are powered from separate Class 1E sources so that a single failure coincident with a LOOP does not impair the system's safety function. The EDG area HVAC system is designed to provide a suitable environment for the operation of equipment and personnel access for inspection, testing, and maintenance.

The system is designed in accordance with the requirements of 10 CFR 50 Appendix A, GDC 2, 4, and 17. The system is designed as safety-related and seismic Category I and remains functional during and following an SSE.

All safety-related components of this system are located in a missile-protected structure that is designed to withstand the effects of natural phenomena such as tornadoes, hurricanes, and floods.

The EDG area HVAC system complies with 10 CFR 50 Appendix A, GDC 17 by protecting electric contacts and relays from dust and dirt in the emergency diesel generator rooms. This is accomplished by taking filtered air from a height of at least 7 m (20 ft) above ground level.

The EDG area HVAC system complies with NRC RG 1.29.

The EDG area HVAC system is designed to maintain the following temperature ranges for the areas serviced during all modes of plant operating conditions.

Room	Temperature
EDG control room	10 °C (50 °F) ~ 40 °C (104 °F)
EDG room	10 °C (50 °F) ~ 50 °C (122 °F)
Diesel fuel oil storage tank room	10 ºC (50 °F) ~ 50°C (122 °F)
Others	10 ºC (50 °F) ~ 50 °C (122 °F)

9.4.5.1.2 <u>Electrical and I&C Equipment Areas HVAC System</u>

The electrical and I&C equipment areas HVAC system is designed to maintain a suitable environment for the operation, maintenance, and testing of electrical and I&C equipment, and to maintain a suitable access and working environment for personnel. The systems are designed in accordance with the requirements of 10 CFR 50 Appendix A, GDC 2, 4, and 17.

The electrical and I&C equipment areas HVAC system complies with NRC RGs 1.29 and 1.128.

The electrical and I&C equipment areas HVAC system is designed to maintain the following temperature and humidity ranges for the areas serviced.

Room	Temperature	Humidity
MUX room LX panel room Penetration MUX room	10 °C (50 °F) ~ 26.7 °C (80 °F)	-
CEDM power control cabinet room Reactor trip switchgear room PCS room	18.3 °C (65 °F) ~ 29.4 °C (85 °F)	-
Class 1E battery room	18.3 °C (65 °F) ~ 29.4 °C (85 °F)	-
Remote control console (RCC) room RSR I&C equipment room	21.1 °C (70 °F) ~ 25 °C (77 °F)	40~60 %
Non-1E battery room	18.3 °C (65 °F) ~ 40 °C (104 °F)	-
Others	10 °C (50 °F) ~ 40 °C (104 °F)	-

(1) Dash (-) indicates no control.

The system consists of two 100 percent redundant trains and each of two trains serves the corresponding electrical and I&C equipment areas. The two redundant safety-related trains are powered from separate Class 1E sources so that a single failure coincident with a LOOP does not impair the system's safety function. During an SBO, the safety-related components of the electrical and I&C equipment areas HVAC system are powered from the AAC source.

The safety-related components are designed as seismic Category I equipment, and remain functional during and following an SSE. Non-safety related portions of this system in areas containing safety-related equipment are classified as seismic Category II to prevent adverse interaction with safety-related system during a seismic event.

All safety-related components of this system are located in a missile-protected structure that is designed to withstand the effects of natural phenomena such as tornadoes, hurricanes, and floods.

The electrical and I&C equipment areas HVAC system complies with 10 CFR 50, Appendix A, GDC 17 by protecting electric contacts and relays from dust and dirt in electrical and I&C equipment rooms. This is accomplished by using filtered air and taking air from a height of at least 7 m (20 ft) above ground level.

9.4.5.1.3 Auxiliary Building Controlled Area HVAC System

The auxiliary building controlled area HVAC system serves the radiologically controlled areas except fuel handling area in the auxiliary building and is designed to maintain room design temperature in the auxiliary building controlled area.

The auxiliary building controlled area HVAC system is designed to maintain the following temperature ranges for the areas serviced.

Room	Temperature
CCW pump room	10 °C (50 °F) ~ 50 °C (122 °F)
S/G wet layup recirculation pump room	10 °C (50 °F) ~ 50 °C (122 °F)
Pipe chase and valve room	10 ºC (50 °F) ~ 50°C (122 °F)
Pipe chase	10 ºC (50 °F) ~ 54.4°C (130 °F)
Hot pipe way	10 ºC (50 °F) ~ 54.4°C (130 °F)
Others	10 ºC (50 °F) ~ 40 °C (104 °F)

The system is designed in accordance with the requirements of 10 CFR 50 Appendix A, GDC 2, 4, and 60. The safety-related components of this system are designed as seismic Category I and remain functional during and following an SSE. Non-safety related portions of this system in areas containing safety-related equipment are classified as seismic Category II to prevent adverse interaction with safety-related system during a seismic event.

All safety-related components of this system are located in a missile-protected structure that is designed to withstand the effects of natural phenomena such as tornadoes, hurricanes, and floods.

The auxiliary building controlled area HVAC system complies with NRC RGs 1.29, 1.52, 1.140, and 4.21.

Two redundant safety-related isolation dampers are installed downstream of the auxiliary building controlled area AHUs and two redundant safety-related isolation dampers are installed upstream of the auxiliary building controlled area normal exhaust ACUs. Each of the two safety-related isolation dampers is powered from separate Class 1E sources so that a single failure coincident with a LOOP does not impair the system's safety function. During an SBO, the safety-related isolation dampers are closed due to loss of the isolation damper power source. The safety-related isolation dampers are closed automatically upon receipt of an engineered safety feature actuation signal – safety injection actuation signal (ESFAS-SIAS) or loss of the isolation damper power source to maintain the auxiliary building controlled area pressure and to limit release of airborne radioactivity.

Two 100 percent capacity redundant safety-related auxiliary building controlled area emergency exhaust ACUs are provided in each division. Each ACU is powered from separate Class 1E sources so that a single failure coincident with a LOOP does not impair the system's safety function. During the SBO, the safety-related auxiliary building controlled area emergency exhaust ACUs are powered from the AAC source. The safety-related auxiliary building controlled area emergency exhaust ACUs operate upon receipt of an ESFAS-SIAS to maintain the safety-related mechanical equipment rooms including emergency core cooling system (ECCS) equipment rooms, which are cooled by safety-related cubicle coolers, under a slightly negative pressure with respect to the surrounding areas by exhausting air from the safety-related mechanical equipment rooms. This minimizes the air exfiltration from the safety-related mechanical equipment rooms to the surrounding areas.

The design and construction of ACUs comply with ASME AG-1, ASME N509, and with the recommendations of NRC RG 1.52 for safety-related ACUs and NRC RG 1.140 for non-safety related ACUs.

9.4.5.2 System Description

9.4.5.2.1 Emergency Diesel Generator Area HVAC System

The emergency diesel generator area HVAC system consists of four 100 percent capacity redundant trains.

The EDG area HVAC system consists of the following subsystems:

a. EDG room normal HVAC subsystem

b. EDG room emergency HVAC subsystem

c. Diesel fuel oil storage tank room HVAC subsystem.

The EDG area HVAC system is shown in Figure 9.4.5-1. Design data for the major components of this system is listed in Table 9.4.5-1.

9.4.5.2.1.1 EDG Room Normal HVAC Subsystem

The EDG room normal HVAC subsystem consists of one 100 percent capacity EDG room normal supply AHU, one 100 percent capacity fuel oil day tank and lube oil makeup tank room exhaust fan, one 100 percent capacity EDG room exhaust fan, one 100 percent capacity EDG control room cubicle cooler, associated ductwork, and ductwork accessories for each train. Tornado dampers are provided to protect against instantaneous pressure changes caused by tornadoes at outside air intake and exhaust outlets. The normal supply AHU consists of a prefilter, an electric heating coil, a chilled water cooling coil, and a fan, along with ducts, dampers, and related instrumentation. The COL applicant is to provide the capacity of the heating coil as affected by site-specific conditions (COL 9.4(1)). The cubicle cooler consists of a chilled water cooling coil and a fan, instrumentation and controls. The chilled water of the cooling coil is supplied from the ECWS.

The normal supply AHU and exhaust fans operate continuously to maintain the ambient temperature in each room below the maximum room design temperature identified in Subsection 9.4.5.1.1, to prevent possible accumulation of oil fumes, and to provide

ventilation during all modes of plant operating conditions. A smoke detector is located at the downstream of the supply AHU. When a smoke detector detects smoke, the supply AHU fan is automatically stopped. The EDG control room cubicle cooler operates automatically by temperature switch to provide additional cooling for the EDG control room with high cooling load.

An electric duct heater is provided for each EDG room in the EDG building to provide additional heating for the EDG room with a high heating requirement. The electric duct heater operates to maintain the minimum required room temperature in the EDG room.

9.4.5.2.1.2 EDG Room Emergency HVAC Subsystem

The EDG room emergency HVAC subsystem consists of two 50 percent capacity EDG room emergency cubicle coolers for each train. Each cubicle cooler consists of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water of the cooling coil is supplied from the ECWS.

EDG room emergency cubicle coolers start automatically when the room temperature reaches its setpoint during EDG operation. The EDG room emergency cubicle coolers operate to maintain the ambient temperature in the EDG room below the maximum room design temperature identified in Subsection 9.4.5.1.1.

In the event of a fire, smoke from the emergency diesel generator room, diesel fuel oil storage tank room, diesel fuel oil day tank room, and lube oil makeup tank room is removed by a portable smoke removal fan after fire suppression.

9.4.5.2.1.3 Diesel Fuel Oil Storage Tank Room HVAC Subsystem

The diesel fuel oil storage tank room HVAC subsystem consists of a supply fan, an exhaust fan, an electric duct heater, and associated ductwork and ductwork accessories for each train. Tornado dampers are provided to protect against instantaneous pressure changes caused by tornadoes at outside air intake and exhaust outlets.

The diesel fuel oil storage tank room supply and exhaust fans operate continuously to prevent possible accumulation of oil fumes and to provide ventilation during all modes of

plant operating conditions. The electric duct heater operates to maintain the minimum required room temperature in the diesel fuel oil storage tank room. The COL applicant is to provide the capacity of the electric duct heater heating coil as affected by site-specific conditions (COL 9.4(2)).

9.4.5.2.2 Electrical and I&C Equipment Areas HVAC System

The electrical and I&C equipment areas HVAC system serves electrical equipment rooms, instrument equipment rooms, and control equipment rooms in the auxiliary building with temperature, humidity, and ventilation conditions. The electrical and I&C equipment areas HVAC system is shown in Figure 9.4.5-2. Design data for the major components of this systemare listed in Table 9.4.5-2.

The electrical and I&C equipment areas HVAC system is composed of the following subsystems:

a. Electrical and I&C equipment areas HVAC subsystem

b. CEDM M/G set room HVAC subsystem

c. Class 1E battery room HVAC subsystem

d. Non-Class 1E battery room exhaust subsystem

e. Remote shutdown room HVAC subsystem

f. Remote control console room HVAC subsystem

During normal operation, safety-related and non-safety related cubicle coolers for each electrical and I&C equipment room operate to maintain a corresponding room design temperature. All cubicle coolers operate automatically by temperature switches to provide additional cooling for the areas with high cooling loads. The electric duct heaters operate automatically by the signal from the respective temperature switches. Outside air for ventilation is supplied through the auxiliary building clean area AHU and the air in the served room is exhausted by auxiliary building clean area exhaust fans to the outside.

During design basis accident (DBA) or LOOP, the safety-related portion of this system that was previously operating is re-energized and started automatically. The air in the Class 1E battery room is continuously exhausted to limit hydrogen accumulation to less than one percent of the total volume of the battery room. The safety-related cubicle coolers for each electrical and I&C equipment room operate automatically according to the room temperature. The electrical and I&C equipment areas are not ventilated because the supply AHU and exhaust fan of the auxiliary building clean area HVAC system are not available.

In the event of a fire, smoke from the electrical and I&C equipment areas is removed by the smoke removal fan of the auxiliary building clean area HVAC system after fire suppression.

9.4.5.2.2.1 Electrical and I&C Equipment Areas HVAC Subsystem

The safety-related portions of the electrical and I&C equipment areas HVAC subsystem consist of two 100 percent capacity redundant divisions to meet single failure criteria. The safety-related portions of the electrical and I&C equipment areas HVAC subsystem consist of electric duct heaters, and safety-related cubicle coolers. The cubicle coolers consist of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water of the cooling coil is supplied from the essential chilled water system (ECWS). Design data for non-safety related cubicle coolers are listed in Table 9.4.5-2.

The non-safety related portions of the electrical and I&C equipment areas HVAC subsystem consist of electric duct heaters, non-safety related cubicle cooler, and humidifiers. The cubicle coolers consist of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water of the cooling coil is supplied from the plant chilled water system (PCWS). Design data for non-safety related cubicle coolers are listed in Table 9.4.5-2.

9.4.5.2.2.2 CEDM M/G Set Room HVAC Subsystem

The CEDM M/G Set room HVAC subsystem is a non-safety related system and consists of one AHU, one electric duct heater, one humidifier, instrumentation and controls, ductwork, and duct accessories. The CEDM M/G set room AHU consists of a chilled water cooling coil and a fan, along with ducts, dampers, and related instrumentation. The chilled water of the cooling coil is supplied from the PCWS. The three-way valve to the chilled water

cooling coil of the AHU is continuously modulated by the respective temperature-indicating controller to maintain the design temperature downstream of the cooling coils.

9.4.5.2.2.3 Class 1E Battery Room HVAC Subsystem

The Class 1E battery room HVAC subsystem is a safety-related system and consists of four trains. Each train consists of one supply fan, one exhaust fan, one safety-related cubicle cooler, and an electric duct heater. The chilled water of the cooling coil is supplied from the ECWS. During all operation modes, the air in the Class 1E battery room is continuously exhausted to limit hydrogen accumulation to less than one percent of the total volume of the battery room based on NRC RG 1.128. Outside air is supplied through the supply fan with filter and the air in the Class 1E battery room is exhausted by the exhaust fan to the outside. The tornado dampers are provided to protect against instantaneous pressure changes caused by tornadoes at outside air intake and exhaust outlets. The electric duct heater and cubicle cooler are affected by site-specific conditions. The COL applicant is to provide the capacities of the electric duct heater heating coil as affected by site-specific conditions (COL 9.4(2)).

9.4.5.2.2.4 Non-Class 1E Battery Room Exhaust Subsystem

The non-Class 1E battery room exhaust subsystem consists of one exhaust fan and one electric duct heater per division. During normal operation, the air in the non-Class 1E battery room is continuously exhausted to limit hydrogen accumulation to less than one percent of the total volume of the battery room based on NRC RG 1.128.

Outside air for ventilation is supplied through the auxiliary building clean area AHU, and the air in the non-Class 1E battery room is exhausted by the exhaust fan to the outside.

9.4.5.2.2.5 Remote Shutdown Room HVAC Subsystem

The remote shutdown room HVAC subsystem consists of two 100 percent capacity supply fans, two 100 percent capacity exhaust fans, two 100 percent capacity cubicle coolers, two 100 percent capacity electric duct heaters, and one humidifier. All components of the remote shutdown room HVAC subsystem are safety-related, except for the humidifier. The humidifier is a non-safety related. Outside air is supplied through the supply fan with

filter for ventilation and the air in the RSR is exhausted by the exhaust fan to the outside. The tornado dampers are provided to protect against instantaneous pressure changes caused by tornadoes at outside air intake and exhaust outlets. The RSR is cooled by one of two safety-related cubicle coolers. The chilled water of the cooling coil is supplied from the ECWS. The electric duct heater and cubicle cooler are affected by site-specific conditions. The COL applicant is to provide the capacities of the electric duct heater heating coil as affected by site-specific conditions (COL 9.4(2)).

9.4.5.2.2.6 Remote Control Console Room HVAC Subsystem

The remote control console room HVAC subsystem is a non-safety related system and consists of one packaged air conditioning unit (PACU). The PACU is provided for the remote control console room to maintain the suitable environment conditions.

9.4.5.2.3 Auxiliary Building Controlled Area HVAC System

The auxiliary building controlled area HVAC system consists of the following subsystems:

a. Auxiliary building controlled area I HVAC subsystem

b. Auxiliary building controlled area II HVAC subsystem

c. HELB area HVAC subsystem

The system is shown in Figure 9.4.5-3 and the design data for major components are listed in Table 9.4.5-3.

9.4.5.2.3.1 Auxiliary Building Controlled Area I and II HVAC Subsystems

Each of the auxiliary building controlled area I and II HVAC subsystems consists of one 100 percent capacity non-safety related supply AHU, two 100 percent capacity non-safety related normal exhaust ACUs, two 100 percent capacity safety-related emergency exhaust ACUs, ductwork, and duct accessories. Cubicle coolers are provided, where required. The safety-related equipment of each subsystem is separated physically and electrically.

Tornado dampers are provided to protect against instantaneous pressure changes caused by tornadoes at outside common exhaust outlets of the emergency exhaust ACUs.

Each AHU consists of a prefilter, an electric heating coil, a chilled water cooling coil and two 100 percent capacity fans, along with ducts, dampers, and related instrumentation. The chilled water is supplied from the plant chilled water system (PCWS). The three-way valve to the chilled water cooling coil of the AHU is continuously modulated by the respective temperature-indicating controller to maintain the design temperature downstream of the cooling coils. The COL applicant is to provide the heating coil and cooling coil capacities as affected by site-specific conditions (COL 9.4(1)).

Each ACU consists of a moisture separator, an electric heating coil, a prefilter, a HEPA filter, a carbon absorber, a postfilter and a fan, along with ducts, dampers, and related instrumentation. The electric heating coil is located upstream of the carbon adsorber to maintain the relative humidity of air entering the carbon adsorber below 70 percent to provide reasonable assurance of carbon adsorber efficiency.

The non-safety related cubicle coolers are provided for non-safety related mechanical equipment rooms to maintain the design room temperature. Each cubicle cooler consists of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water is supplied from the essential chilled water system (ECWS).

The non-safety related cubicle coolers are provided for non-safety related rooms requiring additional cooling to maintain the design room temperature. Each cubicle cooler consists of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water is supplied from the PCWS.

Normal Operation

During normal operation, the auxiliary building controlled area supply AHUs, auxiliary building controlled area normal exhaust ACUs, and safety-related and non-safety related cubicle coolers operate to maintain suitable temperature, ventilation, and pressure for personnel and equipment.

The filtered and conditioned air is supplied to the auxiliary building controlled area from the auxiliary building controlled area supply AHU and the exhaust air from the auxiliary building controlled area is filtered through the auxiliary building controlled area normal exhaust ACU before it is released to the atmosphere. The auxiliary building controlled area is maintained under a slightly negative pressure with respect to the surrounding areas by exhausting more air than supply air. The supply airflow rate from the auxiliary building controlled area supply AHU is 62,520 cmh (36,800 cfm) in Div. I and 60,821 cmh (35,800 cfm) in Div. II. The exhaust air flow rate through the auxiliary building controlled area normal exhaust ACU is 64,559 cmh (38,000 cfm) in Div. I and 61,416 cmh (36,150 cfm) in Div. II. The auxiliary building controlled area I and II HVAC subsystems are designed to maintain the dose level in normally accessible areas below the prescribed value in 10 CFR 20 by supplying and exhausting sufficient airflow.

Radiation monitors are provided at the common inlet duct of the normal exhaust ACUs to monitor the airborne radioactivity of the exhaust air from the auxiliary building controlled area as described in Subsection 11.5.3. An alarm is actuated in the MCR when the radioactivity level exceeds the limit value. Upon detection of high level of radioactivity at the common inlet duct of the normal exhaust ACUs, the operating normal exhaust ACU operates continuously the same as operating before the high level of radioactivity is detected.

Radiation monitors are also provided at the common discharge duct of the normal exhaust ACUs to sample air particulate and iodine before it is released to the environment as described in the Subsection 11.5.3.

Cubicle coolers operate automatically by temperature switches to provide additional cooling for the rooms with high cooling loads.

The non-safety related auxiliary building controlled area supply AHUs and normal exhaust ACUs, and non-safety related cubicle coolers are not required to operate during DBA or LOOP.

Abnormal and Accident Operation

Upon receipt of an ESFAS-SIAS, all of the auxiliary building controlled area emergency exhaust ACUs start and the two safety-related isolation dampers at the outlet of the

auxiliary building controlled area AHUs and two safety-related isolation dampers at the inlet of the auxiliary building controlled area normal exhaust ACUs are closed automatically. One of the two emergency exhaust ACUs per division manually stops by the operator and the stopped emergency exhaust ACUs are placed on standby status. When the emergency exhaust ACUs start, their isolation dampers at the inlet and outlet of the emergency exhaust ACUs are opened automatically. Upon receipt of the safety-related isolation dampers close signal, the auxiliary building controlled area normal exhaust ACUs and the auxiliary building controlled area supply AHUs stop sequentially.

In the event that the safety-related isolation dampers are closed due to loss of the isolation damper power source, the auxiliary building controlled area normal exhaust ACUs and the auxiliary building controlled area supply AHUs stop sequentially. The operator manually starts one of two emergency exhaust ACUs per division.

In the event that the auxiliary building controlled area supply AHUs and the auxiliary building controlled area normal exhaust ACUs are unavailable due to loss of power or equipment failure, two safety-related isolation dampers at the outlet of the auxiliary building controlled area supply AHUs and two safety-related isolation dampers at the inlet of the auxiliary building normal exhaust ACUs are closed manually, and one of two emergency exhaust ACUs per division starts manually by the operator.

One of two emergency exhaust ACUs per division operates to control the release of airborne radioactive materials from the safety-related mechanical equipment rooms. The safety-related mechanical equipment rooms are maintained under a slightly negative pressure by exhausting air from the safety-related mechanical equipment rooms. The exhaust air is filtered through the emergency exhaust ACU before it is released to the atmosphere. The exhaust airflow rate through the auxiliary building controlled area emergency exhaust ACU is 5,097 cmh (3,000 cfm). In case of failure of the operating emergency exhaust ACU, the standby ACU starts automatically.

Radiation monitors are provided at the common inlet duct of the emergency exhaust ACUs to monitor the airborne radioactivity of the exhaust air from the safety-related mechanical equipment rooms as described in Subsection 11.5.3. An alarm is actuated in the MCR when the radioactivity level exceeds the limit value. Upon detection of high levels of radioactivity at the common inlet duct of the emergency exhaust ACUs, the operating

emergency exhaust ACU operates continuously, the same as before the high level of radioactivity is detected.

Radiation monitors are also provided at the common discharge duct of the emergency exhaust ACUs to sample air particulate and iodine before it is released to the environment as described in the Subsection 11.5.3.

A smoke detector is located at the downstream of the supply AHU. When a smoke detector detects smoke, the supply AHU fan is automatically stopped.

During DBA or LOOP, the safety-related cubicle coolers operate the same as normal operation to maintain the design room temperature.

9.4.5.2.3.2 HELB Area HVAC Subsystem

The HELB area HVAC subsystem consists of one 100 percent capacity non-safety related supply AHU, two 100 percent capacity non-safety related exhaust ACUs, ductwork, and duct accessories. Non-safety related cubicle coolers are provided, where required.

The AHU consists of a prefilter, an electric heating coil, a chilled water cooling coil and a fan, along with ducts, dampers, and related instrumentation. The chilled water of the cooling coil is supplied from the PCWS. The three-way valve to the chilled water cooling coil of the AHU is continuously modulated by the respective temperature-indicating controller to maintain the design temperature downstream of the cooling coil. The COL applicant is to provide the heating coil and cooling coil capacities as affected by site-specific conditions (COL 9.4(1)).

Each ACU consists of a moisture separator, an electric heating coil, a prefilter, a HEPA filter, a carbon adsorber, a postfilter and a fan, along with ducts, dampers, and related instrumentation. The electric heating coil is located upstream of the carbon adsorber to maintain the relative humidity of air entering the carbon adsorber below 70 percent to provide reasonable assurance of the carbon adsorber efficiency.

The non-safety related cubicle coolers are provided for non-safety related rooms requiring additional cooling to maintain the design room temperature. Each cubicle cooler consists

of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water of the cooling coil is supplied from the PCWS.

During normal operation, cubicle coolers operate automatically by temperature switches to provide additional cooling for the areas with high cooling loads.

During normal operation, the HELB area supply AHU, HELB area exhaust ACUs, and cubicle coolers operate to maintain suitable temperature, ventilation, and pressure for personnel and equipment. The filtered and conditioned air is supplied to the HELB area from the HELB area supply AHU and the exhaust air from the HELB area is filtered through the HELB area exhaust ACU before it is released to the atmosphere. A smoke detector is located at the downstream of the supply AHU. When a smoke detector detects smoke, the supply AHU fan is automatically stopped. The HELB area is maintained under a slightly negative pressure with respect to the surrounding areas by exhausting more air than supply air. The supply air flow rate from the HELB area supply AHU is 14,611 cmh (8,600 cfm) and the exhaust air flow rate through the HELB area exhaust ACU is 15,290 cmh (9,000 cfm). The HELB area HVAC subsystem is designed to maintain the dose level in normally accessible areas below the prescribed value in 10 CFR 20 by supplying and exhausting sufficient airflow.

Upon receipt of an ESFAS-SIAS, the HELB area supply AHU, HELB area exhaust ACUs, and non-safety related cubicle coolers operate continuously if the corresponding powers are available.

Radiation monitors are provided at the common inlet duct of the HELB area exhaust ACUs to monitor the airborne radioactivity of the exhaust air from the HELB area as described in Subsection 11.5.3. An alarm is actuated in the MCR when the radioactivity level exceeds the limit value. Upon detection of high level of radioactivity at the common inlet duct of the HELB area exhaust ACUs, the operating HELB area exhaust ACU operates continuously, the same as before the high level of radioactivity is detected.

Radiation monitors are also provided at the common discharge duct of the HELB area exhaust ACUs to sample air particulate and iodine before it is released to the environment as described in the Subsection 11.5.3.

The non-safety related HELB area supply AHUs and exhaust ACUs, and non-safety related cubicle coolers are not required to operate during DBA or LOOP.

9.4.5.3 Safety Evaluation

9.4.5.3.1 Emergency Diesel Generator Area HVAC System

The EDG area HVAC system consists of four redundant trains, each capable of performing its safety function during a DBA or LOOP. Each train is powered from corresponding Class 1E source and designed as seismic Category I.

The EDG area HVAC system FMEA is shown in the Table 9.4.5-4 and the FMEA shows that a single failure does not impair the safety function of the system.

The intake and exhaust structures are protected from externally generated missiles, rain, or trash. The system is protected against external missiles and instantaneous pressure changes caused by tornadoes. The safety-related AHU, cubicle cooler, supply, and exhaust fan housings are designed to withstand penetration by internally generated missiles.

Fire dampers are provided in fire-rated barriers in the emergency diesel generator area and have the same fire resistance rating as the fire barrier.

9.4.5.3.2 Electrical and I&C Equipment Areas HVAC System

The safety-related portions of electrical and I&C equipment areas HVAC system are provided with redundancy to meet single failure criteria and major components of each division are located in separate areas not subject to common hazards that would affect operation of the entire system. All safety-related components including safety-related fans and cubicle coolers are powered from the corresponding Class 1E source. The safety-related cubicle coolers are supplied chilled water from the separated ECWS. At least one of two redundant cubicle coolers in the safety-related electrical and I&C equipment rooms operates to maintain a corresponding room design temperature assuming a single failure of an active component concurrent with a LOOP. During all modes of operation, the air in the Class 1E battery is continuously exhausted to limit hydrogen accumulation to less than one percent of the total volume of the Class 1E battery room. The electrical and I&C

equipment area HVAC system FMEA is shown in Table 9.4.5-4, and the FMEA shows that a single failure does not impair the safety function of the system.

All safety-related components of the electrical and I&C equipment areas HVAC system are designed as seismic Category I.

Non-safety related portions of the system in areas containing safety-related equipment are classified as seismic category II to prevent adverse interaction with safety-related systems during a seismic event.

The intake and exhaust structures are protected from externally generated missiles, rain, or trash. The system is protected against external missiles and instantaneous pressure changes caused by tornadoes. The safety-related cubicle cooler and supply and exhaust fan housings are designed to withstand penetration by internally generated missiles.

Fire dampers are installed in fire-rated barriers in the electrical and I&C equipment areas and have the same fire resistance rating as the fire barrier.

9.4.5.3.3 Auxiliary Building Controlled Area HVAC System

The auxiliary building controlled area HVAC system has two 100 percent capacity redundant safety-related auxiliary building controlled area emergency exhaust ACUs per division, each capable of performing its safety function during a DBA or LOOP. Each ACU is powered from a corresponding Class 1E source and is located in a physically separate room.

The auxiliary building controlled area emergency exhaust ACU operates automatically upon receipt of an ESFAS-SIAS to maintain the safety-related mechanical equipment rooms including ECCS equipment rooms under a slightly negative pressure with respect to the surrounding areas. The exhaust air from the safety-related mechanical equipment rooms is filtered through the emergency exhaust ACU before it is released to the atmosphere.

Two redundant safety-related isolation dampers are installed at the outlet of the auxiliary building controlled area supply AHUs and two redundant safety-related isolation dampers

are installed at the inlet of the auxiliary building controlled area normal exhaust ACUs. Each of two safety-related isolation dampers is powered from corresponding Class 1E source and these isolation dampers are closed automatically upon receipt of an ESFAS-SIAS or loss of the isolation damper power source to maintain the auxiliary building controlled area pressure and to limit release of airborne radioactivity.

A safety-related cubicle cooler is provided to each safety-related mechanical equipment room and each cubicle cooler is powered from the corresponding Class 1E source. Each of the safety-related cubicle coolers operates automatically by room temperature switch to maintain the room temperature below the maximum room temperature.

The auxiliary building controlled area HVAC system FMEA is shown in the Table 9.4.5-4 and the FMEA shows that a single failure does not impair the safety function of the system.

All safety-related equipment is designed as seismic Category I. Non-safety related portions of the system in areas containing safety-related equipment are classified as seismic Category II to prevent adverse interaction with safety-related systems during a seismic event.

The intake and exhaust structures are protected from externally generated missiles, rain, or trash. The system is protected against external missiles and instantaneous pressure changes caused by tornadoes. The safety-related ACU and cubicle cooler fan housings are designed to withstand penetration by internally generated missiles.

Fire dampers are installed in fire-rated barriers in the auxiliary building controlled areas and have the same fire resistance rating as the fire barrier.

9.4.5.4 Inspection and Testing Requirements

The major components of the ESF HVAC systems are periodically checked and tested to provide reasonable assurance of design operation and performance.

The ESF HVAC systems are provided with proper instrumentation and devices capable of checking the design properties such as pressure drop, flow rate, and temperature. Controls,

interlocks, and safety devices on the system are functionally checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation.

Preoperational testing of the ESF HVAC systems are performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

Air handling units are factory inspected and tested in accordance with AMCA standards (References 12 and 13). Filters are inspected and tested in accordance with ASHRAE standards (Reference 11). Cooling coils are hydrostatically tested in accordance with ASME AG-1. The cooling coil performance rating is developed in accordance with AHRI standards (References 14, 15, and 16).

Leak testing of system ductwork is performed in accordance with ASME AG-1 and ASME N511.

9.4.5.4.1 Emergency Diesel Generator Area HVAC System

The general inspection and test requirements in Subsection 9.4.5.4 are applied.

9.4.5.4.2 Electrical and I&C Equipment Areas HVAC System

The general inspection and test requirements in Subsection 9.4.5.4 are applied.

9.4.5.4.3 Auxiliary Building Controlled Area HVAC System

ACUs are factory inspected and tested for housing leakage, filter bypass leakage, and airflow performance. Periodically and subsequent to each filter or carbon adsorber replacement, the unit is inspected and tested in-place in accordance with the requirements of ASME N510, ASME AG-1, and NRC RG 1.52 for safety-related ACUs or NRC RG 1.140 for non-safety related ACUs. The HEPA filters are periodically checked and carbon adsorber samples are tested for efficiency in an independent laboratory in accordance with NRC RGs 1.52, 1.140, and ASTM D 3803.

The safety-related isolation dampers are inspected periodically and tested in accordance with ASME AG-1 and the damper seats are replaced when it is required.

Inservice test and test interval requirements of the auxiliary building controlled area HVAC system are described in Subsections 3.7.12 and 5.5.11, ventilation filter testing program (VFTP) of Chapter 16, Technical Specifications.

9.4.5.5 Instrumentation Requirements

The safety-related instrumentation of the ESF ventilation systems meets the requirements of IEEE Std. 323, IEEE Std. 344, and IEEE Std. 603. The instrumentation, including indication and alarms of the ACUs in the auxiliary building controlled area HVAC system, is designed in accordance with the requirements of ASME N509.

9.4.5.5.1 Emergency Diesel Generator Area HVAC System

The following instrumentation is provided in the MCR and RSR.

a. Indication of temperature for room served by cubicle cooler

b. Indication of the inlet air temperature of safety-related AHU

c. Indication of the heating coil downstream temperature of AHU

d. Indication of the cooling coil downstream temperature of AHU

e. Indication of the AHU downstream airflow rate

f. Alarm of the prefilter pressure differential high of AHU

g. Alarm of temperature high-high for room served by cubicle cooler

h. Alarm of the heating coil temperature high-high and low of AHU

i. Alarm of the cooling coil temperature high of AHU

j. Alarm of AHU downstream airflow rate low

k. Alarm on smoke detection at the AHU downstream

9.4.5.5.2 Electrical and I&C Equipment Areas HVAC System

The following instrumentation is provided in the MCR and RSR.

a. Indication of temperature for room served by safety related cubicle cooler

b. Indication of inlet plenum air temperature of CEDM AHU

c. Indication of temperature downstream the cooling coil of CEDM AHU

d. Alarm of temperature high downstream the cooling coil of CEDM AHU

e. Alarm of hydrogen concentration high in the battery room

f. Alarm of temperature high-high for room served by cubicle cooler

g. Alarm of airflow rate low downstream of RSR cubicle cooler, RSR supply fan, and RSR exhaust fan

9.4.5.5.3 Auxiliary Building Controlled Area HVAC System

The following instrumentation is provided in the MCR and RSR.

a. Indication of temperature for room served by safety-related cubicle cooler

b. Indication of the heating coil downstream temperature of AHU

c. Indication of the cooling coil downstream temperature of AHU

d. Indication of the AHU downstream airflow rate

e. Indication of the inlet air temperature of safety-related ACU

f. Indication of the heating coil downstream temperature of ACU

g. Indication of the carbon adsorber downstream temperature of ACU

h. Indication of the ACU downstream airflow rate

i. Alarm of temperature high-high for room served by cubicle cooler

j. Alarm of the heating coil temperature high-high and low of AHU

k. Alarm of the cooling coil temperature high of AHU

l. Alarm of AHU downstream airflow rate low

m. Alarm on smoke detection at the AHU downstream

n. Alarm of the heating coil temperature high-high, high and low of ACU

o. Alarm of the carbon adsorber temperature high-high and high of ACU

p. Alarm of the prefilter pressure differential high of safety-related ACU

q. Alarm of the HEPA filter pressure differential high of safety-related ACU

r. Alarm of the postfilter pressure differential high of safety-related ACU

s. Alarm of the filter total pressure differential high of safety-related ACU

t. Alarm on high radioactivity detection at the common inlet duct of ACUs

9.4.6 Reactor Containment Building HVAC System and Purge System

The reactor containment building HVAC system is designed to maintain the appropriate environmental conditions inside the reactor containment building during plant normal operation and does not serve any safety related functions.

The reactor containment building purge system is designed to clean up the containment atmosphere during normal operation and to maintain suitable environmental conditions during refueling condition.

9.4.6.1 Design Bases

9.4.6.1.1 Reactor Containment Building HVAC System

The reactor containment building HVAC system is classified as non-safety related and seismic Category II. This system is designed to provide reasonable assurance of proper operation of equipment and controls during normal plant operation, normal shutdown, and personnel access for inspection, testing, and maintenance.

This system is designed to maintain the containment atmosphere temperature between 10 °C (50 °F) and 48.9 °C (120 °F) for structure, equipment, instrumentation, and controls inside the containment during normal plant operation. This system is also designed to remove heat and water vapor and to provide proper mixing of air for achieving a uniform containment atmosphere condition during the containment integrated leakage rate test (ILRT).

This system is designed to maintain the temperature in the in-core instrumentation (ICI) chase and reactor cavity between 15.6 °C (60 °F) and 48.9 °C (120 °F) during normal plant operation.

The reactor containment building HVAC system complies with NRC RG 4.21.

This system is designed to remove the heat dissipated by the control element drive mechanism (CEDM) coils during normal plant operation.

During LOOP conditions, the reactor containment building HVAC system is powered from the permanent non-safety (PNS) source.

9.4.6.1.2 Reactor Containment Building Purge System

The reactor containment building purge system is non-safety related, except for the containment isolation component. Non-safety related equipment and ductwork including supports are designed to meet seismic Category II requirements to preclude damage to safety-related component during a safety shutdown earthquake. Redundant containment isolation valves (CIVs) are designed, constructed, and tested in accordance with ASME Section III (Reference 6), safety Class 2, and seismic Category I. The CIVs are powered from Class 1E and AAC source. During a DBA or LOOP, these isolation valves are closed upon receipt of an engineered safety feature actuation signal – containment purge isolation actuation signal (ESFAS-CPIAS) or an engineered safety feature actuation signal – containment isolation actuation signal (ESFAS-CIAS).

This system is designed to provide the proper atmosphere and adequate ventilation for personnel before and during periods of personnel access for refueling and maintenance operations when the plant is in cold shutdown.

This system is designed to control containment airborne fission products during normal plant operation and shutdown to allow containment access while limiting personnel exposures and while limiting annual releases to the environment within the requirements of 10 CFR 20 Appendix B and 10 CFR 50 Appendix I.

This system is designed to purge containment atmosphere for personnel access to the building following a loss-of-coolant accident (LOCA).

The system is designed in accordance with the requirements of 10 CFR 50 Appendix A, GDC 60. The CIVs are designed in accordance with the requirements of 10 CFR 50 Appendix A, GDC 2 and 10 CFR 50.34(f)(2)(xv).

The design and construction of ACUs complies with ASME AG-1, ASME N509 and with the recommendations of NRC RGs 1.140 and 4.21.

9.4.6.2 System Description

9.4.6.2.1 Reactor Containment Building HVAC System

The reactor containment building HVAC system consists of the following subsystems:

a. Reactor containment building cooling subsystem

b. Reactor cavity cooling subsystem

c. CEDM cooling subsystem

The reactor containment building HVAC system is shown in Figure 9.4.6-1. Design data for major components of this system are listed in Table 9.4.6-1.

9.4.6.2.1.1 Reactor Containment Building Cooling Subsystem

The reactor containment building cooling subsystem consists of four 50 capacity percent reactor containment fan coolers (RCFCs), four 50 capacity percent steam generator (SG) enclosure recirculation fans, four 50 capacity percent annulus area recirculation fans, ductwork, and duct accessories. Four RCFCs are arranged in two pairs, with one RCFC of each pair normally operating. The chilled water for RCFCs is served from the plant chilled water system (PCWS).

This subsystem provides cooling air to the SG cavities, pressurizer enclosures, regenerative heat exchanger room, containment annulus, and other equipment areas.

During the LOOP condition, the reactor containment cooling subsystem is powered from the PNS source. The chilled water for the RCFC cooling coils is supplied from the PCWS powered from the PNS source.

9.4.6.2.1.2 Reactor Cavity Cooling Subsystem

The reactor cavity cooling subsystem consists of one 100 percent capacity AHU, ductwork, instrumentation and controls. The AHU has a cooling coil and two 100 percent capacity fans.

The reactor cavity supply AHU induces air from outside the primary shield wall and discharges it to the ICI chase for conveying the air to the reactor cavity.

The chilled water for the AHU is served from the PCWS.

During the LOOP condition, the AHU is powered from the PNS source. The chilled water for the AHU cooling coil is supplied from the PCWS powered from the PNS source.

9.4.6.2.1.3 CEDM Cooling Subsystem

The CEDM cooling subsystem consists of three 50 percent capacity fans with instruments for operation monitoring. This subsystem is located on the integrated head assembly (IHA). The fans draw cooling air into the CEDM cooling shrouds from reactor containment and discharge it into the reactor containment building to remove heat from the CEDM coils and nozzles. The maximum inlet temperature of the CEDM cooling air is 48.9 °C (120 °F). Two of three fans operate alternatively during normal operation.

During the LOOP condition, the fans are powered from the PNS source.

9.4.6.2.2 Reactor Containment Building Purge System

The reactor containment building purge system consists of the following subsystems:

a. High-volume purge subsystem

b. Low-volume purge subsystem

The reactor containment building purge system is shown in Figure 9.4.6-2. Design data for the major components of this system are listed in Table 9.4.6-2.

A radiation monitor is provided at the common discharge duct of the high volume purge exhaust ACUs and low volume purge exhaust ACUs to monitor the airborne radioactivity of the exhaust air from the containment as described in Subsection 11.5.3. An alarm is actuated in the MCR when the radioactivity level exceeds the limit value. Upon detection of high level of radioactivity at the common discharge duct, the operating high volume purge exhaust ACUs or low volume purge exhaust ACU stop automatically.

The subsystem exhaust and supply penetrations through the containment are provided with two CIVs in series in each line, with one located inside and one located outside the containment. The CIVs are normally closed during all modes of plant operation except operating the subsystem. The CIVs are designed to keep fail-safe position in loss of the electrical power source. The CIVs are automatically closed upon receipt of an ESFAS-CPIAS or an ESFAS-CIAS, and the operating purge subsystem stops.

9.4.6.2.2.1 High-Volume Purge Subsystem

The high-volume purge subsystem consists of one 100 percent capacity supply AHU and two 50 percent capacity exhaust ACUs, CIVs, ductwork, duct accessories, instrumentation and controls. The supply AHU consists of a prefilter, an electric heating coil, a chilled water cooling coil, and two 50 percent capacity fans, along with ducts, dampers, and related instrumentation. The chilled water of the cooling coil is supplied from the plant chilled water system (PCWS). The COL applicant is to provide the heating coil and cooling coil capacities as affected by site-specific conditions (COL 9.4(1)). Each exhaust ACU consists of a prefilter, a HEPA filter, and a fan, along with duct, dampers, and related instrumentation.

This subsystem provides filtered outside air into the containment around the periphery of the reactor refueling pool for maintenance or inspections and discharges it to the atmosphere through the exhaust ACUs during cold shutdown and refueling conditions.

A smoke detector is located at the downstream of the high volume purge supply AHU. When the detector detects smoke, the supply AHU fans are manually stopped from the MCR.

9.4.6.2.2.2 Low-Volume Purge Subsystem

The low-volume purge subsystem consists of two 100 percent capacity supply fans and two 100 percent capacity exhaust ACUs, CIVs, ductwork, duct accessories, instrumentation and controls. Each exhaust ACU consists of a moisture separator, an electric heating coil, a prefilter, a HEPA filter, a carbon adsorber, a postfilter, and a fan, along with ducts, dampers, and related instrumentation. The electric heating coil is located upstream of the carbon adsorber to maintain the relative humidity of air entering the carbon adsorber below 70 percent to provide reasonable assurance of the carbon adsorber efficiency. Only one of the two exhaust ACUs is operated to prevent the common failure of the two ACUs from the pressure caused by LOCA during low volume purge.

This subsystem provides filtered outside air utilizing the high volume purge supply AHU into the containment and discharges it to the outside through the exhaust ACU during normal operation, when required.

This subsystem controls the containment atmosphere pressure and removes gaseous and particulate contamination from the containment atmosphere and to allow safe, controlled, timely access to the containment without routine use of full protective personnel equipment.

This subsystem operates either in an exhaust mode or in a recirculation mode to limit airborne concentrations to less than or equal to those specified in 10 CFR 50, Appendix I. The air from the containment building is filtered through the low volume purge exhaust ACU before it is released to the atmosphere. Upon detection of high level of radioactivity at the common discharge duct, the operating low volume purge exhaust ACU stops automatically. This subsystem is placed in the recirculation mode by closing the outside discharge isolation damper manually and opening the recirculation isolation damper manually. The low volume purge exhaust ACU operates manually and the discharged air from low volume purge exhaust ACU flows back to the containment building through the low volume purge supply fan.

9.4.6.3 Safety Evaluation

9.4.6.3.1 Reactor Containment Building HVAC System

The reactor containment building HVAC system is non-safety related, so no safety evaluation is provided.

9.4.6.3.2 Reactor Containment Building Purge System

The reactor containment building purge system is non-safety related, except for containment isolation component.

The reactor containment building purge system FMEA is shown in the Table 9.4.6-3 and the FMEA shows that a single failure does not impair the safety function of the system.

The valve closure time of the containment isolation valves is dictated by the radiological consequences of a LOCA, which do not exceed the radiation dose limits of 10 CFR 50.34(a)(1). The closure time, including instrumentation delays, of containment low-volume purge containment isolation valves, does not exceed five seconds in accordance with Branch Technical Position (BTP) 6-4 (Reference 31).

Fire dampers are provided in fire-rated barriers in the auxiliary building and have the same fire resistance rating as the fire barrier.

9.4.6.4 Inspection and Testing Requirements

9.4.6.4.1 Reactor Containment Building HVAC System

The major components of the reactor containment building HVAC system are periodically checked and tested to provide reasonable assurance of design operation and performance.

The reactor containment building HVAC system is provided with proper instrumentation and devices capable of checking the design properties such as pressure drop, flow rate, and temperature. Controls, interlocks, and safety devices on the system are functionally

checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation.

Preoperational testing of the reactor containment building HVAC system is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test program and specifications.

RCFCs and the reactor cavity supply air handling units are factory inspected and tested in accordance with AMCA standards (References 12 and 13). Filters are inspected and tested in accordance with ASHRAE standards (Reference 11). Cooling coils are hydrostatically tested in accordance with ASME Section VIII. The cooling coil performance rating is developed in accordance with AHRI standards (References 14, 15, and 16).

Leak test of system ductwork is performed in accordance with ASME AG-1.

9.4.6.4.2 Reactor Containment Building Purge System

The major components of the reactor containment building purge system are periodically checked and tested to provide reasonable assurance of design operation and performance.

The reactor containment building purge system is provided with proper instrumentation and devices capable of checking the design properties such as pressure drop, flow rate, and temperature. Controls, interlocks, and safety devices on the system are functionally checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation.

Preoperational testing of the reactor containment building purge system is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

ACUs are factory inspected and tested for housing leakage, filter bypass leakage, and airflow performance. Periodically and subsequent to each filter or carbon adsorber replacement, the unit is inspected and tested in-place in accordance with the requirements of ASME N510, ASME AG-1, and NRC RG 1.140. The HEPA filters are periodically

checked and carbon adsorber samples are tested for efficiency in an independent laboratory in accordance with NRC RG 1.140 and ASTM D 3803.

Air handling units are factory inspected and tested in accordance with AMCA standards (References 12 and 13). Filters are inspected and tested in accordance with ASHRAE standards (Reference 11). Cooling coils are hydrostatically tested in accordance with ASME Section VIII. The cooling coil performance rating is developed in accordance with AHRI standards (References 14, 15, and 16).

Leak testing of system ductwork is performed in accordance with the ASME N511 and ASME AG-1.

The safety-related isolation valves are inspected periodically and the valve seats are replaced when required.

9.4.6.5 Instrumentation Requirements

9.4.6.5.1 Reactor Containment Building HVAC System

9.4.6.5.1.1 Reactor Containment Building Cooling Subsystem

The following instrumentation is provided in the MCR and RSR.

a. Indication of RCFC inlet and outlet air temperature

b. Indication of RCFC fan motor vibration

c. Alarm of RCFC inlet air temperature high

d. Alarm of RCFC fan motor vibration high

9.4.6.5.1.2 Reactor Cavity Cooling Subsystem

The following instrumentation is provided in the MCR and RSR:

a. Indication of reactor cavity AHU inlet and outlet air temperature

b. Indication of reactor cavity air temperature

c. Alarm of reactor cavity air temperature high and low

9.4.6.5.1.3 CEDM Cooling Subsystem

The following instrumentation is provided in the MCR and RSR:

a. Indication of CEDM cooling fan inlet and outlet air temperature

b. Alarm of CEDM cooling fan outlet air temperature high and low

9.4.6.5.2 Reactor Containment Building Purge System

CIVs and the exhaust ACU are operated manually, and their operating status signals are displayed in MCR and RSR.

The instrumentation in the reactor containment building purge system, including indication and alarms of the ACUs, is designed in accordance with the requirements of ASME N509.

The following instrumentation is provided in the MCR and RSR:

a. Indication of temperature downstream the electric heating coil of the AHUs

b. Indication of outlet airflow rate of the low volume purge supply fans and ACUs

c. Indication of carbon adsorber outlet air temperature of low volume purge exhaust ACUs

d. Indication of the position status (open/close) of each containment isolation valve

e. Alarm of air temperature low, high, high-high downstream of the electric heating coil of the AHUs and low volume purge exhaust ACUs

f. Alarm of outlet airflow rate low of the AHU and high volume purge exhaust ACUs

g. Alarm of outlet airflow rate low, high of the low volume purge supply fans and low volume purge exhaust ACUs

h. Alarm of carbon adsorber outlet air temperature high, high-high low volume purge exhaust ACUs

i. Alarm on high radioactivity in the exhaust duct of ACUs

9.4.7 Compound Building HVAC System

The compound building HVAC system is designed to maintain the suitable environment for all equipment and personnel, and the radiation zone of the compound building under a slightly negative pressure with respect to atmospheric pressure during normal operation.

The compound building HVAC system consists of the following subsystems:

a. Compound building clean area HVAC subsystem

b. Compound building controlled area HVAC subsystem

9.4.7.1 Design Bases

9.4.7.1.1 Compound Building Clean Area HVAC Subsystem

The compound building clean area HVAC subsystem is designed to:

a. Maintain the areas such as compound building control room and health physics areas at a positive pressure with respect to surrounding areas.

b. Maintain the temperature between 21.1 °C (70 °F) and 26.7 °C (80 °F) and relative humidity from 30 through 70 percent.

c. Provide ventilation for compound building chiller room.

d. Maintain the hydrogen concentration to less than one percent by volume within the battery room.

9.4.7.1.2 Compound Building Controlled Area HVAC Subsystem

The compound building controlled area HVAC subsystem is designed to:

a. Maintain a suitable environment for the operation, maintenance, and testing of equipment.

b. Prevent the spreading of airborne radioactivity to surrounding areas by maintaining the laboratory room and sample counting rooms at a negative pressure with respect to surrounding areas.

c. Maintain the areas of higher potential radioactive contamination under slightly negative pressure with respect to surrounding areas of low potential radioactive contamination in the controlled area.

d. Filter and monitor the exhaust air to limit the release of airborne radioactivity to the outside.

e. Maintain the temperature between 10 °C (50 °F) and 50 °C (122 °F) in the tank rooms and between 10 °C (50 °F) and 40 °C (104 °F) in the other rooms.

The compound building HVAC system is designed in accordance with the requirements of 10 CFR 50 Appendix A, GDC 60.

The compound building HVAC system is classified as non-safety related and seismic Category III.

The design and construction of ACUs complies with ASME AG-1, ASME N509, and with the recommendations of NRC RGs 1.140 and 4.21.

The compound building HVAC system is designed to maintain the dose level in normally accessible areas below the prescribed value in 10 CFR 20 by supplying and exhausting sufficient airflow.

9.4.7.2 System Description

The compound building HVAC system is shown in Figure 9.4.7-1. The design data of the major components are listed in Table 9.4.7-1.

9.4.7.2.1 Compound Building Clean Area HVAC Subsystem

The compound building clean area HVAC subsystem is designed to maintain an environment suitable for all equipment and personnel in the clean area of the compound building, and maintain clean areas, such as compound building control room and health physics areas, at a positive pressure with respect to surrounding areas.

The compound building clean area HVAC subsystem consists of two 50 percent capacity supply air handling units (AHUs), one return fan, one clean area exhaust fan, chiller room exhaust fan, packaged air conditioning units (PACUs), electric steam humidifiers, electric duct heaters (EDHs), cubicle coolers, associated ductwork, and duct accessories. Each AHU consists of a prefilter, an electric heating coil, a chilled water cooling coil, a fan, along with ducts, dampers, and related instrumentation. Chilled water of the cooling coil is served from the PCWS. The three-way valve to the chilled water cooling coil of the AHU is continuously modulated by the respective temperature-indicating controller to maintain the design temperature downstream of the cooling coils. The air is recirculated from the served areas, except for the battery room and chiller room, and is mixed with outside air to be used as supply air. The mixed air is filtered and cooled (or heated) through the supply AHU, and distributed to the compound building clean area subsystem boundary to maintain a suitable environment. The COL applicant is to provide the heating coil and cooling coil capacities as affected by site-specific conditions (COL 9.4(1)).

The air from the chiller room is exhausted to prevent excessive refrigerant accumulation in the event of a refrigerant leak. The chiller room is provided with one 100 percent capacity exhaust fan. The ventilation for chiller room is provided in accordance with ASHRAE 15.

The air in the battery is continuously exhausted to limit hydrogen accumulation to less than one percent of the total volume of the battery room based on NRC RG 1.128.

Cubicle coolers located in the electrical equipment rooms operate automatically by temperature switches to provide additional cooling for the areas with high cooling loads. Each cubicle cooler consists of a chilled water cooling coil, a fan, instrumentation and controls. The chilled water of the cooling coil is supplied from the PCWS.

The compound building clean area supply AHU operates only when the compound building controlled area exhaust air cleaning subsystem is available.

The smoke detectors are located at the downstream of the supply AHUs. When a smoke detector detects smoke, the supply AHU fans are automatically stopped. The return fan does not operate unless the supply AHU fan is running.

9.4.7.2.2 Compound Building Controlled Area HVAC Subsystem

The compound building controlled area HVAC subsystem includes:

a. Compound building controlled area supply subsystem

b. Compound building controlled area exhaust air cleaning subsystem

c. Hot machine shop exhaust air cleaning subsystem

The compound building controlled area HVAC subsystem is designed to maintain an environment suitable for all equipment and personnel in the potentially radioactive area of the compound building. This system also prevents the spreading of airborne radioactivity to surrounding areas by maintaining the laboratory and sample counting rooms at a negative pressure with respect to surrounding areas.

9.4.7.2.2.1 Compound Building Controlled Area Supply Subsystem

The compound building controlled area supply subsystem consists of two 50 percent capacity supply AHUs, and associated ductwork and duct accessories. Each AHU consists

of a prefilter, an electric heating coil, a chilled water cooling coil, and a fan, along with ducts, dampers, and related instrumentation. The chilled water of the cooling coil is supplied from the PCWS. The three-way valve to the chilled water cooling coil of the AHU is continuously modulated by the respective temperature-indicating controller to maintain the design temperature downstream of the cooling coils. The COL applicant is to provide the heating coil and cooling coil capacities as affected by site-specific conditions (COL 9.4(1)).

The compound building controlled area supply AHU operates only when both of the compound building controlled area exhaust air cleaning subsystem and hot machine shop exhaust air cleaning subsystem are available.

The smoke detectors are located at the downstream of the supply AHUs. When a smoke detector detects smoke, the supply AHU fans are automatically stopped.

9.4.7.2.2.2 Compound Building Controlled Area Exhaust Air Cleaning Subsystem

The compound building controlled area exhaust air cleaning subsystem is designed to maintain the areas of higher potential radioactive contamination under negative pressure with respect to surrounding areas of low potential radioactive contamination. More air is exhausted than supplied to maintain the building at a slightly negative pressure. The total supply airflow rate from two compound building controlled area supply AHUs is 82,240 cmh (48,400 cfm), and the total exhaust airflow rate through the compound building exhaust ACUs is 116,280 cmh (68,440 cfm). This minimizes the air exfiltration from the compound building controlled area to the system surrounding areas. The system maintains direction of airflow from areas of low potential radioactivity to areas of higher potential radioactivity. This system provides a filter and monitors the exhaust air to limit the release of airborne radioactivity to the outside. The exhaust air from the compound building controlled area including the gaseous effluents from the gaseous waste management system (GWMS) is filtered through the ACUs before it is released to the atmosphere. Radioactive effluents releases from the GWMS are described in Subsection 11.3.3.1.

The compound building controlled area exhaust air cleaning subsystem consists of two 50 percent capacity HEPA filter exhaust ACUs and two 50 percent capacity carbon adsorber

exhaust ACUs. The HEPA filter and carbon adsorber exhaust ACUs are designed to limit the release of airborne radioactivity to the outside.

Each HEPA filter exhaust ACU consists of a prefilter, a HEPA filter, and a fan, along with ducts, dampers, and related instrumentation. The HEPA filter exhaust ACUs operate while the radiation levels are below a preset value.

Each carbon adsorber exhaust ACU consists of a moisture separator, an electric heating coil, a prefilter, a HEPA filter, a carbon absorber, postfilter, and a fan, along with ducts, dampers, and related instrumentation. The electric heating coil is located upstream of the carbon adsorber to maintain the relative humidity of air entering the carbon adsorber below 70 percent to provide reasonable assurance of the carbon adsorber efficiency. A radiation monitor is provided at the common inlet duct of the HEPA filter exhaust ACUs and carbon adsorber exhaust ACUs to monitor the airborne radioactivity of the exhaust air from the compound building controlled area as described in Subsection 11.5.3. An alarm is actuated in the MCR when the radioactivity level exceeds the limited value. A radiation monitor is also provided at the common discharge ducts of the HEPA filter exhaust ACUs and carbon adsorber exhaust ACUs to sample air particulate and iodine prior to release to the environment as described in the Subsection 11.5.3.

Each HEPA filter exhaust ACU operates continuously. However, upon indication of high radioactivity from the radiation monitor at the common inlet duct of the HEPA filter exhaust ACUs and carbon adsorber exhaust ACUs, the HEPA filter exhaust ACU stops and the associated carbon adsorber exhaust ACU starts automatically. The isolation dampers upstream of the HEPA filter exhaust ACUs are automatically closed and isolation dampers upstream of the carbon adsorber exhaust ACUs are automatically opened. The operating carbon adsorber exhaust ACU controls the release of airborne radioactive materials from the compound building by maintaining the compound building controlled area under a slightly negative pressure and by collecting and processing the exhaust air prior to release to the atmosphere.

9.4.7.2.2.3 Hot Machine Shop Exhaust Air Cleaning Subsystem

The hot machine shop exhaust air cleaning subsystem is designed to maintain the hot machine shop complex including hot machine shop, hot tool room, hot instrument room, and welding room at a negative pressure with respect to outside to avoid uncontrolled

release of airborne contamination. More air is exhausted than supplied to maintain the building at a slightly negative pressure. The total supply airflow rate from compound building controlled area supply AHU is 3,910 cmh (2,300 cfm) in the hot machine shop complex and the total exhaust airflow rate through the hot machine shop exhaust ACU is 6,630 cmh (3,900 cfm). All exhaust air from the hot machine shop is discharged to the outside through the hot machine shop exhaust air cleaning unit. All air in the welding room is exhaust from the room through the hood to avoid fumes or gas accumulation and is discharged to outside through the hot machine shop exhaust air cleaning unit.

This subsystem consists of an exhaust ACU with a fan, prefilter, and HEPA filter.

The hot machine shop exhaust ACU operates continuously to provide a controlled environment for personnel access and controlled operation and to prevent the spread or release to atmosphere of airborne radioactive particulate materials from the hot machine shop complex. Radiation monitor is provided at the discharge duct of the hot machine shop exhaust ACU to monitor the airborne radioactivity of the exhaust air from the hot machine shop complex as described in Subsection 11.5.3. An alarm is actuated in the MCR when the radioactivity level exceeds the limited value.

9.4.7.3 Safety Evaluation

Since the compound building HVAC system is non-safety related, no safety evaluation is provided.

9.4.7.4 Inspection and Testing Requirements

The major components of the compound building HVAC system are checked periodically and tested to provide reasonable assurance of design operation and performance.

The compound building HVAC system is provided with proper instrumentation and devices capable of checking the design properties such as pressure drop, flow rate, and temperature. Controls, interlocks, and safety devices on the system are functionally checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation.

Preoperational testing of the compound building HVAC system is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

ACUs are factory inspected and tested for housing leakage, filter bypass leakage, and airflow performance. Periodically and subsequent to each filter or carbon adsorber replacement, the unit is inspected and tested in-place in accordance with the requirements of ASME N510, ASME AG-1, and NRC RG 1.140. The HEPA filters are periodically checked and carbon adsorber samples are tested for efficiency in an independent laboratory in accordance with NRC RG 1.140 and ASTM D 3803.

AHUs and cubicle coolers are factory inspected and tested in accordance with AMCA standards (References 12 and 13). Filters are inspected and tested in accordance with ASHRAE standards (Reference 11). Cooling coils are hydrostatically tested in accordance with ASME Section VIII. The cooling coil performance rating is developed in accordance with AHRI standards (References 14, 15, and 16).

Leak testing of system ductwork is performed in accordance with ASME N511 and ASME AG-1.

9.4.7.5 Instrumentation Requirements

Instrumentation is included to provide automatic or manual operation of the system from the radwaste control console located in compound building control room and permit verification that the system is operating satisfactorily.

Indication of the fan operating status is provided on the radwaste control console. Failure of a running fan is alarmed on the radwaste control console.

The instrumentation including indication and alarms of the ACUs in the compound building HVAC system is designed in accordance with the requirements of ASME N509.

The following instrumentation is provided in the MCR and RSR.

a. Alarm of smoke detection in the downstream of AHUs

The following instrumentation is provided in the radwaste control console.

a. Indication of carbon adsorber outlet air temperature

b. Indication of temperature downstream the electric heating coil of the AHUs and carbon adsorber exhaust ACUs

c. Indication of outlet airflow rate in the common exhaust duct of the ACUs

d. Alarm of airflow rate low downstream of the AHUs, compound building clean area return and exhaust fan

e. Alarm of air temperature low downstream of the electric heating coil of the AHUs

f. Alarm of air temperature low, high, high-high downstream of the electric heating coil of the carbon adsorber exhaust ACUs

g. Alarm of temperature high-high for room served by cubicle cooler

h. Alarm of carbon adsorber outlet air temperature high, high-high

i. Alarm of outlet airflow rate low, high in the exhaust duct downstream of the ACUs

j. Alarm on high radioactivity in the exhaust duct of ACUs

9.4.8 Design Features for Minimization of Contamination

The APR1400 HVAC systems that service building areas, which may contain radiologically contaminated materials, are designed with features to meet the requirements of 10 CFR 20.1406 and NRC RG 4.21. These systems comprise the fuel handling area HVAC system, the auxiliary building controlled area HVAC system, the reactor containment building HVAC system, the reactor containment building purge system, and the compound building HVAC system. The system components include design features designed to limit leakage and control the spread of contamination. The basic principles of NRC RG 4.21, and the

methods of control suggested in the regulations are specifically delineated into four design objectives and two operational objectives discussed in Subsection 12.3.1.10. The following summarizes the major features to address the design and operational objectives for the potentially contaminated building HVAC systems.

Prevention/Minimization of Unintended Contamination

a. The system components, including the air cleaning units (ACUs), air handling units (AHUs), cubicle coolers, and recirculating fans, are fabricated from materials such as carbon and stainless steels that are compatible with the chemical, physical, and radiological environment and are of welded construction for life-cycle planning. The design thus minimizes unintended leakage and unintended contamination of the facility and the environment.

b. For the reactor containment building HVAC system, the chilled water side of the AHUs and fan coolers is operated at a higher pressure than the containment environment to prevent the contamination of the chilled water. Corrosion inhibitor chemicals are also added to the chilled water system to minimize the potential of leakage due to corrosion.

c. The mounting frames of the HEPA filter and carbon adsorber are stainless steel and of welded construction for life-cycle planning and to prevent unfiltered in-leakage.

d. Doors and door frames are the marine bulkhead type or an equivalent airtight construction, thus minimizing leakage and unintended contamination of the facility and the environment.

e. All ACU housing penetrations are sealed by welds or adjustable compression-gland type seals to prevent unfiltered in-leakage.

f. All drain lines from ACUs, AHUs, and fan coolers are sloped and routed to the protective equipment drain.

Adequate and Early Leak Detection

a. The ACU housing leak test is performed in the manufacturer's shop prior to shipment and in the field following the recommended test frequency described in ASME N510 to prevent unfiltered in-leakage.

b. The mounting frame leak tests of HEPA filters and carbon adsorbers are performed in the manufacturer's shop prior to shipment and performed in accordance with ASME N510 recommended test frequencies at the site to prevent unfiltered in-leakage.

c. Radiation monitors are provided at the outlet of ACUs to monitor the radiological contamination levels to provide reasonable assurance that the effluent release limit will not be exceeded.

Reduction of Cross-Contamination, Decontamination, and Waste Generation

a. The ACU is designed to operate slightly below atmospheric pressure through the use of an induced fan. This design approach minimizes air leakage from the ACU to its surrounding. All ducts are of welded construction to minimize cross-contamination.

b. HVAC component housing surfaces are painted smooth for corrosion protection, ease of decontamination, and cleaning.

c. HEPA filters capture radioactive particles and carbon adsorbers remove organic and inorganic forms of iodine from the air stream, thus minimizing the spread of contamination and the resultant waste generation.

d. The low volume purge exhaust ACUs are equipped with medium and high efficiency particulate filters to capture radioactive particles and carbon adsorbers to remove organic and inorganic forms of iodine from the air stream. This design minimizes cross-contamination within the building. Because of the large air flow, the high volume purge exhaust ACUs are designed to have medium and high efficiency particulate filters to remove particulates from the air stream.

e. Adequate space is provided around the HVAC equipment to enable prompt assessment and responses when required.

Decommissioning Planning

a. The ACUs, AHUs, fan coolers, and recirculating fans are designed and fabricated as modular units and compartments for easy decommissioning.

Operations and documentation

a. Adequate work space between mounting frames for the ACUs is provided to facilitate maintenance and minimize the potential for the spread of contamination.

b. Carbon removal from the carbon adsorber is facilitated by the use of portable pneumatic carbon removal equipment to minimize spillage.

c. ACUs, AHUs, fan coolers, and recirculating fans are designed with adequate instrumentation to be remotely operated with manual initiation and stop from the main control room and the remote shutdown room.

d. The ACUs and AHUs are packaged units. Instruction manuals including assembly/disassembly procedures and maintenance/surveillance programs are provided from the equipment vendor.

Site Radiological Environmental Monitoring Program

a. The air quality around the plant is routinely sampled and analyzed for contamination levels and migration pathways as part of the Site Radiological Environmental Monitoring Program. The potentially contaminated building HVAC systems, as part of the overall plant, are expected to be included in this program.

9.4.9 Combined License Information

COL 9.4(1) The COL applicant is to provide the capacities of heating coils in the safety-related air handling units and cooling and heating coils in the non-safety related air handling units affected by site-specific conditions.

COL 9.4(2) The COL applicant is to provide the capacities of heating coils of electric duct heaters affected by site-specific conditions.

COL 9.4(3) The COL applicant is to provide the system design information of ESW intake structure and CCW heat exchanger building HVAC system including flow diagram, if the ESW intake structure and CCW heat exchanger building requires the HVAC system.

9.4.10 References

1. ASME AG-1-2009, "Code on Nuclear Air and Gas Treatment."

2. ASME N509-2002, "Nuclear Power Plant Air-Cleaning Units and Components."

3. ASME N510-2007, "Testing of Nuclear Air Treatment Systems."

4. ASME N511-2007, "In-Service Testing of Nuclear Air Treatment, Heating, Ventilation, and Air Conditioning System."

5. ASTM D 3803-1991, "Standard Test Method for Nuclear-Grade Activated Carbon."

6. ASME Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Facility Component," 2007 with 2008 Addenda.

7. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, "Rules for Construction of Pressure Vessels," 2010.

8. ASTM E741-00, 2000, "Standard Test Method for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution."

9. ASHRAE Handbook Fundamentals-2010.

10. ASHRAE 15-2010, “Safety Standard for Refrigeration Systems.”

11. ASHRAE 52.2-2007, “Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.”

12. ANSI/AMCA-210-2007, “Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.”

13. ANSI/AMCA 230-2007, “Laboratory Methods of Testing Air Circulator Fans for Rating.”

14. AHRI 410-2001, “Forced-Circulation Air-Cooling and Air-Heating Coils.”

15. AHRI 430-2009, “Performance of Rating of Central Station Air-Handling Units.”

16. AHRI 440-2008, “Performance Rating of Room Fan-coils.”

17. IEEE Std. 323-2003, “IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations.”

18. IEEE Std. 344-2004, “IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.”

19. IEEE Std. 603-1991, “IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations.”

20. NRC RG 1.13, Rev. 2, “Spent Fuel Storage Facility Design Basis.”

21. NRC RG 1.29, Rev. 4, “Seismic Design Classification.”

22. NRC RG 1.52, Rev. 4, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants.”

23. NRC RG 1.78, Rev. 1, “Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release.”

24. NRC RG 1.128, Rev. 2, “Installation Design and Installation of Vented Lead-Acid Storage Batteries for Nuclear Power Plants.”

25. NRC RG 1.140, Rev. 2, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants.”

26. NRC RG 1.155-1988, “Station Blackout,” August 1988.

27. NRC RG 1.183-2000, Rev.0, “Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors.”

28. NRC RG 1.197-2003, “Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors,” May 2003.

29. NRC RG 4.21, Rev.0, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning.”

30. NFPA 804-2010, “Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants.”

31. NUREG-0800 Branch Technical Position 6-4, Rev.3, “Containment Purging During Normal Plant Operations.”

Table 9.4.1-1 (1 of 3)

Equipment Parameters for Control Room HVAC System

1. Control room supply AHUs

Quantity per unit:	4 (2 at 100 % per division)
Type:	Draw-through
Seismic Category:	I

The control room supply AHUs are classified as safety-related and consist of the following components:

1.1 Prefilter (see Table 9.4.1-3)

1.2 Heating coil

Quantity per AHU:	1
Type:	Electric

1.3 Cooling coil

Type:	Chilled water
Capacity, kcal/hr (Btu/hr):	374,970 (1,488,000)

1.4 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	49,610 (29,200)

2. Control room emergency makeup ACUs

Quantity per unit:	2 (1 at 100 % per division)
Type:	Draw-through
Seismic Category:	I

The control room emergency makeup ACUs are classified as safety-related and consist of the following components:

2.1 Moisture separator

Type:	Impingement

2.2 Electric heating coil

Quantity per ACU:	2 at 100 %

2.3 Prefilter (see Table 9.4.1-3)

2.4 HEPA filter (see Table 9.4.1-3)

2.5 Carbon adsorber (see Table 9.4.1-3)

2.6 Postfilter (see Table 9.4.1-3)

Table 9.4.1-1 (2 of 3)

2.7	Fan	
	Quantity per ACU:	2 at 100 %
	Type:	Centrifugal
	Air flow rate, cmh (cfm):	13,592 (8,000)

3. Kitchen & toilet exhaust fan

Quantity per unit:	1
Type:	Vane axial
Air flow rate, cmh (cfm):	3,228 (1,900)
Seismic Category:	II

4. Smoke removal fan

Quantity per unit:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	9,345 (5,500)
Seismic Category:	II

5. Humidifier

Quantity per unit:	4 (1 at 100 % per division)
Type:	Electric steam
Seismic Category:	II

6. Computer room packaged air conditioning unit

Quantity per unit:	2
Type:	Draw-through
Seismic Category:	III

The control room packaged air conditioning units (PACUs) are classified as non-safety related and consist of the following components:

6.1	Prefilter (see Table 9.4.1-3)	
6.2	Cooling coil	
	Type:	Direct expansion
	Capacity, kcal/hr (Btu/hr):	72,766 (288,760)
6.3	Heating coil	
	Type:	Electric

Table 9.4.1-1 (3 of 3)

6.4.	Humidifier	
	Type:	Electric steam
6.5	Fan	
	Type:	Centrifugal
	Air flow rate, cmh (cfm):	21,917 (12,900)

Table 9.4.1-2 (1 of 3)

Control Room HVAC System Failure Modes and Effect Analysis

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
MCR Supply AHU HV01A HV01B HV01C HV01D	Fails to operate/ mechanical or electrical failure	Loss of supply of conditioned air to CRE None; redundant division is available.	Fan status, high-low airflow alarm, and fan motor trip alarm in the MCR and RSR	Redundant division is provided.
Emergency Makeup ACU AU01A AU01B	Fails to operate upon the demand signal/ mechanical or electrical failure	Loss of supply of filtered air to CRE None; redundant division is available.	Fan status, high-low airflow alarm, and fan motor trip alarm in the MCR and RSR	Redundant division is provided.
Air Intake Outside Isolation Damper Y0011A Y0011B Y0012A Y0012B	Failure of damper to open or close/ mechanical or electrical failure	Loss of supply of outside makeup air Loss of isolation of the contaminated outside air None; redundant air path is available.	Damper status indicates in the MCR and RSR.	Redundant outside air path remains available. The contaminated air path is isolated from outside air another damper in series.
Supply AHU Inlet Isolation Damper Y0013A Y0013C Y0014B Y0014D Y0015A Y0015C Y0016B Y0016D	Failure of damper to close upon the demand signal/ mechanical or electrical failure	Unfiltered outside air enters AHU and CRE None; redundant division is available.	Damper status indicates in the MCR and RSR.	Two dampers in series are provided so that failure of a single damper does not compromise system isolation. Redundant division is provided.

Table 9.4.1-2 (2 of 3)

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Supply AHU Outlet Flow Control Damper Y0021A Y0021C Y0022B Y0022D	Failure of damper to close/ mechanical or electrical failure	Loss of supply of conditioned air to CRE None; redundant division is available.	Low airflow alarm and damper status indicate in the MCR and RSR.	Redundant division is provided.
Emergency ACU Inlet Isolation Damper Y0017A Y0017C Y0018B Y0018D	Failure of damper to open upon the demand signal/mechanical or electrical failure	Loss of supply of filtered makeup air None; redundant division is available.	Damper status indicates in the MCR and RSR.	Redundant division is provided.
Emergency ACU Outlet Flow Control Damper Y0023A Y0023C Y0024B Y0024D	Failure of damper to close/mechanical or electrical failure	Loss of supply of filtered air to CRE None; redundant division is available.	Low airflow alarm and damper status indicate in the MCR and RSR.	Redundant division is provided.
Emergency ACU Return Air Isolation Damper Y0019A Y0019C Y0020B Y0020D	Failure of damper to open upon the demand signal/ mechanical or electrical failure	Loss of supply of filtered return air None; two dampers in series are provided.	Damper status indicates in the MCR.	Redundant division is provided.

Table 9.4.1-2 (3 of 3)

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Kitchen & Toilet Exhaust Isolation Damper Y0027 Y0028	Failure of damper to close upon the demand signal	Loss of isolation of the CRE from outside air None; redundant division is available.	Damper status indicates in the MCR and RSR.	Two dampers in series are provided so that failure of a single damper does not compromise system isolation.
Smoke Removal Exhaust Isolation Damper Y0029 Y0030	Failure of damper to close upon the demand signal	Loss of isolation of the CRE from outside air None; two dampers in series are provided.	Damper status indicates in the MCR and RSR.	Two dampers in series are provided so that failure of a single damper does not compromise system isolation.

Table 9.4.1-3

Typical Parameters of Filters and Adsorbers

	Safety-Related	Non-Safety Related
1. Prefilter		
Filter media	Glass fiber	Glass fiber
Efficiency (%)	90 ~ 95	85
2. HEPA filter		
Type	Nuclear grade	Nuclear grade
Filter media	Glass fiber	Glass fiber
Efficiency (%) for 0.3 micron particle (design basis)	99	99
Efficiency (%) for 0.3 micron particle (purchase specification)	99.97	99.97
3. Carbon adsorber		
Type	Single assembly, fixed and rechargeable in place (Type III)	Single assembly, fixed and rechargeable in place (Type III)
Filter media	Natural grain coconut shell	Natural grain coconut shell
Efficiency (%) (design basis)	99	90
4. Postfilter		
Filter media	Glass fiber	Glass fiber
Efficiency (%)	95	95

Table 9.4.2-1 (1 of 2)

Equipment Parameters for Fuel Handling Area HVAC System

1. Fuel handling area normal supply AHU

Quantity:	1 at 100 %
Type:	Draw-through
Seismic Category:	II

The fuel handling area normal supply AHUs are classified as non-safety related and consist of the following components:

1.1 Prefilter (see Table 9.4.1-3)

1.2 Heating coil

Type:	Electric

1.3 Cooling coil

Type:	Chilled water

1.4 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	46,638 (27,450)

2. Fuel handling area normal exhaust ACU

Quantity:	1
Type:	Draw-through
Seismic Category:	II

The fuel handling area normal exhaust ACUs are classified as non-safety related and consist of the following components:

2.1 Prefilter (see Table 9.4.1-3)

2.2 HEPA filter (see Table 9.4.1-3)

2.3 Fan

Quantity per ACU:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	48,337 (28,450)

Table 9.4.2-1 (2 of 2)

3. Fuel handling area emergency ACUs

Quantity:	2 (1 at 100 % per division)
Type:	Draw-through
Seismic Category:	I

The fuel handling area emergency exhaust ACUs are classified as safety-related and consist of the following components:

3.1 Moisture separator

Type:	Impingement

3.2 Electric heating coil

Quantity per ACU:	1

3.3 Prefilter (see Table 9.4.1-3)

3.4 HEPA Filter (see Table 9.4.1-3)

3.5 Carbon adsorber (see Table 9.4.1-3)

3.6 Postfilter (see Table 9.4.1-3)

3.7 Fan

Quantity per ACU: 1

Type: Centrifugal

Air flow rate, cmh (cfm): 8,495 (5,000)

4. Spent fuel pool cooling HX room cubicle coolers

Quantity:	2 at 100 % (1 per Room)
Type:	Draw-through
Seismic Category:	I

The spent fuel pool cooling HX room cubicle coolers consist of the following components:

4.1 Cooling coil

Type:	Chilled water
Capacity, kcal/hr (Btu/hr):	8,442 (33,500)

4.2 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	1,699 (1,000)

Table 9.4.2-2 (1 of 2)

Fuel Handling Area HVAC System Failure Modes and Effect Analysis

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Emergency Exhaust ACU AU02A AU02B	Fails to operate upon the demand signal/ mechanical or electrical failure	Loss of filtered exhaust air to atmosphere None; redundant division is available.	Fan status, high-low airflow alarm, and fan motor trip alarm in the MCR and RSR.	Redundant division is provided.
Normal Supply AHU Air Intake Isolation Damper Y0001A Y0002B	Failure of damper to close upon the demand signal/ mechanical or electrical failure	Loss of outside air isolation Loss of isolation from outside air None; redundant isolation damper is available	Damper status indicates in the MCR and RSR.	Redundant isolation damper remains available.
Normal Exhaust ACU Outlet Isolation Damper Y0003A Y0004B	Failure of damper to close upon the demand signal/ mechanical or electrical failure	Loss of outside air isolation Loss of isolation from outside air None; redundant isolation damper is available.	Damper status indicates in the MCR and RSR.	Redundant isolation damper remains available.
Emergency ACU Inlet Isolation Damper Y0005A Y0006B	Failure of damper to open upon the demand signal/ mechanical or electrical failure	Loss of filtered exhaust air to atmosphere None; redundant division is available.	Damper status indicates in the MCR.	Redundant division is provided.
Emergency ACU Outlet Flow Control Damper Y0007A Y0008B	Failure of damper to close/ mechanical or electrical failure	Loss of filtered exhaust air to atmosphere None; redundant division is available.	Low airflow alarm and damper status indicate in the MCR.	Redundant division is provided.

Table 9.4.2-2 (2 of 2)

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
SFP Cooling Heat Exchanger Room Cubicle Cooler HV02A HV02B	Fails to operate/ mechanical or electrical failure	Loss of room cooling None; redundant division is available.	Fan status, fan motor trip, and high-high room temperature alarm in the MCR.	Redundant division is provided.

Table 9.4.3-1 (1 of 4)

Equipment Parameters for Auxiliary Building Clean Area HVAC System

1. Auxiliary building clean area I supply AHU

Quantity:	1
Type:	Draw-through
Seismic Category:	II

The auxiliary building clean area I supply AHU is classified as non-safety related and consists of the following components:

1.1 Prefilter (see Table 9.4.1-3)

1.2 Heating coil

Type:	Electric

1.3 Cooling coil

Type:	Chilled water

1.4 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	57,596 (33,900)

2. Auxiliary building clean area II supply AHU

Quantity:	1
Type:	Draw-through
Seismic Category:	II

The auxiliary building clean area II supply AHU is classified as non-safety related and consists of the following components:

2.1 Prefilter (see Table 9.4.1-3)

2.2 Heating coil

Type:	Electric

2.3 Cooling coil

Type:	Chilled water

2.4 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	51,395 (30,250)

Table 9.4.3-1 (2 of 4)

3. Main steam valve room supply AHU

Quantity:	2 (1 at 100% per division)
Type:	Draw-through
Seismic Category:	II

The main steam valve room supply AHU is classified as non-safety related and consists of the following components:

3.1 Prefilter (see Table 9.4.1-3)

3.2 Cooling coil

Type:	Direct expansion

3.3 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	20,388 (12,000)

4. Auxiliary building clean area I exhaust fan

Quantity:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	53,604 (31,550)
Seismic Category:	II

5. Auxiliary building clean area II exhaust fan

Quantity:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	44,599 (26,200)
Seismic Category:	II

6. Chiller room supply fans

Quantity:	2 (1 at 100 % per division)
Type:	Vane axial
Air flow rate, cmh (cfm):	21,557 (12,700)
Seismic Category:	II

Table 9.4.3-1 (3 of 4)

7. Chiller room exhaust fans

Quantity:	2 (1 at 100 % per division)
Type:	Vane axial
Air flow rate, cmh (cfm):	21,577 (12,700)
Seismic Category:	II

8. Auxiliary building smoke removal fans

Quantity:	2 (1 at 100 % per division)
Type:	Vane axial
Air flow rate, cmh (cfm):	5,437 (3,200)
Seismic Category:	II

9. Main steam enclosure supply fans

Quantity:	4 (2 at 50 % per division)
Type:	Vane axial
Air flow rate, cmh (cfm):	15,290 (9,000)
Seismic Category:	II

10. Main steam enclosure low volume supply fans

Quantity:	2 (1 at 100 % per division)
Type:	Vane axial
Air flow rate, cmh (cfm):	6,800 (4,000)
Seismic Category:	II

Table 9.4.3-1 (4 of 4)

11. Cubicle coolers (CCs)

    Type: Draw-through

    The CCs consist of the following components:

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation (1)
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
Turbine-driven auxiliary feedwater (AFW) pump room CC (HV05)	Chilled Water	13,457 (53,400)	Centrifugal	2,718 (1,600)	II	NSR
Turbine-driven AFW pump room CC (HV06)	Chilled Water	13,457 (53,400)	Centrifugal	2,718 (1,600)	II	NSR
Essential chiller room CC A (HV31A)	Chilled Water	5,065 (20,100)	Centrifugal	1,019 (600)	I	SR
Essential chiller room CC B (HV31B)	Chilled Water	5,065 (20,100)	Centrifugal	1,019 (600)	I	SR
Essential chiller room CC C (HV32A)	Chilled Water	7,157 (28,400)	Centrifugal	1,444 (850)	I	SR
Essential chiller room CC D (HV32B)	Chilled Water	5,065 (20,100)	Centrifugal	1,019 (600)	I	SR
Motor-driven AFW pump room CC A (HV33A)	Chilled Water	43,041 (170,800)	Centrifugal	8,665 (5,100)	I	SR
Motor-driven AFW pump room CC B (HV33B)	Chilled Water	43,041 (170,800)	Centrifugal	8,665 (5,100)	I	SR

(1) SR = safety-related
    NSR = non-safety related

Table 9.4.3-2

Auxiliary Building Clean Area HVAC System Failure Modes and Effect Analysis

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Essential Chiller Room Cubicle Cooler HV31A HV31B HV32A HV32B	Fails to operate/ mechanical or electrical failure	Loss of room cooling None; redundant division is available.	Fan status, fan motor trip, and high-high room temperature alarm in the MCR.	Redundant division is provided.
Motor-Driven AFW Pump Room Cubicle Cooler HV33A HV33B	Fails to operate/ mechanical or electrical failure	Loss of room cooling None; redundant division is available.	Fan status, fan motor trip, and high-high room temperature alarm in the MCR.	Redundant division is provided.

Table 9.4.4-1 (1 of 5)

Equipment Parameters for Turbine Generator Building HVAC System

1. Turbine generator building roof exhaust fans

Quantity:	12 at 8 1/3 %
Type:	Propeller
Seismic Category:	III

2. Turbine generator building ground floor supply fans

Quantity:	12 at 8 1/3 %
Type:	Vane axial
Seismic Category:	III

3. HP/LP feedwater heater area supply fans

Quantity:	2 at 50 % each
Type:	Vane axial
Seismic Category:	III

4. Dearator floor roof supply fans

Quantity:	4 at 25 % each
Type:	Vane axial
Seismic Category:	III

5. MS/FW piping area supply fan

Quantity:	2 at 50 %
Type:	Vane axial
Seismic Category:	III

6. Turbine generator building gravity roof ventilators

Quantity:	42 at 2-8/21 % each
Type:	Gravity
Seismic Category:	III

7. Exciter control cubicle room exhaust fan

Quantity:	1 at 100%
Type:	Propeller
Seismic Category:	III

Table 9.4.4-1 (2 of 5)

8. Battery room exhaust fan

Quantity:	1 at 100 %
Type:	Propeller
Seismic Category:	III

9. Battery room supply fan

Quantity:	1 at 100 %
Type:	Centrifugal
Seismic Category:	III

10. Condensate polishing area exhaust fan

Quantity:	1 at 100 %
Type:	Vane axial
Seismic Category	III

11. Lube oil storage exhaust fan

Quantity:	1 at 100 %
Type:	Centrifugal
Seismic Category	III

12. Chemical handling room exhaust fan

Quantity:	1 at 100 %
Type:	Centrifugal
Seismic Category	III

13. Turbine lube oil room exhaust fan

Quantity:	1 at 100 %
Type:	Centrifugal
Seismic Category	III

14. Switchgear area exhaust fan

Quantity:	1 at 100%
Type:	Vane axial
Seismic Category:	III

Table 9.4.4-1 (3 of 5)

15. Switchgear area exhaust fan

Quantity:	1at 100%
Type:	Vane axial
Seismic Category:	III

16. Switchgear area exhaust fan

Quantity:	1at 100%
Type:	Vane axial
Seismic Category:	III

17. Repair shop and office area supply AHU

Quantity:	1
Type:	Draw-through
Seismic Category:	III

The repair shop and office area supply AHU is classified as non-safety related and consists of the following components:

17.1 Prefilter (see Table 9.4.1-3)

17.2 Cooling Coil

Type:	Chilled water

17.3 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	20,400 (12,000)

18. Repair shop and office area return fan

Quantity:	1 at 100 %
Type:	Centrifugal
Seismic Category	III

19. Repair shop and office area exhaust fan

Quantity:	1 at 100 %
Type:	Centrifugal
Seismic Category	III

Table 9.4.4-1 (4 of 5)

20. Exciter control cubicle room packaged air conditioning unit (PACU)

Quantity:	1
Type:	Draw-through
Seismic Category:	III

The PACU is classified as non-safety related and consists of the following components:

20.1 Prefilter (see Table 9.4.1-3)

20.2 Cooling Coil

Type:	Chilled water

20.3 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	20,400 (12,000)

Table 9.4.4-1 (5 of 5)

21. Cubicle coolers (CCs)

Type: Draw-through

The CCs consist of the following components:

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation (1)
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
Turbine Generator Building Basement Floor CC (HV01/02/03)	Chilled Water	391,864 (1,550,000)	Centrifugal	53,900 (31,700)	III	NSR
Main Steam Stop Valve Area CC (HV04)	Chilled Water	85,427 (339,000)	Centrifugal	11,900 (7,000)	III	NSR
Switchgear Room Basement Floor CC (HV06)	Chilled Water	55,691 (221,000)	Centrifugal	10,200 (6,000)	III	NSR
Switchgear Room Ground Floor CC (HV07)	Chilled Water	56,951 (226,000)	Centrifugal	10,200 (6,000)	III	NSR
Switchgear Room Operating Floor CC (HV08)	Chilled Water	60,731 (241,000)	Centrifugal	10,880 (6,400)	III	NSR
Exciter Control Cubicle Room CC (HV09)	Chilled Water	108,106 (429,000)	Centrifugal	23,800 (14,000)	III	NSR
Mux. Cabinet Room CC (HV10)	Chilled Water	11,844 (47,000)	Centrifugal	2,550 (1,500)	III	NSR
Control Panel Room CC (HV11)	Chilled Water	15,372 (61,000)	Centrifugal	3,400 (2,000)	III	NSR
Main Feedwater Pump Control Panel Area CC (HV12)	Chilled Water	73,331 (291,000)	Centrifugal	5,100 (3,000)	III	NSR
MUX Cabinet Room CC (HV13)	Chilled Water	11,844 (47,000)	Centrifugal	2,550 (1,500)	III	NSR
CP Control Room CC (HV14)	Chilled Water	11,088 (44,000)	Centrifugal	2,400 (1,400)	III	NSR

(1) SR: safety-related
NSR: non-safety related

Table 9.4.5-1 (1 of 3)

Equipment Parameters for Engineered Safety Feature Ventilation System

1. Emergency diesel generator area HVAC system

1.1 Emergency diesel generator room normal supply AHUs

Quantity:	4 at 100 % (1 per EDG Room)
Type:	Draw-through
Seismic Category:	I

Each normal supply AHUs is classified as safety-related and consists of the following components:

1.1.1 Prefilter (see Table 9.4.1-3)

1.1.2 Heating coil

Type:	Electric

1.1.3 Cooling coil

Type:	Chilled water
Capacity, kcal/hr (Btu/hr):	42,638 (169,200) (Train A&B) / 52,894 (209,900) (Train C&D)

1.1.4 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	9,174 (5,400) (Train A&B) / 11,383 (6,700) (Train C&D)

1.2 Emergency diesel generator room exhaust fans

Quantity:	4 at 100 % (1 per EDG room)
Type:	Vane axial
Air flow rate, cmh (cfm):	8,325 (4,900) (Train A&B) / 10,533 (6,200) (Train C&D)
Seismic Category:	I

Table 9.4.5-1 (2 of 3)

1.3. Emergency diesel generator room emergency cubicle coolers

Quantity:	2 at 50 % (2 per EDG room)
Type:	Draw-through
Seismic Category:	I

Each emergency diesel generator room emergency cubicle cooler consists of the following components:

1.3.1 Cooling coil

Type:	Chilled water
Capacity, kcal/hr (Btu/hr):	299,951 (1,190,300)

1.3.2 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	28,881 (17,000) each

1.4 Diesel fuel oil storage tank room supply fans

Quantity:	4 at 100 % (1 per tank room)
Type:	Vane axial
Air flow rate, cmh (cfm):	3,398 (2,000)
Seismic Category:	I

1.5 Diesel fuel oil storage tank room exhaust fans

Quantity:	4 at 100% (1 per tank room)
Type:	Vane axial
Air flow rate, cmh (cfm):	3,398 (2,000)
Seismic Category:	I

1.6 Diesel fuel oil day tank and lube oil makeup tank room exhaust fans

Quantity:	4 at 100 % (1 per tank room)
Type:	Vane axial
Air flow rate, cmh (cfm):	850 (500)
Seismic Category:	I

Table 9.4.5-1 (3 of 3)

1.7 Emergency diesel generator room electric duct heaters

Quantity:	2 at 100 % (1 per EDG room in the EDG building)
Seismic Category:	I

1.8 Diesel fuel oil storage tank room electric duct heaters

Quantity:	4 at 100 % (1 per tank room)
Seismic Category:	I

1.9 Emergency diesel generator control room cubicle cooler

Quantity:	4 at 100 % (1per EDG control room)
Type:	Draw-through
Seismic Category:	I

Each of the emergency diesel generator control room cubicle coolers consists of the following components:

1.9.1. Cooling coil

Type:	Chilled water
Capacity, kcal/hr (Btu/hr):	16,884 (67,000) (Train A&B) 11,819 (46,900) (Train C&D)

1.9.2. Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	3,398 (2,000) (Train A&B) 2,209 (1,300) (Train C&D)

Table 9.4.5-2 (1 of 7)

Equipment Parameters for Engineered Safety Feature Ventilation System

2. Electrical and I&C equipment areas HVAC system

2.1 Train-A/C/D battery room supply fans

Quantity:	1 at 100 % (1 per train)
Type:	Vane axial
Air flow rate, cmh (cfm):	3,570 (2,100)
Seismic Category:	I

2.2 Train-B battery room supply fan

Quantity:	1 at 100 %
Type:	Vane axial
Air flow rate, cmh (cfm):	4,420 (2,600)
Seismic Category:	I

2.3 Train-A/C/D battery room exhaust fans

Quantity:	1 at 100 % (1 per train)
Type:	Vane axial
Air flow rate, cmh (cfm):	3,570 (2,100)
Seismic Category:	I

2.4 Train-B battery room exhaust fans

Quantity:	1 at 100 %
Type:	Vane axial
Air flow rate, cmh (cfm):	4,420 (2,600)
Seismic Category:	I

2.5 Remote shutdown room supply fans

Quantity:	2 (1 at 100 % per division)
Type:	Vane axial
Air flow rate, cmh (cfm):	1,020 (600)
Seismic Category:	I

Table 9.4.5-2 (2 of 7)

2.6 Remote shutdown room exhaust fans

Quantity:	2 (1 at 100 % per division)
Type:	Vane axial
Air flow rate, cmh (cfm):	935 (550)
Seismic Category:	I

2.7 Non-1E battery room exhaust fans

Quantity:	2 (1 at 100 % per division)
Type:	Vane axial
Air flow rate, cmh (cfm):	2,210 (1,300)
Seismic Category:	II

2.8 CEDM M/G Set supply AHU

Quantity:	1 at 100 %
Type:	Draw-through
Seismic Category:	II

The CEDM M/G set supply AHU is classified as non-safety related and consists of the following components:

2.8.1 Cooling coil

Type:	Chilled water
Capacity, kcal/hr (Btu/hr)	108,860 (432,000)

2.8.2 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm)	19,880 (11,700)

2.9 Remote control console room PACU

Quantity:	1 at 100 %
Type:	Draw-through
Seismic Category:	II

Table 9.4.5-2 (3 of 7)

The PACU is classified as non-safety related and consists of the following components:

2.9.1 Prefilter (see Table 9.4.1-3)

2.9.2 Cooling coil

Type: Direct expansion

2.9.3 Heating coil

Type: Electric

2.9.4 Humidifier

Type: Electric steam

2.9.5 Fan

Type: Centrifugal

Air flow rate, cmh (cfm): 2,380 (1,400)

2.10 Train-A/B/C/D battery room electric duct heater

Quantity: 1 at 100 %

Seismic Category: I

2.11 Remote shutdown room electric duct heaters

Quantity: 2 (1 at 100 % per division)

Seismic Category: I

2.12 Cubicle coolers (CCs)

Type: Draw-through

The CCs consist of the following components:

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation (2)
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
Class 1E switchgear 01C room CC (HV01A)	Chilled water	19,404 (77,000)	Centrifugal	3,910 (2,300)	I	SR
Class 1E switchgear 01D room CC (HV01B)	Chilled water	19,404 (77,000)	Centrifugal	3,910 (2,300)	I	SR
Class 1E load center 01C room CC (HV02A)	Chilled water	23,688 (94,000)	Centrifugal	4,760 (2,800)	I	SR
Class 1E load center 01D room CC (HV02B)	Chilled water	23,688 (94,000)	Centrifugal	4,760 (2,800)	I	SR

Table 9.4.5-2 (4 of 7)

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation (2)
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
Channel A DC&IP equipment room CC (HV03A)	Chilled water	49,319 (195,000)	Centrifugal	8,840 (5,200)	I	SR
Channel B DC&IP equipment room CC (HV03B)	Chilled water	52,667 (209,000)	Centrifugal	9,350 (5,500)	I	SR
Channel C DC&IP equipment room CC (HV04A)	Chilled water	65,267 (259,000)	Centrifugal	10,710 (6,300)	I	SR
Channel D DC&IP equipment room CC (HV04B)	Chilled water	65,267 (259,000)	Centrifugal	10,710 (6,300)	I	SR
480V Class 1E MCC 01A room CC (HV06A)	Chilled water	2,772 (11,000)	Centrifugal	510 (300)	I	SR
480V Class 1E MCC 01B room CC (HV06B)	Chilled water	2,772 (11,000)	Centrifugal	510 (300)	I	SR
Class 1E switchgear 01A room CC (HV07A)	Chilled water	33,767 (134,000)	Centrifugal	6,460 (3,800)	I	SR
Class 1E switchgear 01B room CC (HV07B)	Chilled water	42,083 (167,000)	Centrifugal	7,990 (4,700)	I	SR
Swing load center room CC (HV08B)	Chilled water	3,528 (14,000)	Centrifugal	680 (400)	I	SR
Electrical penetration room CC (HV09A)	Chilled water	9,324 (37,000)	Centrifugal	1,870 (1,100)	I	SR
Electrical penetration D room CC (HV09B)	Chilled water	9,324 (37,000)	Centrifugal	1,870 (1,100)	I	SR
480V Class 1E MCC 03C room CC (HV10A)	Chilled water	6,804 (27,000)	Centrifugal	1,360 (800)	I	SR
480V Class 1E MCC 03D room CC (HV10B)	Chilled water	6,048 (24,000)	Centrifugal	1,190 (700)	I	SR
Electrical penetration room C CC (HV11A)	Chilled water	10,332 (41,000)	Centrifugal	2,340 (1,200)	I	SR
Electrical penetration room D CC (HV11B)	Chilled water	10,332 (41,000)	Centrifugal	2,340 (1,200)	I	SR

Table 9.4.5-2 (5 of 7)

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation [(2)]
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
Penetration MUX A room CC (HV12A)	Chilled water	14,616 (58,000)	Centrifugal	4,420 (2,600)	I	SR
Penetration MUX B room CC (HV12B)	Chilled water	19,404 (77,000)	Centrifugal	5,610 (3,300)	I	SR
Electrical penetration room A CC (HV13A)	Chilled water	8,820 (35,000)	Centrifugal	1,700 (1,000)	I	SR
Electrical penetration room B CC (HV13B)	Chilled water	8,820 (35,000)	Centrifugal	1,700 (1,000)	I	SR
480V Class 1E MCC 03A room CC (HV14A)	Chilled Water	5,292 (21,000)	Centrifugal	1,020 (600)	I	SR
480V Class 1E MCC 03B room CC (HV14B)	Chilled Water	3,528 (14,000)	Centrifugal	680 (400)	I	SR
480V Class 1E MCC 04A room CC (HV15A)	Chilled Water	5,292 (21,000)	Centrifugal	1,020 (600)	I	SR
480V Class 1E MCC 04B room CC (HV15B)	Chilled Water	3,528 (14,000)	Centrifugal	680 (400)	I	SR
I&C equipment room A CC (HV16A)	Chilled Water	18,900 (75,000)	Centrifugal	5,440 (3,200)	I	SR
I&C equipment room B CC (HV16B)	Chilled Water	25,200 (100,000)	Centrifugal	7,310 (4,300)	I	SR
I&C equipment room C CC (HV17A)	Chilled Water	25,704 (102,000)	Centrifugal	7,480 (4,400)	I	SR
I&C equipment room D CC (HV17B)	Chilled Water	25,704 (102,000)	Centrifugal	7,480 (4,400)	I	SR
Remote shutdown room CC (HV18A/18B)	Chilled Water	16,632 (66,000)	Centrifugal	4,760 (2,800)	I	SR
PNS switchgear room CC (HV41)	Chilled Water	31,248 (124,000)	Centrifugal	6,290 (3,700)	II	NSR
PNS switchgear room CC (HV42)	Chilled Water	31,248 (124,000)	Centrifugal	6,290 (3,700)	II	NSR
480V N1E MCC room CC (HV43)	Chilled Water	2,772 (11,000)	Centrifugal	510 (300)	II	NSR

Table 9.4.5-2 (6 of 7)

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation (2)
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
MUX N2 room CC (HV44)	Chilled Water	7,056 (28,000)	Centrifugal	2,040 (1,200)	II	NSR
MUX N1 room CC (HV45)	Chilled Water	7,056 (28,000)	Centrifugal	2,040 (1,200)	II	NSR
Electrical equipment room CC (HV46)	Chilled Water	11,844 (47,000)	Centrifugal	2,380 (1,400)	II	NSR
Electrical equipment room CC (HV47)	Chilled Water	27,972 (111,000)	Centrifugal	5,610 (3,300)	II	NSR
Electrical equipment room CC (HV48)	Chilled Water	27,972 (111,000)	Centrifugal	5,610 (3,300)	II	NSR
N1E DC&IP equipment room CC (HV49)	Chilled Water	41,075 (163,000)	Centrifugal	8,330 (4,900)	II	NSR
N1E DC&IP equipment room CC (HV50)	Chilled Water	62,999 (250,000)	Centrifugal	12,750 (7,500)	II	NSR
Electrical equipment room CC (HV51)	Chilled Water	28,728 (114,000)	Centrifugal	5,780 (3,400)	II	NSR
MUX N2 room CC (HV52)	Chilled Water	5,796 (23,000)	Centrifugal	1,700 (1,000)	II	NSR
Electrical equipment room CC (HV53)	Chilled Water	20,412 (81,000)	Centrifugal	4,080 (2,400)	II	NSR
Electrical equipment room CC (HV54)	Chilled Water	19,404 (77,000)	Centrifugal	3,910 (2,300)	II	NSR
Electrical equipment room CC (HV55)	Chilled Water	26,208 (104,000)	Centrifugal	5,270 (3,100)	II	NSR
Electrical equipment room CC (HV56)	Chilled Water	47,879 (190,000)	Centrifugal	9,690 (5,700)	II	NSR
I&C equipment room CC (HV57)	Chilled Water	22,932 (91,000)	Centrifugal	6,626 (3,900)	II	NSR

Table 9.4.5-2 (7 of 7)

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation (2)
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
I&C equipment room CC (HV58)	Chilled Water	25,704 (102,000)	Centrifugal	7,476 (4,400)	II	NSR
Electrical equipment room CC (HV59)	Chilled Water	16,128 (64,000)	Centrifugal	3,230 (1,900)	II	NSR
480V N1E MCC room CC (HV60)	Chilled Water	19,404 (77,000)	Centrifugal	3,910 (2,300)	II	NSR

(1) SR = safety-related
NSR = non-safety related

Table 9.4.5-3 (1 of 6)

Equipment Parameters for Engineered Safety Feature Ventilation System

3 Auxiliary building controlled area HVAC system

3.1 Auxiliary building controlled area supply AHUs

Quantity: 2 (1 at 100 % per division)

Type: Draw-through

Seismic Category: II

The auxiliary building controlled area supply AHUs are classified as non-safety related and each of the supply AHUs consists of the following components:

3.1.1 Prefilter (see Table 9.4.1-3)

3.1.2 Heating Coil

Type: Electric

3.1.3 Cooling coil

Type: Chilled water

3.1.4 Fan

Type: Centrifugal

Air flow rate, cmh (cfm): 62,520 (36,800) [Div I], 60,821 (35,800) [Div II]

3.2 HELB area supply AHU

Quantity: 1

Type: Draw-through

Seismic Category: II

The HELB area supply AHU is classified as non-safety related and consists of the following components:

3.2.1 Prefilter (see Table 9.4.1-3)

3.2.2 Heating Coil

Type: Electric

3.2.3 Cooling coil

Type: Chilled water

3.2.4 Fan

Type: Centrifugal

Air flow rate, cmh (cfm): 14,611 (8,600)

Table 9.4.5-3 (2 of 6)

3.3 Auxiliary building controlled area normal exhaust ACUs

Quantity: 4 (2 at 100 % per division)

Type: Draw-through

Seismic Category: II

The auxiliary building controlled area normal exhaust ACUs are classified as non-safety related and each of the normal exhaust ACUs consists of the following components:

3.3.1 Moisture separator

Type: Impingement

3.3.2 Electric heating coil

Quantity per ACU: 1

3.3.3 Prefilter (see Table 9.4.1-3)

3.3.4 HEPA filter (see Table 9.4.1-3)

3.3.5 Carbon adsorber (see Table 9.4.1-3)

3.3.6 Postfilter (see Table 9.4.1-3)

3.3.7 Fan

Quantity per ACU: 1

Type: Centrifugal

Air flow rate, cmh (cfm): 64,559 (38,000) [Div I], 61,416 (36,150) [Div II]

3.4 Auxiliary building controlled area emergency exhaust ACUs

Quantity: 4 (2 at 100 % per division)

Type: Draw-through

Seismic Category: I

The auxiliary building controlled area emergency exhaust ACUs are classified as safety-related and each of the emergency exhaust ACUs consists of the following components:

3.4.1 Moisture separator

Type: Impingement

3.4.2 Electric heating coil

Quantity per ACU: 1

3.4.3 Prefilter (see Table 9.4.1-3)

3.4.4 HEPA filter (see Table 9.4.1-3)

3.4.5 Carbon adsorber (see Table 9.4.1-3)

Table 9.4.5-3 (3 of 6)

3.4.6 Postfilter (see Table 9.4.1-3)

3.4.7 Fan

Quantity per ACU:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	5,097 (3,000)

3.5 HELB area exhaust ACUs

Quantity:	2
Type:	Draw-through
Seismic Category:	II

The HELB area exhaust ACUs are classified as non-safety related and each of the exhaust ACUs consists of the following components:

3.5.1 Moisture separator

Type:	Impingement

3.5.2 Electric heating coil

Quantity per ACU:	1

3.5.3 Prefilter (see Table 9.4.1-3)

3.5.4 HEPA filter (see Table 9.4.1-3)

3.5.5 Carbon adsorber (see Table 9.4.1-3)

3.5.6 Postfilter (see Table 9.4.1-3)

3.5.7 Fan

Quantity per ACU:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	15,290 (9,000)

Table 9.4.5-3 (4 of 6)

3.6 Cubicle Coolers

Type: Draw-through

The cubicle coolers consist of the following components:

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation (1)
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
CS pump and mini-flow HX room CC (HV10A)	Chilled Water	44,099 (175,000)	Centrifugal	8,834 (5,200)	I	SR
CS pump and mini-flow HX room CC (HV10B)	Chilled Water	44,099 (175,000)	Centrifugal	8,834 (5,200)	I	SR
SI pump room CC (HV11A)	Chilled Water	41,327 (164,000)	Centrifugal	8,155 (4,800)	I	SR
SI pump room CC (HV11B)	Chilled Water	41,327 (164,000)	Centrifugal	8,155 (4,800)	I	SR
SI pump room CC (HV12A)	Chilled Water	41,579 (165,000)	Centrifugal	8,325 (4,900)	I	SR
SI pump room CC (HV12B)	Chilled Water	41,579 (165,000)	Centrifugal	8,325 (4,900)	I	SR
CCW pump room CC (HV13A)	Chilled Water	41,579 (165,000)	Centrifugal	5,267 (3,100)	I	SR
CCW pump room CC (HV13B)	Chilled Water	41,579 (165,000)	Centrifugal	5,267 (3,100)	I	SR
CCW pump room CC (HV14A)	Chilled Water	41,831 (166,000)	Centrifugal	5,267 (3,100)	I	SR
CCW pump room CC (HV14B)	Chilled Water	41,831 (166,000)	Centrifugal	5,267 (3,100)	I	SR
CS HX room CC (HV15A)	Chilled Water	16,884 (67,000)	Centrifugal	3,398 (2,000)	I	SR
CS HX room CC (HV15B)	Chilled Water	16,884 (67,000)	Centrifugal	3,398 (2,000)	I	SR
SC pump and mini-flow HX room CC (HV16A)	Chilled Water	36,287 (144,000)	Centrifugal	7,305 (4,300)	I	SR
SC pump and mini-flow HX room CC (HV16B)	Chilled Water	36,287 (144,000)	Centrifugal	7,305 (4,300)	I	SR

Table 9.4.5-3 (5 of 6)

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation (1)
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
SC HX room CC (HV17A)	Chilled Water	8,820 (35,000)	Centrifugal	1,699 (1,000)	I	SR
SC HX room CC (HV17B)	Chilled Water	8,820 (35,000)	Centrifugal	1,699 (1,000)	I	SR
Charging pump room CC (HV18A)	Chilled Water	35,531 (141,000)	Centrifugal	7,135 (4,200)	I	SR
Charging pump room CC (HV18B)	Chilled Water	35,531 (141,000)	Centrifugal	7,135 (4,200)	I	SR
Mechanical penetration room CC (HV19A)	Chilled Water	8,568 (34,000)	Centrifugal	1,699 (1,000)	I	SR
Mechanical penetration room CC (HV19B)	Chilled Water	19,404 (77,000)	Centrifugal	3,908 (2,300)	I	SR
Mechanical penetration room CC (HV20A)	Chilled Water	26,208 (104,000)	Centrifugal	5,267 (3,100)	I	SR
Mechanical penetration room CC (HV20B)	Chilled Water	19,404 (77,000)	Centrifugal	3,908 (2,300)	I	SR
Aux. charging pump room CC (HV21B)	Chilled Water	12,852 (51,000)	Centrifugal	2,548 (1,500)	I	SR
Aux. bldg controlled area emergency exhaust ACU room CC (HV22A)	Chilled Water	8,568 (34,000)	Centrifugal	1,699 (1,000)	I	SR
Aux. bldg controlled area emergency exhaust ACU room CC (HV22B)	Chilled Water	8,568 (34,000)	Centrifugal	1,699 (1,000)	I	SR
Aux. bldg controlled area emergency exhaust ACU room CC (HV23A)	Chilled Water	8,568 (34,000)	Centrifugal	1,699 (1,000)	I	SR
Aux. bldg controlled area emergency exhaust ACU room CC (HV23B)	Chilled Water	8,568 (34,000)	Centrifugal	1,699 (1,000)	I	SR

Table 9.4.5-3 (6 of 6)

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation [1]
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
Condensate return pump CC (HV30) [2]	Chilled Water	17,640 (70,000)	Centrifugal	3,398 (2,000)	II	NSR
Gas stripper room CC (HV31) [2]	Chilled Water	46,619 (185,000)	Centrifugal	9,344 (5,500)	II	NSR
Boric acid conc. Pump room CC (HV32) [2]	Chilled Water	46,619 (185,000)	Centrifugal	9,004 (5,300)	II	NSR
SG blowdown flash tank room CC (HV33) [2]	Chilled Water	28,980 (115,000)	Centrifugal	5,776 (3,400)	II	NSR
Boric acid makeup pump room CC (HV34) [2]	Chilled Water	11,844 (47,000)	Centrifugal	2,378 (1,400)	II	NSR
General access area CC (HV35)	Chilled Water	8,568 (34,000)	Centrifugal	1,699 (1,000)	II	NSR
General access area CC (HV36)	Chilled Water	12,852 (51,000)	Centrifugal	2,548 (1,500)	II	NSR

(1) SR: safety-related, NSR: non-safety related

(2) Cubicle cooler is located in the HELB area of the auxiliary building controlled area.

Table 9.4.5-4 (1 of 3)

Engineered Safety Feature Ventilation System Failure Modes and Effect Analysis

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Emergency Diesel Generator Area HVAC System				
EDG Room Normal Supply AHU HV11A/B/C/D	Fails to operate/ mechanical or electrical failure	Loss of supply of conditioned air to EDG room None; three redundant trains are available.	Fan status, fan motor trip alarm, high-high room temperature, high-low airflow alarm, and smoke detection alarm in the MCR and RSR.	Three redundant trains are provided.
EDG Room Emergency Cubicle Cooler HV12A/B/C/D HV13A/B/C/D	Fails to operate / mechanical or electrical failure	Loss of room cooling None; three redundant trains are available.	Fan status, fan motor trip alarm, low differential pressure, and high-high room temperature alarm in the MCR and RSR.	Three redundant trains are provided.
EDG Control Room Cubicle Cooler HV10A/B/C/D	Fails to operate / mechanical or electrical failure	Loss of room cooling None; three redundant trains are available.	Fan status, fan motor trip alarm, and high-high room temperature alarm in the MCR and RSR.	Three redundant trains are provided.
EDG Room Exhaust Fan, Diesel Fuel Oil Day Tank and Lube Oil Makeup Tank Room Exhaust Fan AH02A/B/C/D, AH07A/B/C/D	Fails to operate / mechanical or electrical failure	Loss of exhaust air from rooms None; three redundant trains are available.	Fan status, fan motor trip alarm, and low differential pressure alarm in the MCR and RSR.	Three redundant trains are provided.
Diesel Fuel Oil Storage Tank Room Supply Fan AH05A/B/C/D	Fails to operate / mechanical or electrical failure	Loss of supply air to Diesel Fuel Oil Storage Tank room None; three redundant trains are available	Fan status, fan motor trip alarm, and low differential pressure alarm in the MCR and RSR.	Three redundant trains are provided.
Diesel Fuel Oil Storage Tank Room Exhaust Fan AH06A/B/C/D	Fails to operate / mechanical or electrical failure	Loss of exhaust air from Diesel Fuel Oil Storage Tank room None; three redundant trains are available	Fan status, fan motor trip alarm, and low differential pressure alarm in the MCR and RSR.	Three redundant trains are provided.

Table 9.4.5-4 (2 of 3)

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Electrical and I&C Equipment Areas HVAC System				
Safety-Related Cubicle Cooler HV01A~04A HV06A,07A HV09A~18A HV01B~04B HV06B~18B	Fails to operate/ mechanical or electrical failure	Loss of room cooling None; redundant division is available.	Fan status, fan motor trip alarm, and high-high room temperature alarm in the MCR and RSR.	Redundant division is provided.
Class 1E Battery Room Supply Fan AH20A AH20B AH20C AH20D	Fails to operate/ mechanical or electrical failure	Loss of supply of air to Class 1E battery room None; redundant division is available.	Fan status, fan motor trip alarm, and low differential pressure alarm in the MCR and RSR.	Redundant division is provided.
Class 1E Battery Room Exhaust Fan AH21A AH21B AH21C AH21D	Fails to operate/ mechanical or electrical failure	Loss of exhaust of air to Class 1E battery room None; redundant division is available.	Fan status, fan motor trip alarm, low differential pressure alarm in the MCR and RSR.	Redundant division is provided.
RSR Room Supply Fan AH22C AH22D	Fails to operate/ mechanical or electrical failure	Loss of supply of air to RSR room None; redundant supply fan is available.	Fan status, fan motor trip alarm, and low flow rate alarm in the MCR and RSR.	Redundant supply fan is provided.
RSR Room Exhaust Fan AH23C AH23D	Fails to operate/ mechanical or electrical failure	Loss of exhaust of air to RSR room None; redundant exhaust fan is available.	Fan status, fan motor trip alarm, and low flow rate alarm in the MCR and RSR.	Redundant exhaust fan is provided.

Table 9.4.5-4 (3 of 3)

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Auxiliary Building Controlled Area HVAC System				
Auxiliary Building Controlled Area Emergency Exhaust ACU AU01 A/B/C/D	Fails to operate upon the demand signal / mechanical or electrical failure	Loss of filtered exhaust air to atmosphere None; a redundant ACU is available.	Fan status, high-low airflow alarm, and fan motor trip alarm in the MCR and RSR.	A redundant ACU is provided.
Emergency Exhaust ACU Inlet Isolation Damper Y0002 A/B/C/D	Failure of damper to open upon the demand signal / mechanical or electrical failure	Loss of filtered exhaust air to atmosphere None; a redundant ACU is available.	Damper status indicates in the MCR and RSR.	A redundant ACU is provided.
Emergency Exhaust ACU Outlet Flow Control Damper Y0001 A/B/C/D	Failure of damper to open upon the demand signal / mechanical or electrical failure	Loss of filtered exhaust air to atmosphere None; a redundant ACU is available.	Damper status indicates in the MCR and RSR.	A redundant ACU is provided.
Supply AHU Outlet Isolation Damper Y0017A/19B, Y0018A/20B	Failure of damper to close upon the A redundant isolation damper demand signal / mechanical or electrical failure	Loss of outside air isolation None; a redundant isolation damper is available.	Damper status indicates in the MCR and RSR.	A redundant isolation damper is provided.
Normal Exhaust ACU Inlet Isolation Damper Y0021A/23B, Y0022A/24B	Failure of damper to close upon the demand signal / mechanical or electrical failure	Loss of outside air isolation None; a redundant isolation damper is available.	Damper status indicates in the MCR and RSR.	A redundant isolation damper is provided.
Safety- Related Cubicle Cooler HV10A~20A, 22A, 23A HV10B~23B	Fails to operate/ mechanical or electrical failure	Loss of room cooling None; at least, a redundant division is available.	Fan status, fan motor trip alarm, and high-high room temperature alarm in the MCR and RSR.	At least, a redundant division is provided.

Table 9.4.6-1 (1 of 2)

Equipment Parameters for Reactor Containment Building
HVAC System and Reactor Containment Building Purge System

1 Reactor containment building HVAC system

1.1 Reactor containment fan coolers

Quantity:	4 at 50 %
Type:	Draw-through
Seismic Category:	II

The reactor containment fan coolers consist of the following components:

1.1.1 Cooling coil

Type:	Chilled water
Capacity, kcal/hr (Btu/hr):	1,725,264 (6,846,400)

1.1.2 Fan

Type:	Vane axial
Air flow rate, cmh (cfm):	169,901 (100,000) at high speed / 112,950 (66,480) at low speed

1.2 Reactor cavity AHU

Quantity:	1
Type:	Draw-through
Seismic Category:	II

The reactor cavity AHU consists of the following components:

1.2.1 Cooling coil

Type:	Chilled water
Capacity, kcal/hr (Btu/hr):	291,710 (1,157,600)

1.2.2 Fan

Quantity per AHU:	2 at 100 %
Type:	Vane axial
Air flow rate, cmh (cfm):	33,980 (20,000)

Table 9.4.6-1 (2 of 2)

1.3	Steam generator enclosure recirculation fans	
	Quantity:	4 at 50 %
	Type:	Vane axial
	Air flow rate, cmh (cfm):	101,940 (60,000)
	Seismic Category:	II
1.4	Annulus area recirculation fans	
	Quantity:	4 at 50 %
	Type:	Vane axial
	Air flow rate, cmh (cfm):	30,582 (18,000)
	Seismic Category:	II
1.5	CEDM cooling fans	
	Quantity:	3 at 50 %
	Type:	Vane axial
	Air flow rate, cmh (cfm):	74,754 (44,000)
	Seismic Category:	II

Table 9.4.6-2 (1 of 2)

Equipment Parameters for Reactor Containment Building
HVAC System and Reactor Containment Building Purge System

2 Reactor containment building purge system

2.1 Reactor containment high-volume purge supply AHU

Quantity:	1
Type:	Draw-through
Seismic Category:	II

The reactor containment high-volume purge supply AHU is classified as non-safety related and consists of the following components:

2.1.1 Prefilter (see Table 9.4.1-3)

2.1.2 Heating coil

Type:	Electric

2.1.3 Cooling coil

Type:	Chilled water

2.1.4 Fan

Quantity per AHU:	2 at 50 %
Type:	Centrifugal
Air flow rate, cmh (cfm):	41,630 (24,500)

2.2 Reactor containment high-volume purge exhaust ACUs

Quantity:	2 at 50 %
Type:	Draw-through
Seismic Category:	II

The reactor containment high-volume purge exhaust ACUs are classified as non-safety related and consist of the following components:

2.2.1 Prefilter (see Table 9.4.1-3)

2.2.2 HEPA filter (see Table 9.4.1-3)

2.2.3 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	45,880 (27,000)

Table 9.4.6-2 (2 of 2)

2.3 Reactor containment low-volume purge supply fans

Quantity:	2 at 100 %
Type:	Centrifugal
Air flow rate, cmh (cfm):	2,300 (1,350)
Seismic Category:	II

2.4 Reactor containment low-volume purge exhaust ACU

Quantity:	2
Type:	Draw-through
Seismic Category:	II

The reactor containment low-volume purge exhaust ACU is classified as non-safety related and consists of the following components:

2.4.1 Moisture separator

Type:	Impingement

2.4.2 Heating coil

Type:	Electric

2.4.3 Prefilter (see Table 9.4.1-3)

2.4.4 HEPA filter (see Table 9.4.1-3)

2.4.5 Carbon adsorber (see Table 9.4.1-3)

2.4.6 Postfilter (see Table 9.4.1-3)

2.4.7 Fan

Quantity per ACU:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	2,550 (1,500)

Table 9.4.6-3 (1 of 2)

Reactor Containment Building Purge System Failure Modes and Effect Analysis

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Containment Isolation Valve V0011	Failure to close / mechanical or electrical failure	None; redundant containment isolation valve VQ-V0012 closes to isolate containment penetration.	Valve position status is indicated in the MCR and RSR.	Redundant containment isolation valve is provided.
Containment Isolation Valve V0012	Failure to close / mechanical or electrical failure	None; redundant containment isolation valve VQ-V0011 closes to isolate containment penetration.	Valve position status is indicated in the MCR and RSR.	Redundant containment isolation valve is provided.
Containment Isolation Valve V0013	Failure to close / mechanical or electrical failure	None; redundant containment isolation valve VQ-V0014 closes to isolate containment penetration.	Valve position status is indicated in the MCR and RSR.	Redundant containment isolation valve is provided.
Containment Isolation Valve V0014	Failure to close / mechanical or electrical failure	None; redundant containment isolation valve VQ-V0013 closes to isolate containment penetration.	Valve position status is indicated in the MCR and RSR.	Redundant containment isolation valve is provided.
Containment Isolation Valve V0031	Failure to close / mechanical or electrical failure	None; redundant containment isolation valve VQ-V0032 closes to isolate containment penetration	Valve position status is indicated in the MCR and RSR.	Redundant containment isolation valve is provided.
Containment Isolation Valve V0032	Failure to close / mechanical or electrical failure	None; redundant containment isolation valve VQ-V0031 closes to isolate containment penetration.	Valve position status is indicated in the MCR and RSR.	Redundant containment isolation valve is provided.

Table 9.4.6-3 (2 of 2)

Components	Failure Mode/Cause	Effect on System	Method of Detection	Inherent Compensating Provision
Containment Isolation Valve V0033	Failure to close / mechanical or electrical failure	None; redundant containment isolation valve VQ-V0034 closes to isolate containment penetration.	Valve position status is indicated in the MCR and RSR.	Redundant containment isolation valve is provided.
Containment Isolation Valve V0034	Failure to close / mechanical or electrical failure	None; redundant containment isolation valve VQ-V0033 closes to isolate containment penetration.	Valve position status is indicated in the MCR and RSR.	Redundant containment isolation valve is provided.

Table 9.4.7-1 (1 of 5)

Equipment Parameters for Compound Building HVAC System

1 Compound building clean area supply AHUs

Quantity:	2 at 50 % capacity
Type:	Draw-through
Seismic Category:	III

The compound building clean area supply AHUs are classified as non-safety related and consist of the following components:

1.1 Prefilter (see Table 9.4.1-3)

1.2 Heating coil

Type:	Electric

1.3 Cooling coil

Type:	Chilled water

1.4 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	51,650 (30,400)

2 Compound building clean area return fan

Quantity:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	48,510 (28,550)
Seismic Category:	III

3 Compound building clean area exhaust fan

Quantity:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	10,280 (6,050)
Seismic Category:	III

Table 9.4.7-1 (2 of 5)

4 Compound building controlled area supply AHUs

Quantity:	2 at 50 % capacity
Type:	Draw-through
Seismic Category:	III

The compound building controlled area supply AHUs are classified as non-safety related and consist of the following components:

4.1 Prefilter (see Table 9.4.1-3)

4.2 Heating coil

Type:	Electric

4.3 Cooling coil

Type:	Chilled water

4.4 Fan

Type:	Centrifugal
Air flow rate, cmh (cfm):	41,120 (24,200)

5 Compound building HEPA exhaust ACUs

Quantity:	2 at 50 % capacity
Type:	Draw-through
Seismic Category:	III

The compound building HEPA filter ACUs are classified as non-safety related and consist of the following components:

5.1 Prefilter (see Table 9.4.1-3)

5.2 HEPA Filter (see Table 9.4.1-3)

5.3 Fan

Quantity per ACU:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	58,140 (34,220)

Table 9.4.7-1 (3 of 5)

6 Compound building carbon adsorber exhaust ACUs

Quantity:	2 at 50 % capacity
Type:	Draw-through
Seismic Category:	III

The compound building carbon adsorber exhaust ACUs are classified as non-safety related and consist of the following components:

6.1 Moisture separator

Type:	Impingement

6.2 Heating coil

Type:	Electric

6.3 Prefilter (see Table 9.4.1-3)

6.4 HEPA filter (see Table 9.4.1-3)

6.5 Carbon adsorber (see Table 9.4.1-3)

6.6 Postfilter (see Table 9.4.1-3)

6.7 Fan

Quantity per ACU:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	58,140 (34,220)

7 Hot machine shop exhaust ACU

Quantity (Common):	1
Type:	Draw-through
Seismic Category:	III

The hot machine shop exhaust ACU consists of the following components:

7.1 Prefilter (see Table 9.4.1-3)

7.2 HEPA filter (see Table 9.4.1-3)

Table 9.4.7-1 (4 of 5)

7.3 Fan

Quantity per ACU:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	6,630 (3,900)

8 Compound building chiller room exhaust fan

Quantity:	1
Type:	Centrifugal
Air flow rate, cmh (cfm):	6,970 (4,100)
Seismic Category:	III

9 Packaged air conditioning units (PACUs)

Quantity:	1 at 100 % (1 per room)
Type:	Draw-through
Seismic Category:	III

The PACUs consist of the following components:

9.1 Prefilter (see Table 9.4.1-3)

9.2 Cooling coil

Cooling Coil	Quantity per PACU	Type
Telecommunication equipment room PACU	1	Direct expansion
CCS cabinet room PACU	1	Direct expansion
Calibration office PACU	1	Direct expansion
Instrument calibration facility room PACU	1	Direct expansion
Sample counting room PACU	1	Direct expansion

Table 9.4.7-1 (5 of 5)

9.3 Fan

Fan	Quantity per PACU	Type	Air Flow Rate, cmh (cfm)
Telecommunication Equipment Room PACU	1	Centrifugal	2,550 (1,500)
CCS cabinet room PACU	1	Centrifugal	3,910 (2,300)
Calibration office PACU	1	Centrifugal	850 (500)
Instrument calibration facility room PACU	1	Centrifugal	1,700 (1,000)
Sample counting room PACU	1	Centrifugal	850 (500)

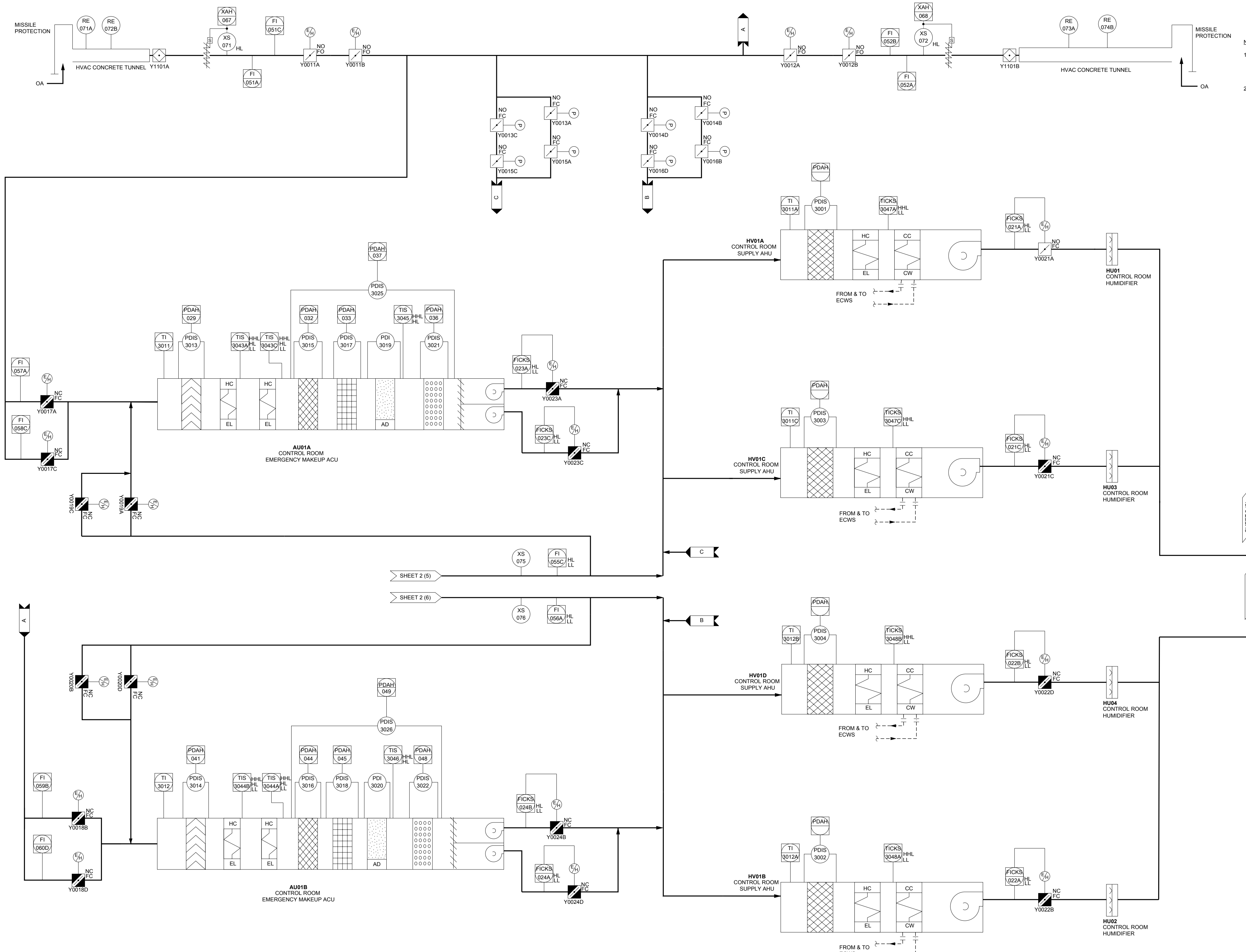
10 Cubicle coolers (CCs)

Type: Draw-through

The CCs consist of the following components:

Cubicle Cooler	Cooling Coil		Fan		Seismic Category	Safety Designation (1)
	Type	Capacity, kcal/hr (Btu/hr)	Type	Air Flow Rate, cmh (cfm)		
Electric equipment room CC (HV05)	Chilled Water	10,836 (43,000)	Centrifugal	2,210 (1,300)	III	NSR
Electric equipment room CC (HV06)	Chilled Water	34,524 (137,000)	Centrifugal	6,800 (4,000)	III	NSR
Electric equipment room CC (HV07)	Chilled Water	50,652 (201,000)	Centrifugal	10,200 (6,000)	III	NSR

(1) SR = safety-related
NSR = non-safety related



NOTES

1. ALL EQUIPMENT, DUCTWORK AND DAMPERS SHOWN ON THIS DRAWING ARE QUALITY GROUP G AND SEIMIC CATEGORY I, EXCEPT HUMIDIFIERS UNITS ARE NON-SAFETY RELATED, QUALITY GROUP E NAD SEISMIC CATEGORY II.

2. ALL PDI, PDIS AND XS ARE NON-SAFETY RELATED AND SEIMIC CATEGORY II.

Figure 9.4.1-1 Control Room HVAC System Flow Diagram (1 of 2)

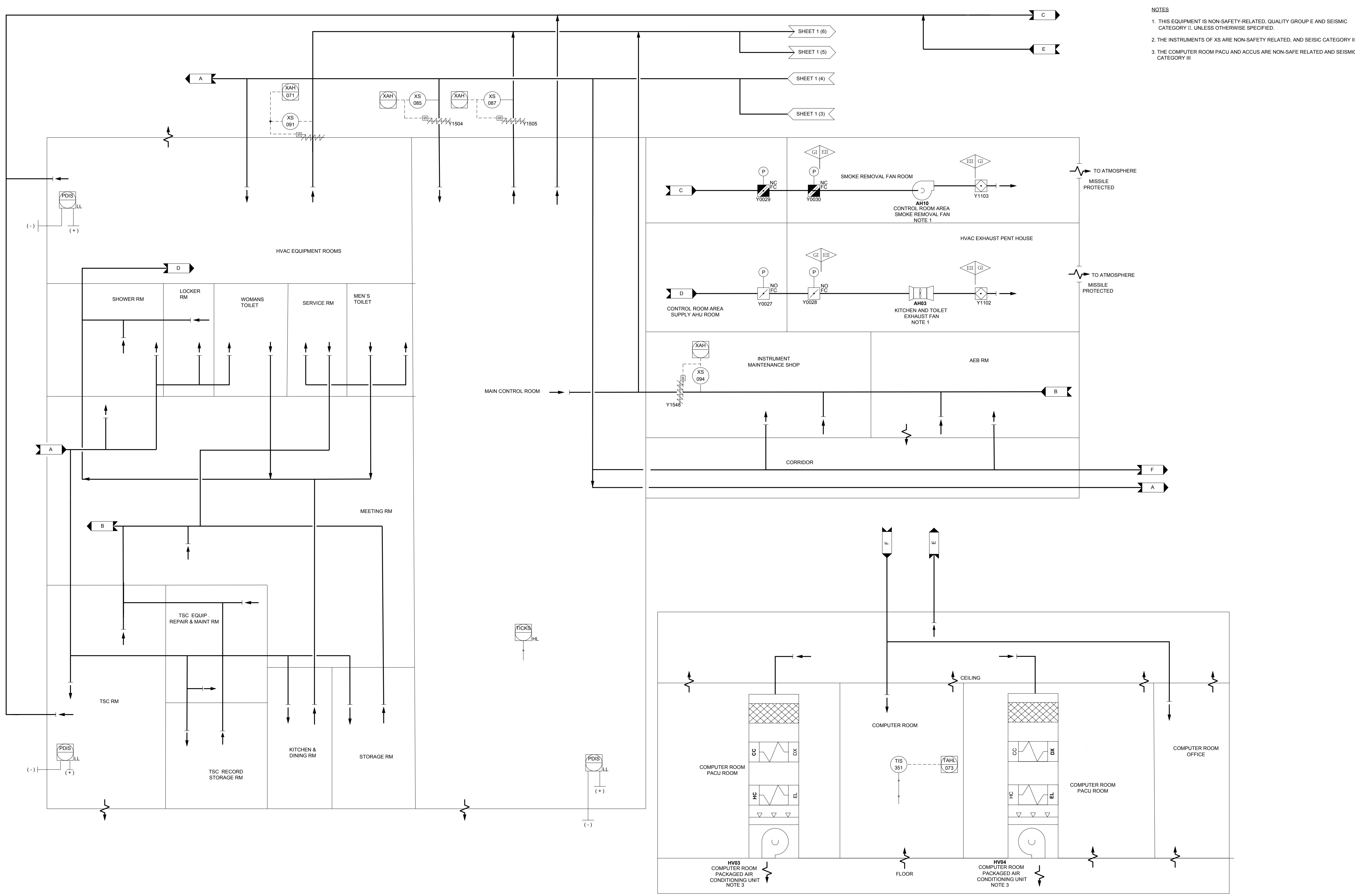
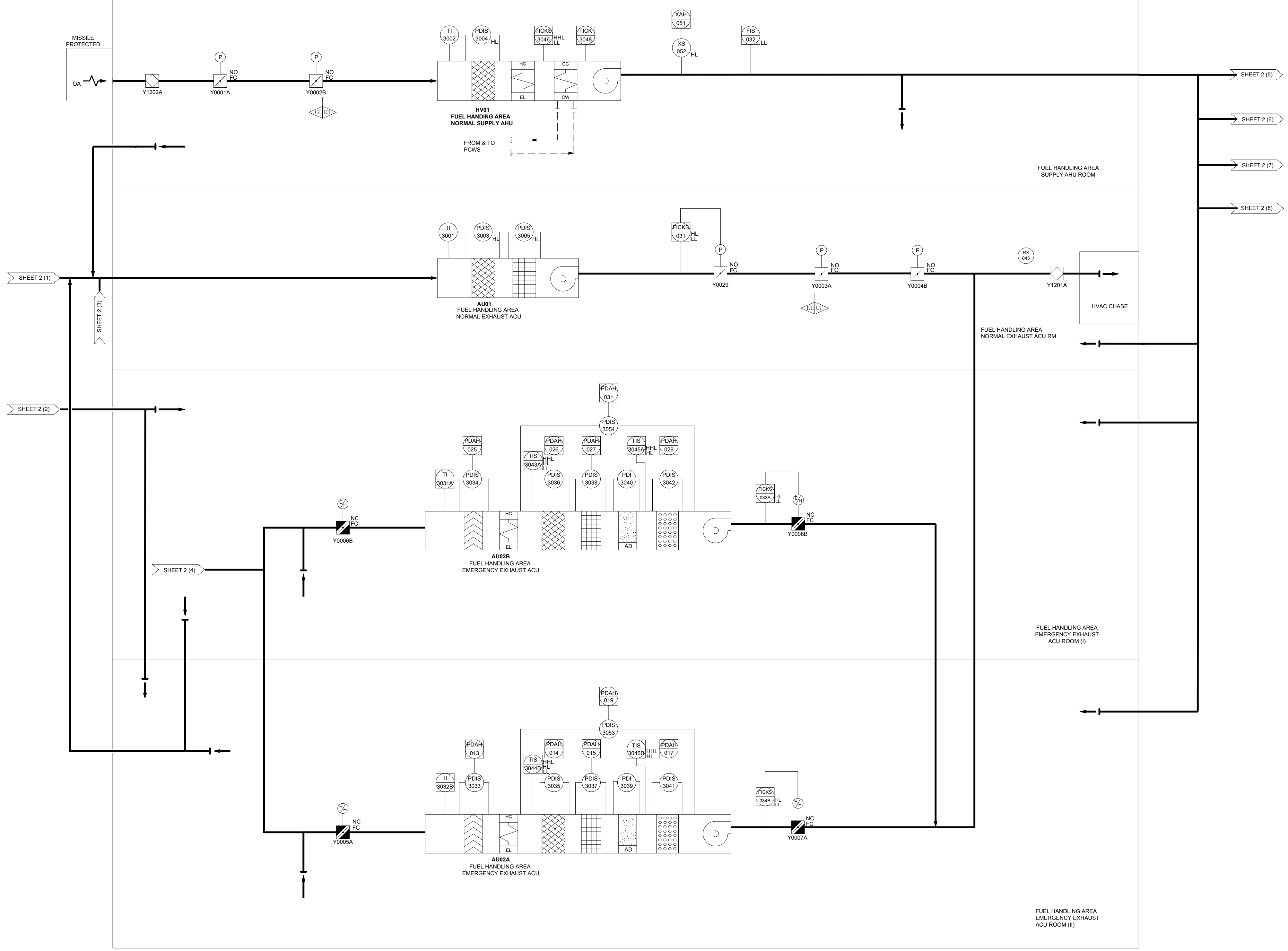


Figure 9.4.1-1 Control Room HVAC System Flow Diagram (2 of 2)



NOTES

1. EQUIPMENT AND DUCTWORK SHOWN ON THIS DRAWING ARE QUALITY GROUP E AND SEISMIC CATEGORY II UNLESS OTHERWISE NOTES.

2. ALL PDI, PDIS AND XS ARE NON-SAFETY RELATED AND SEISMIC CATEGORY II.

Figure 9.4.2-1 Fuel Handling Area HVAC System Flow Diagram (1 of 2)

NOTES

1. EQUIPMENT AND DUCTWORK SHOWN ON THIS DRAWING ARE QUALITY GROUP E AND SEISMIC CATEGORY II EXCEPT SAFETY RELATED CUBICLE COOLERS ARE QUALITY GROUP G AND SEISMIC CATEGORY I.
2. PIPING AND VALVES ARE QUALITY GROUP D AND SEISMIC CATEGORY II

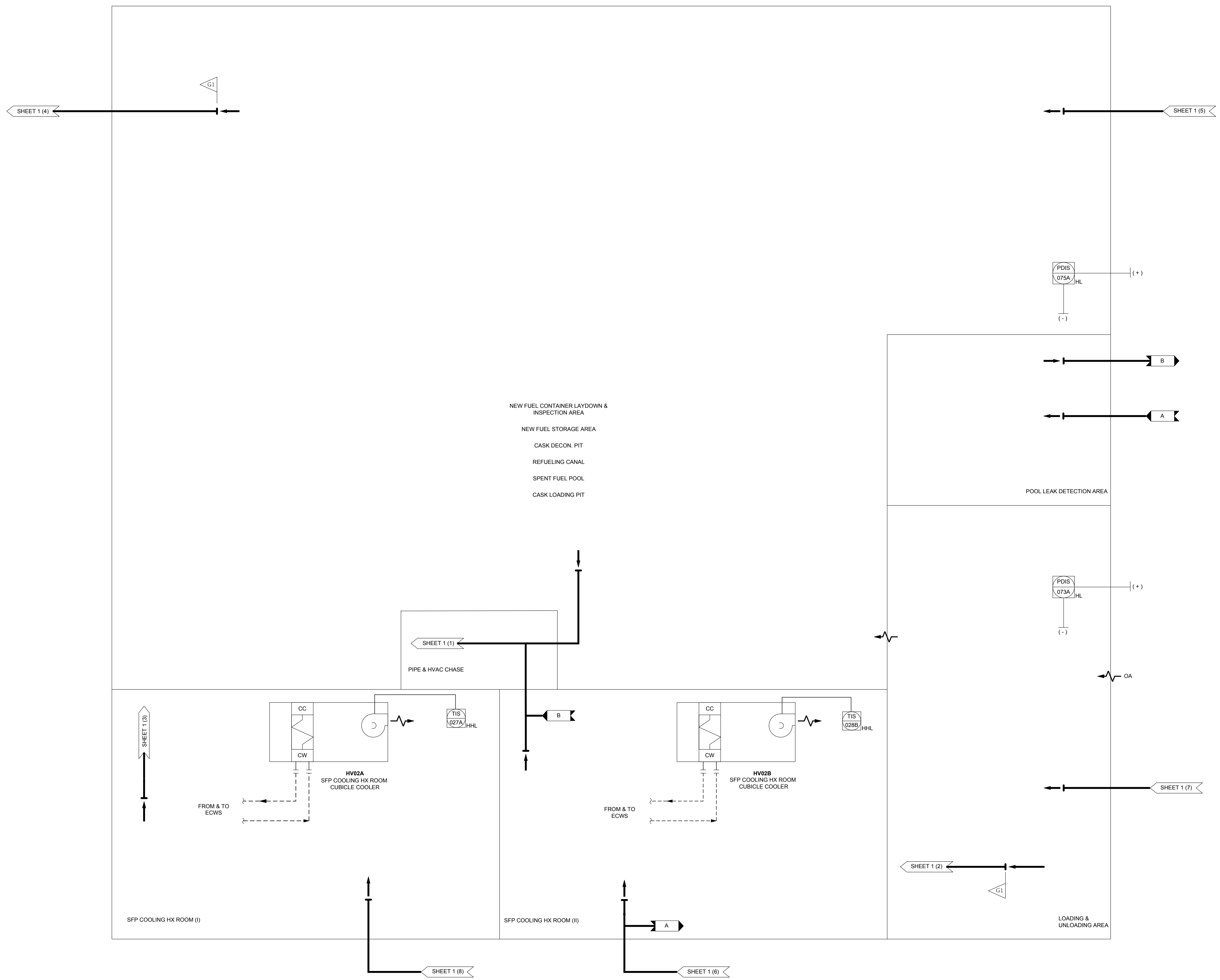
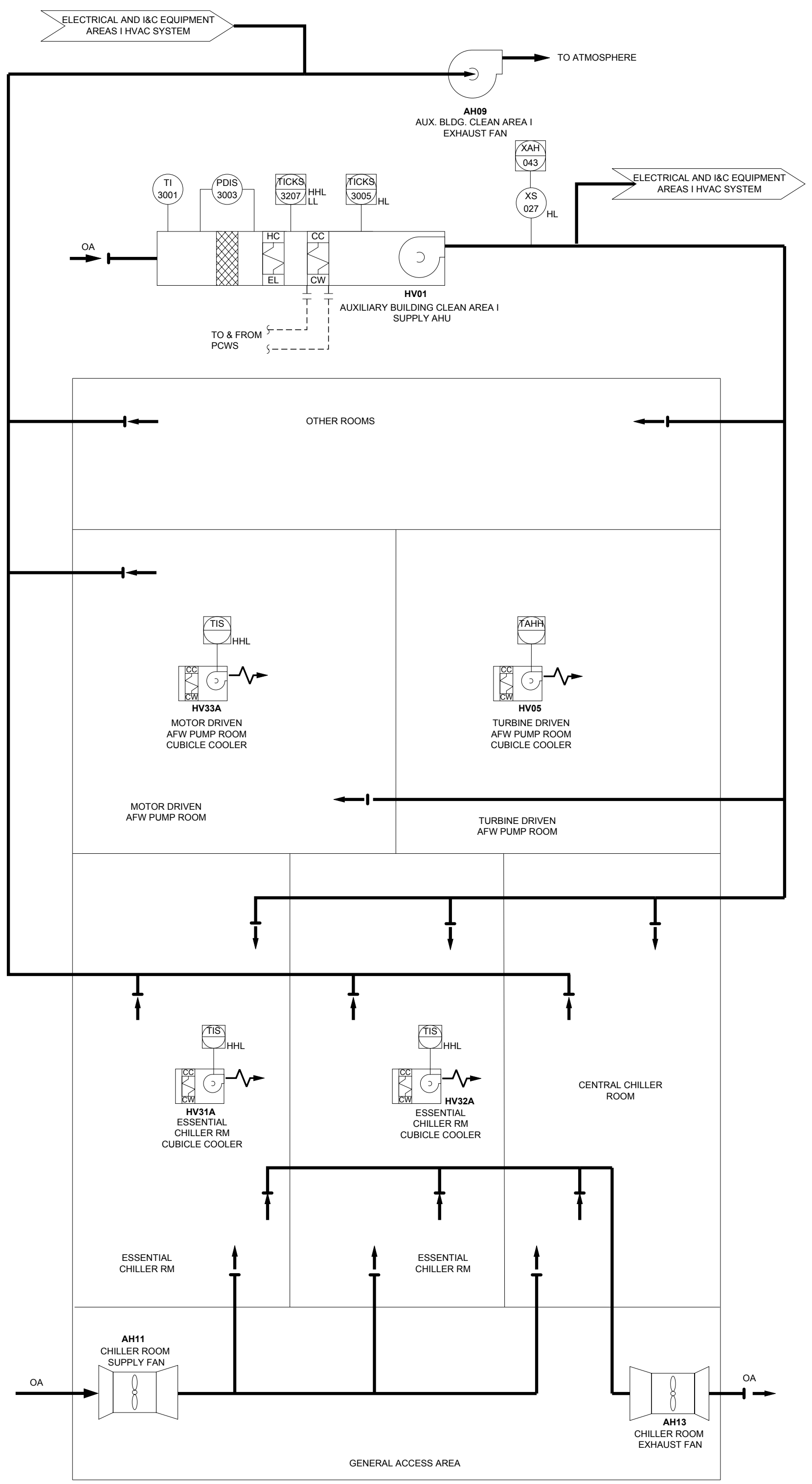
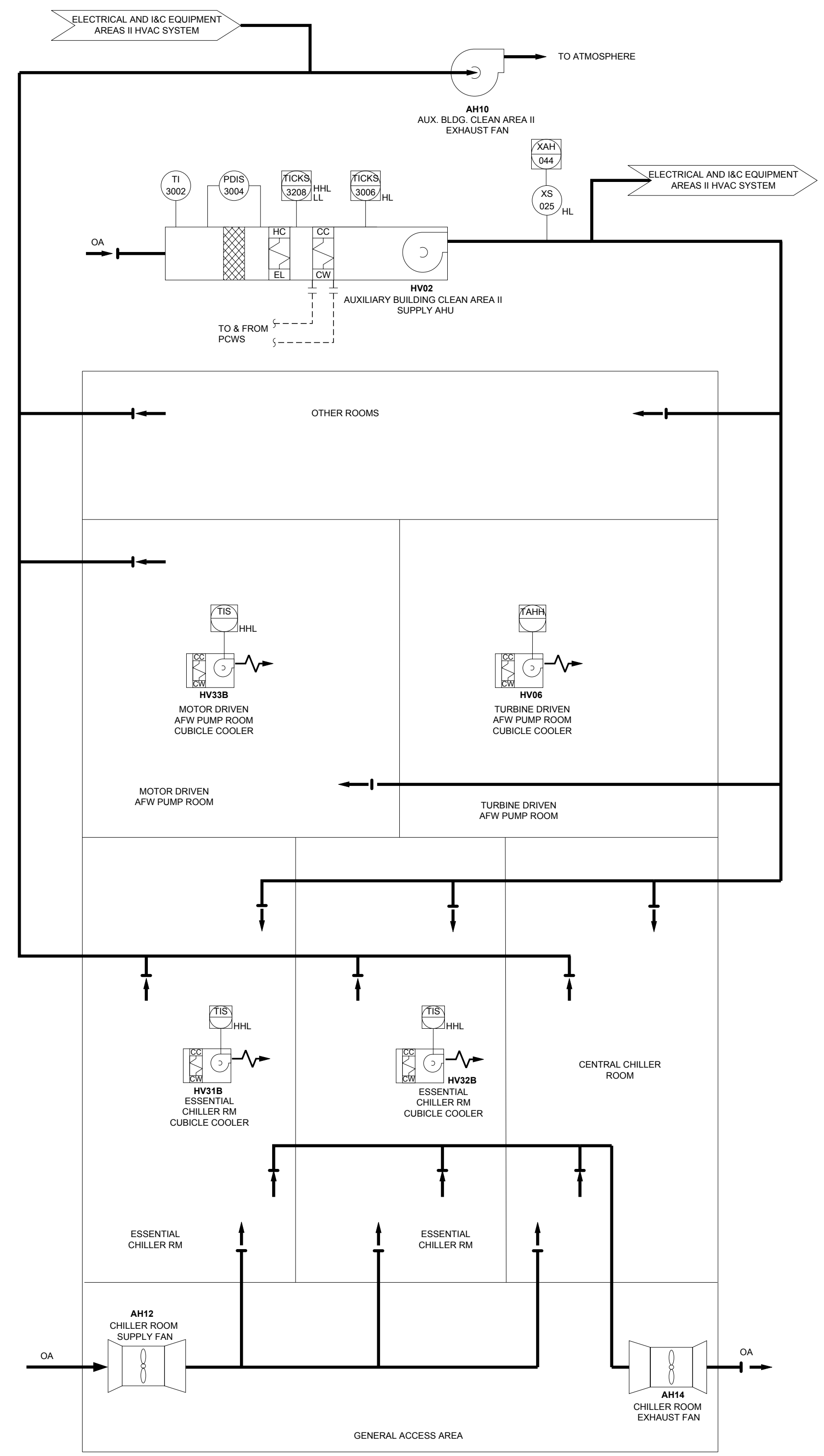


Figure 9.4.2-1 Fuel Handling Area HVAC System Flow Diagram (2 of 2)



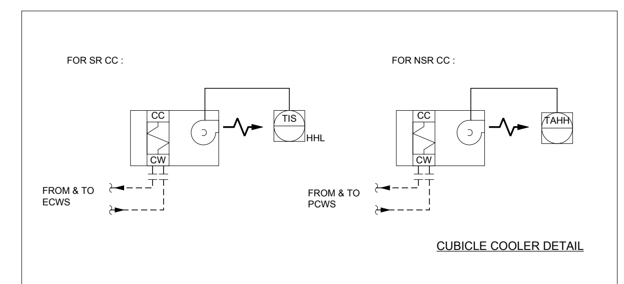
AUXILIARY BUILDING CLEAN AREA DIV.I HVAC SUBSYSTEM



AUXILIARY BUILDING CLEAN AREA DIV.II HVAC SUBSYSTEM

NOTES

1. ALL EQUIPMENT, COMPONENTS AND DUCTWORK SHOWN ON THIS DRAWING ARE QUALITY GROUP E AND SEISMIC CATEGORY II, UNLESS NOTED OTHERWISE.
2. THE CUBICLE COOLERS NOTED AS ´SR´ IN THE SAFETY DESIGNATION COLUMN ON CUBICLE COOLER SCHEDULE ARE SAFETY-RELATED, QUALITY GROUP C AND SEISMIC CATEGORY I.



CUBICLE COOLER DETAIL

CUBICLE COOLER SCHEDULE

CUBICLE COOLER (CC) NAME		EQUIP. NO.	SAFETY DESIGNATION
AREA I	TURBINE DRIVEN AFW PUMP ROOM CC	HV05	NSR
	ESSENTIAL CHILLER ROOM CC	HV31A	SR
	ESSENTIAL CHILLER ROOM CC	HV32A	SR
	MOTOR DRIVEN AFW PUMP ROOM CC	HV33A	SR
AREA II	TURBINE DRIVEN PUMP ROOM CC	HV06	NSR
	ESSENTIAL CHILLER ROOM CC	HV31B	SR
	ESSENTIAL CHILLER ROOM CC	HV32B	SR
	MOTOR DRIVEN AFW PUMP ROOM CC	HV33B	SR

Figure 9.4.3-1 Auxiliary Building Clean Area HVAC System Flow Diagram (1 of 2)

NOTES

1. ALL EQUIPMENT, COMPONENTS AND DUCTWORK SHOWN ON THIS DRAWING ARE QUALITY GROUP E AND SEISMIC CATEGORY II, UNLESS NOTED OTHERWISE.

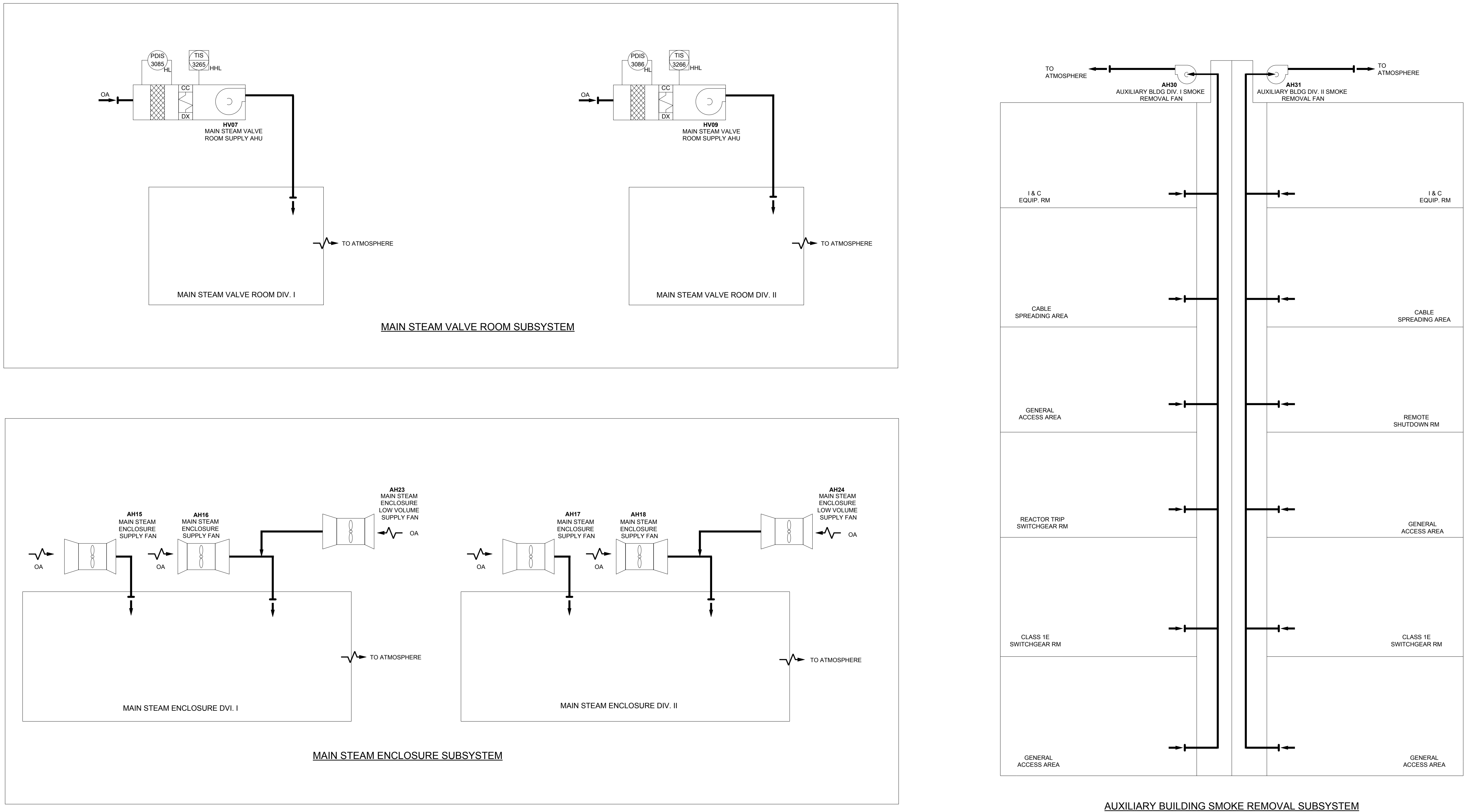


Figure 9.4.3-1 Auxiliary Building Clean Area HVAC System Flow Diagram (2 of 2)

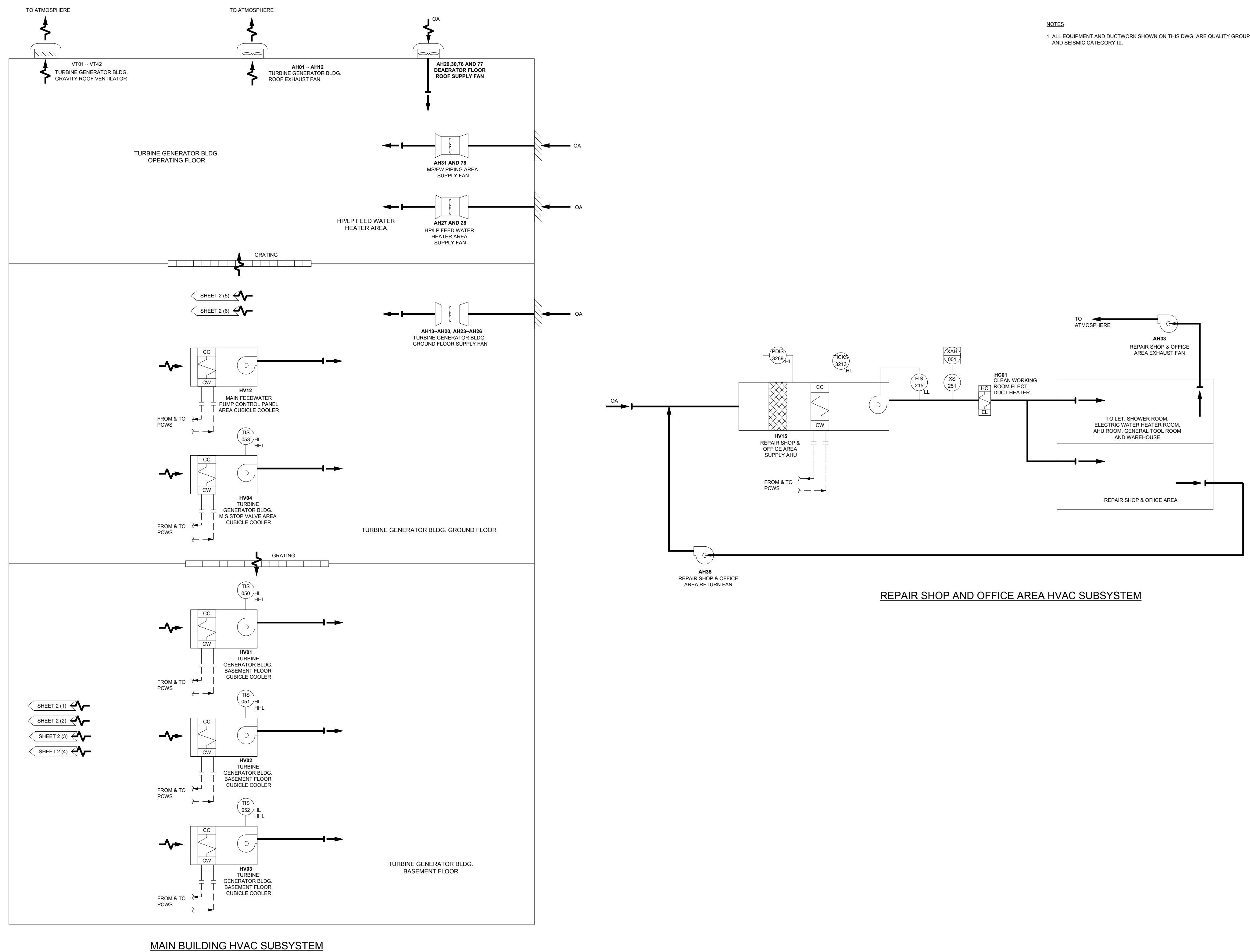
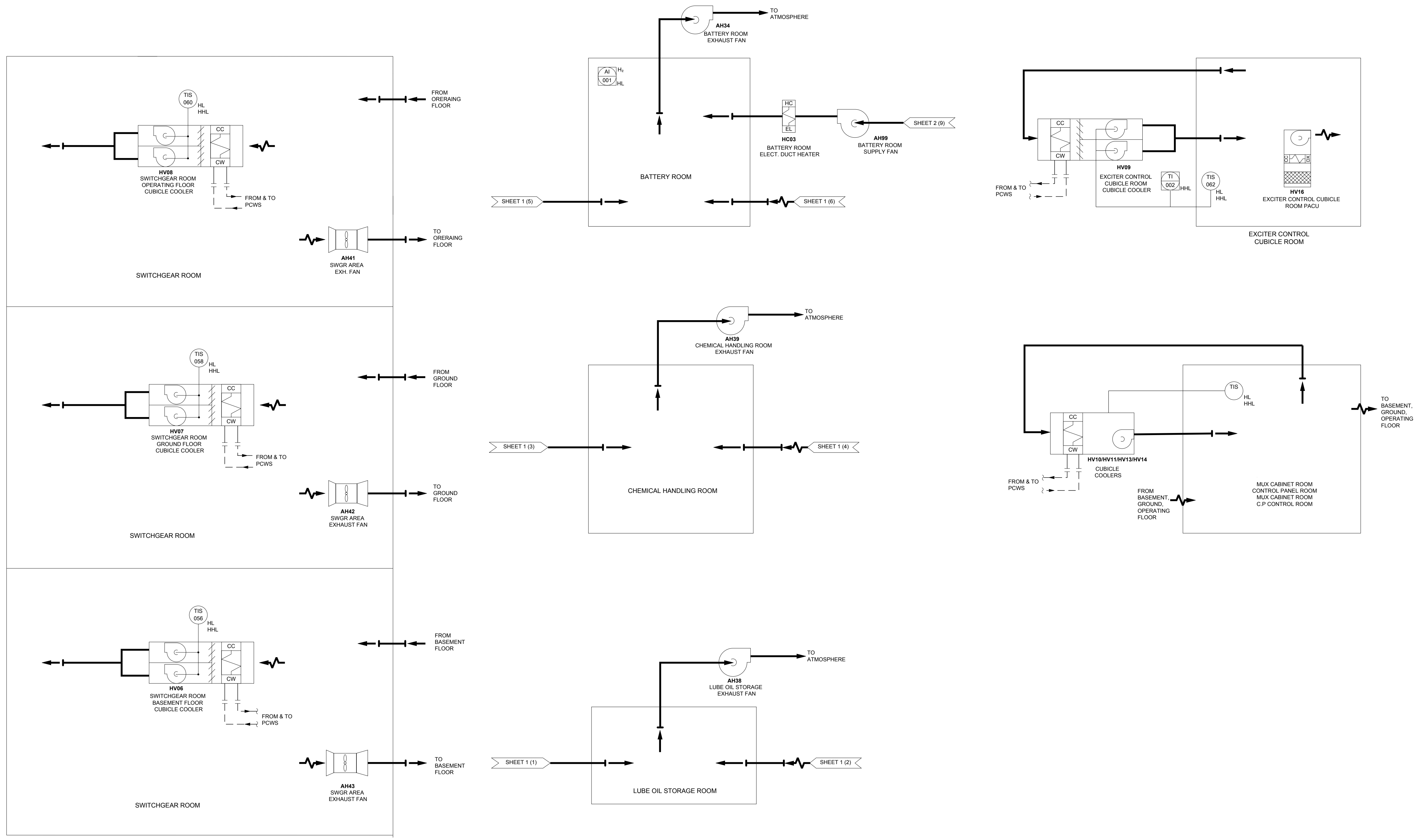


Figure 9.4.4-1 Turbine Generator Building HVAC System Flow Diagram (1 of 2)

NOTES

1. ALL EQUIPMENT & DUCTWORK SHOWN ON THIS DWG ARE QUALITY GROUP E AND SEISMIC CATEGORY III.



ENCLOSED ROOM HVAC SUBSYSTEM

Figure 9.4.4-1 Turbine Generator Building HVAC System Flow Diagram (2 of 2)

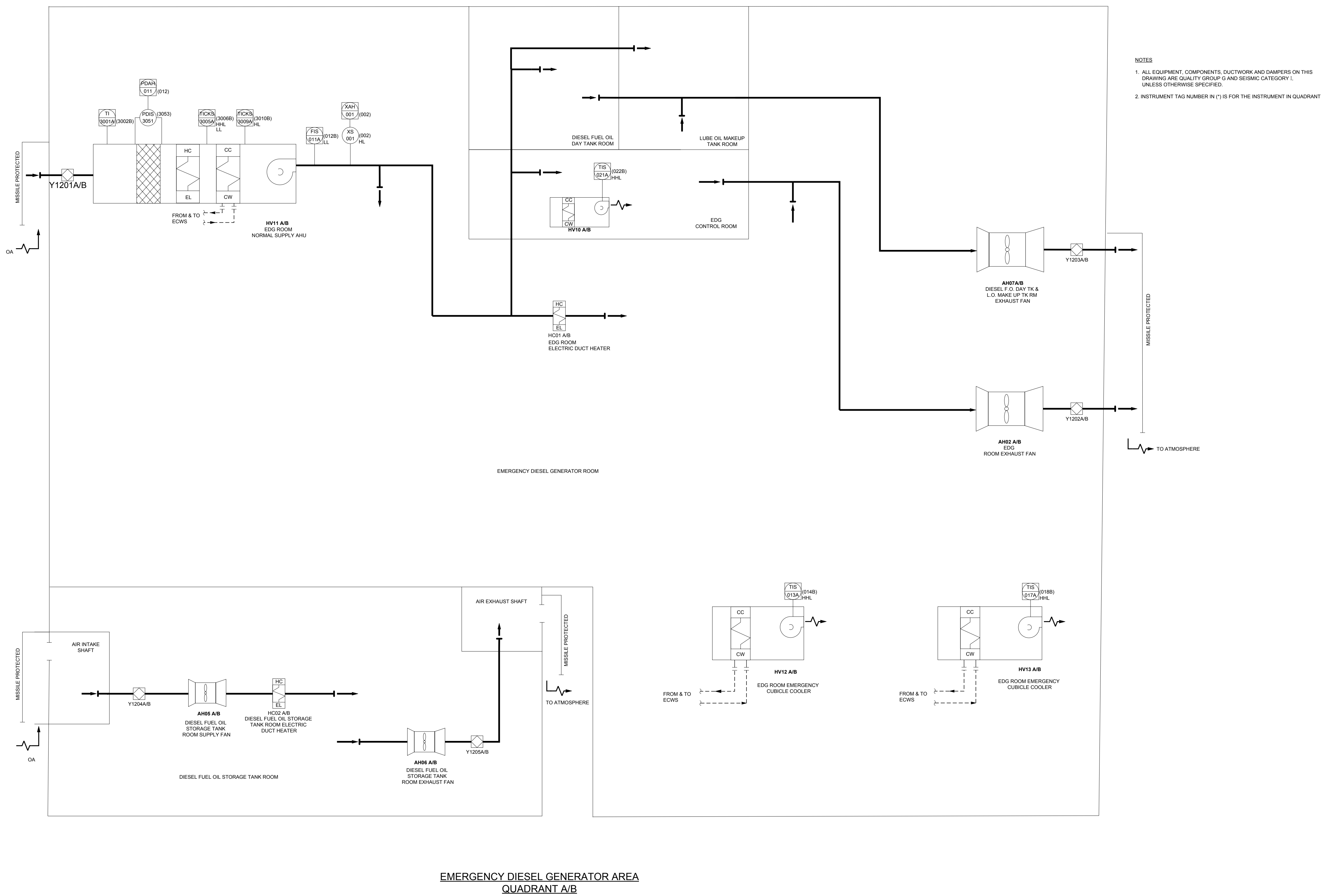
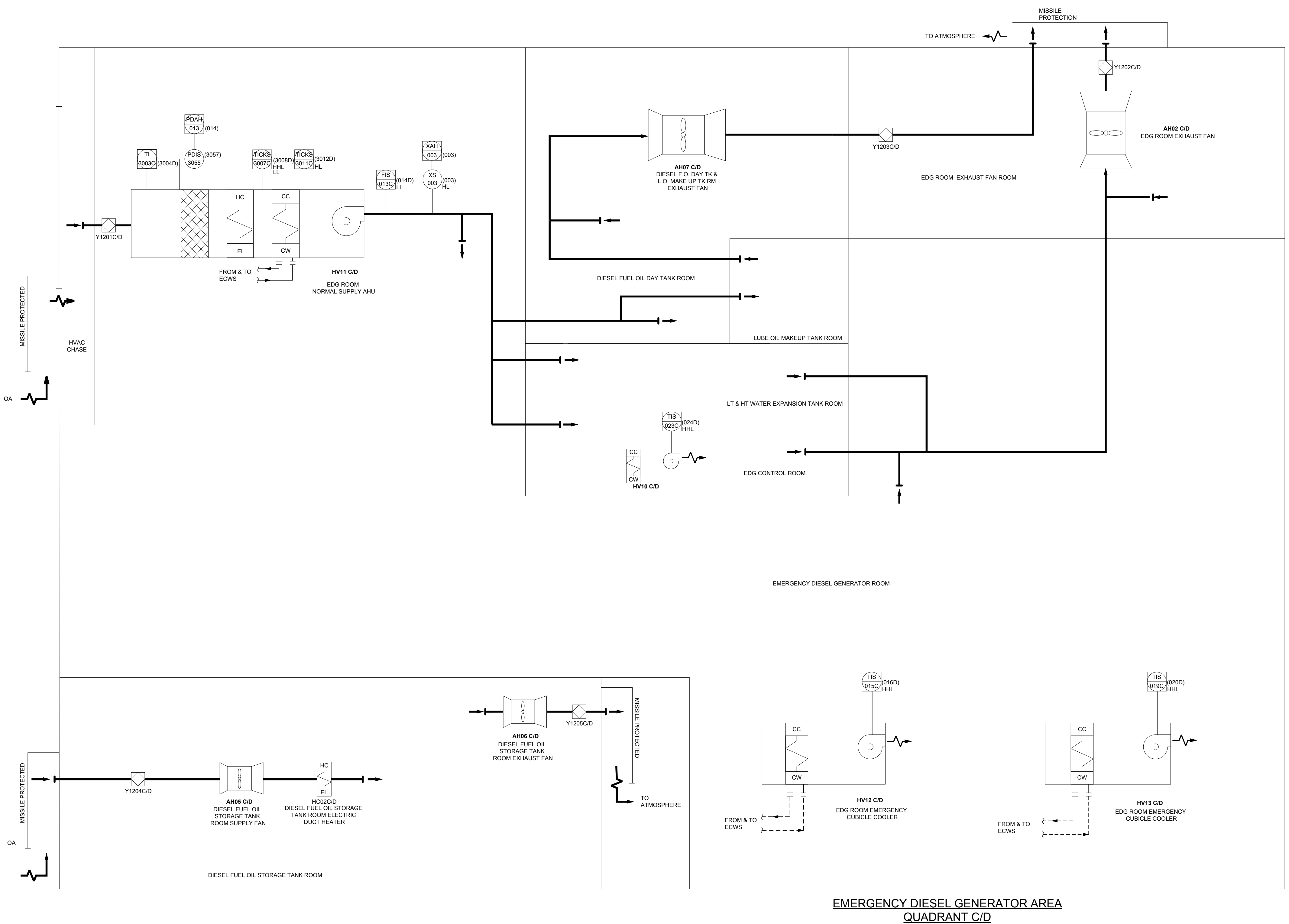


Figure 9.4.5-1 Emergency Diesel Generator Area HVAC System (1 of 2)



NOTES

1. ALL EQUIPMENT, COMPONENTS, DUCTWORK AND DAMPERS ON THIS DRAWING ARE QUALITY GROUP G AND SEISMIC CATEGORY I, UNLESS OTHERWISE SPECIFIED.

2. INSTRUMENT TAG NUMBER IN (*) IS FOR THE INSTRUMENT IN QUADRANT D.

Figure 9.4.5-1 Emergency Diesel Generator Area HVAC System (2 of 2)

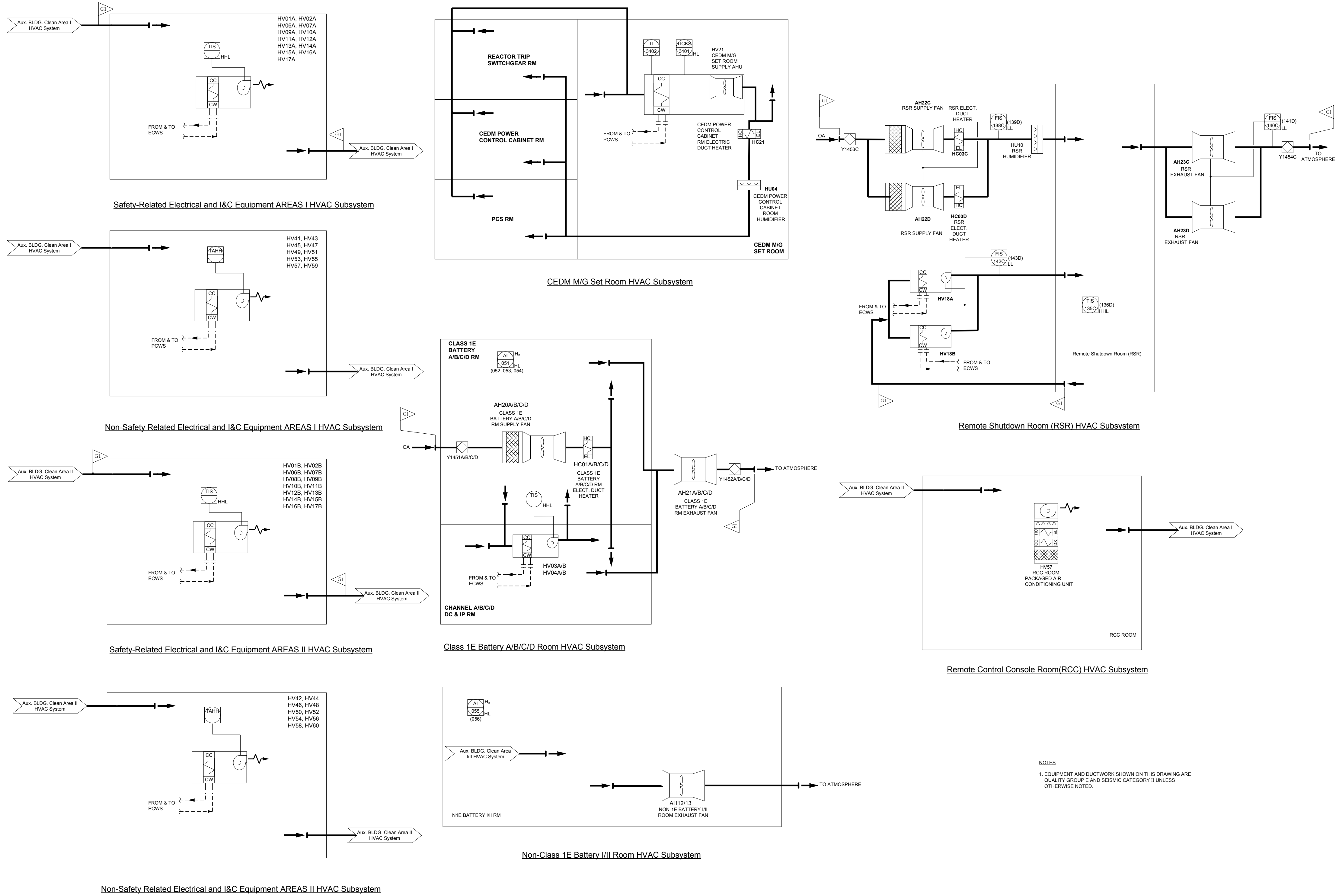


Figure 9.4.5-2 Electrical and I&C Equipment Areas HVAC System

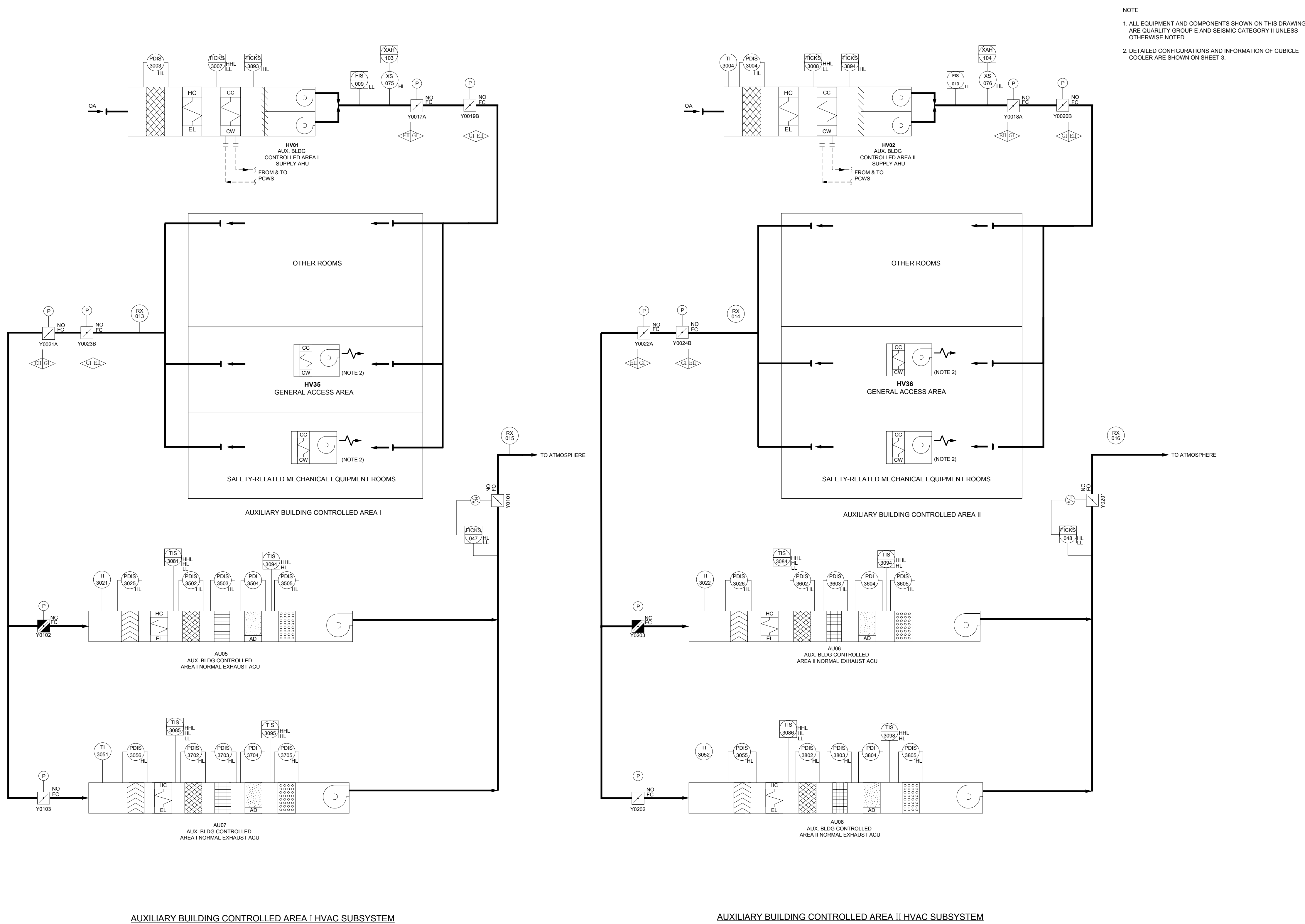
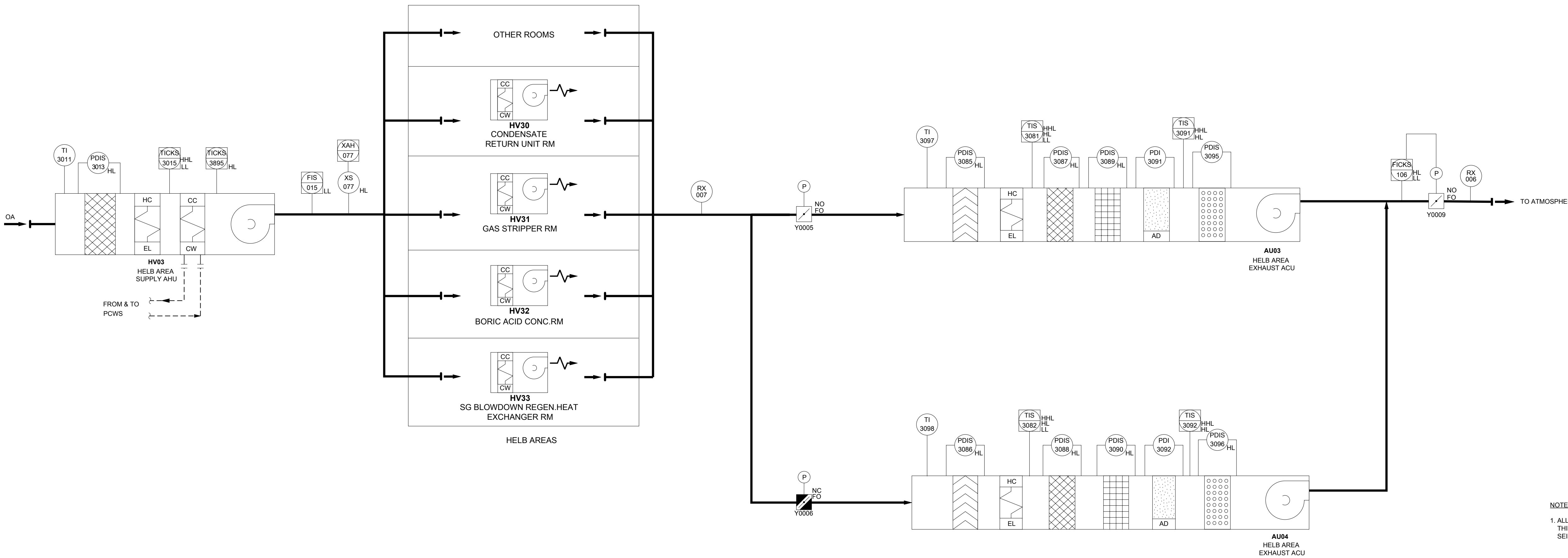
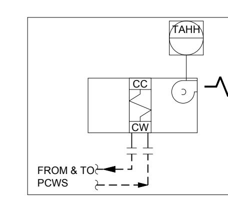


Figure 9.4.5-3 Auxiliary Building Controlled Area HVAC System Flow Diagram (1 of 3)



NOTE

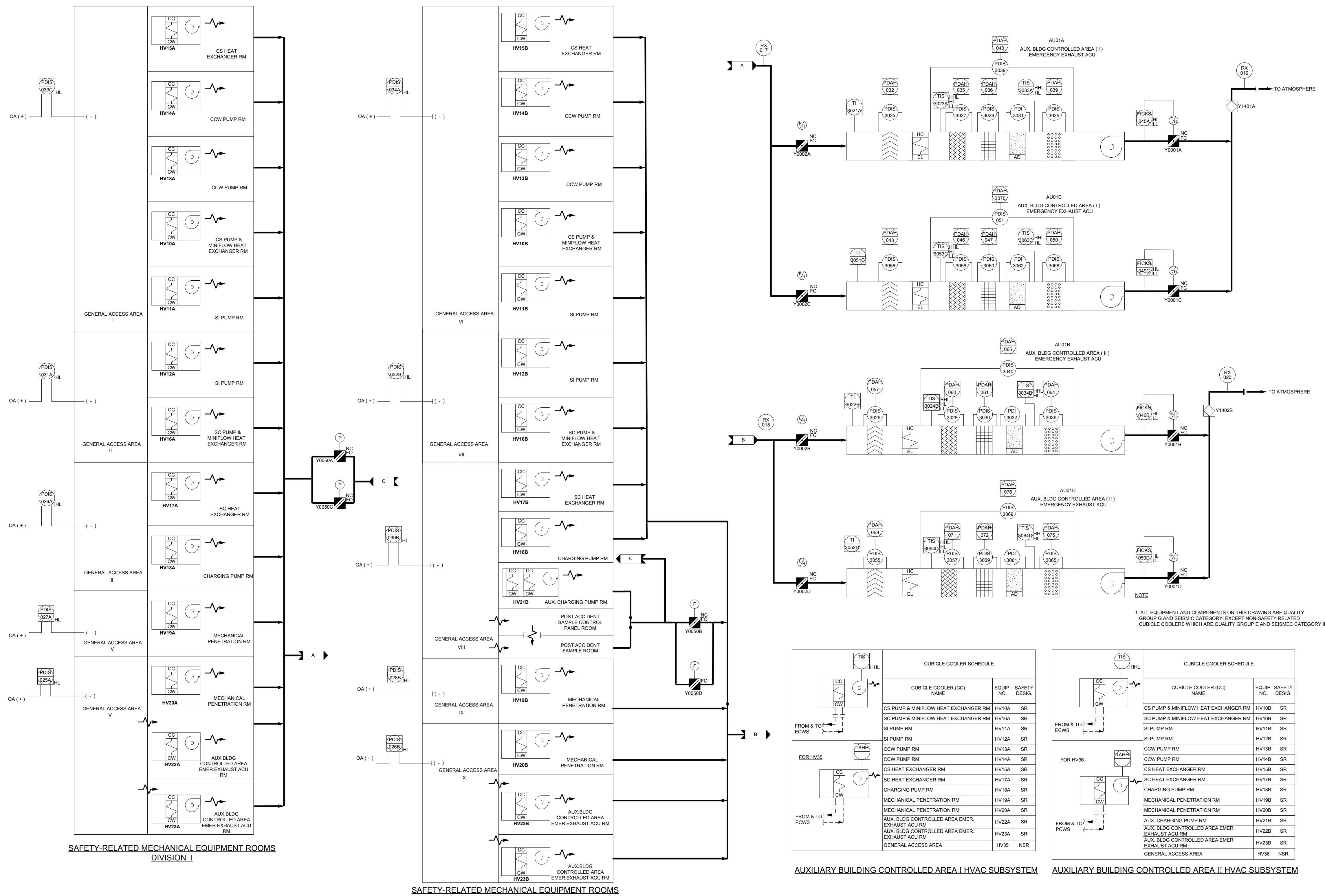
1. ALLEQUIPMENT AND COMPONTS SHOWN ON THIS DRAWING ARE QUARLITY GROUP E AND SEISMIC CATEGORY II



CUBICLE COOLER SCHEDULE		
CUBICLE COOLER (CC) NAME	EQUIP. NO.	SAFETY DESIG.
CONDENSATE RETURN UNIT RM CC	HV30	NSR
GAS STRIPPER RM CC	HV31	NSR
BORIC ACID CONC. RM CC	HV32	NSR
SG BLOWDOWN REGEN. HEAT EXCHANGER RM CC	HV33	NSR

HELB AREA HVAC SUBSYSTEM

Figure 9.4.5-3 Auxiliary Building Controlled Area HVAC System Flow Diagram (2 of 3)



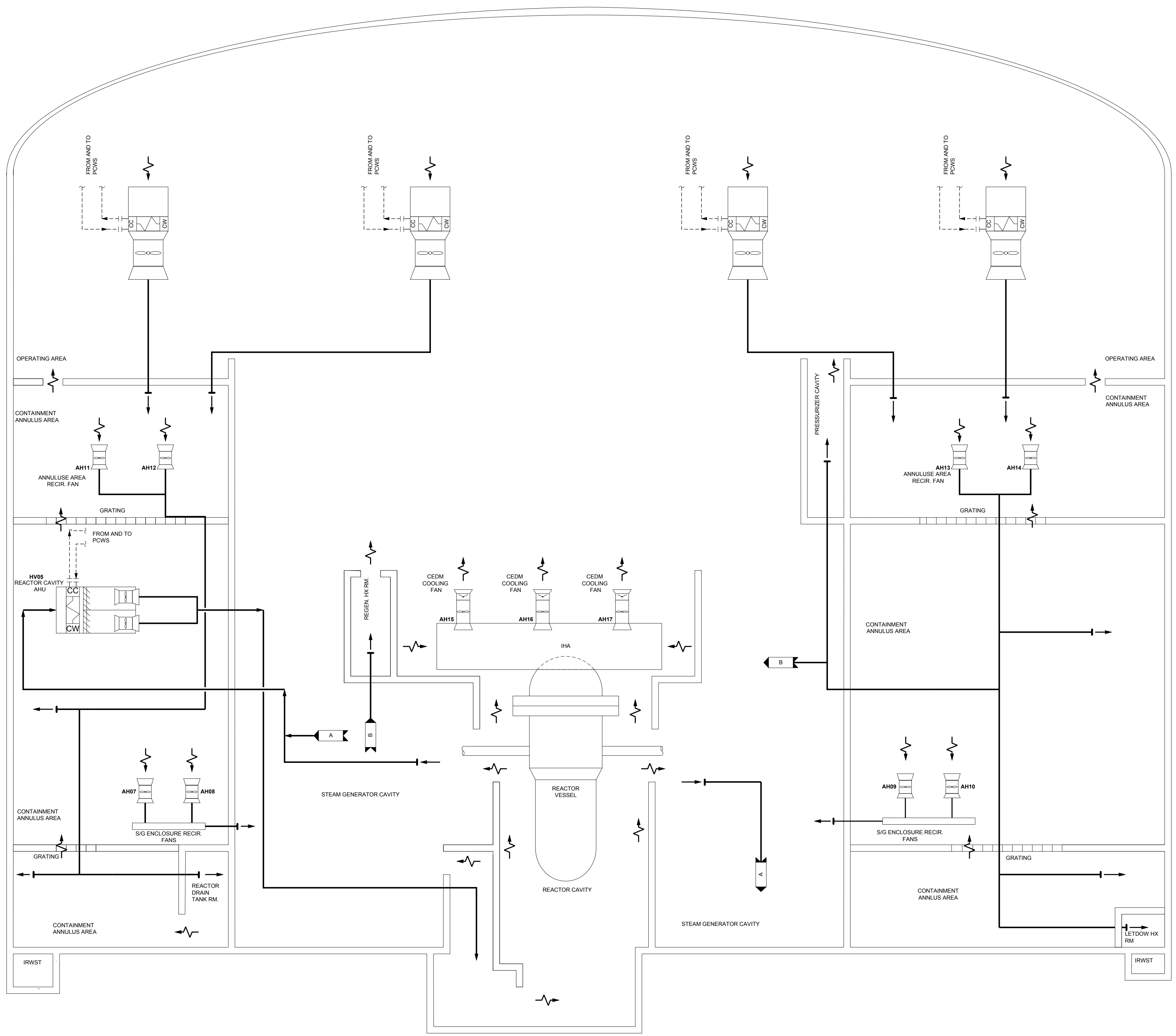
CUBICLE COOLER SCHEDULE

CUBICLE COOLER (CC) NAME	EQUIP. NO.	SAFETY DESIG.
CS PUMP & MINIFLOW HEAT EXCHANGER RM	HV10A	SR
SC PUMP & MINIFLOW HEAT EXCHANGER RM	HV16A	SR
SI PUMP RM	HV11A	SR
SI PUMP RM	HV12A	SR
CCW PUMP RM	HV13A	SR
CCW PUMP RM	HV14A	SR
CS HEAT EXCHANGER RM	HV15A	SR
SC HEAT EXCHANGER RM	HV17A	SR
CHARGING PUMP RM	HV18A	SR
MECHANICAL PENETRATION RM	HV19A	SR
MECHANICAL PENETRATION RM	HV20A	SR
AUX. BLDG CONTROLLED AREA EMER. EXHAUST ACU RM	HV22A	SR
AUX. BLDG CONTROLLED AREA EMER. EXHAUST ACU RM	HV23A	SR
GENERAL ACCESS AREA	HV35	NSR

CUBICLE COOLER SCHEDULE

CUBICLE COOLER (CC) NAME	EQUIP. NO.	SAFETY DESIG.
CS PUMP & MINIFLOW HEAT EXCHANGER RM	HV10B	SR
SC PUMP & MINIFLOW HEAT EXCHANGER RM	HV16B	SR
SI PUMP RM	HV11B	SR
SI PUMP RM	HV12B	SR
CCW PUMP RM	HV13B	SR
CCW PUMP RM	HV14B	SR
CS HEAT EXCHANGER RM	HV15B	SR
SC HEAT EXCHANGER RM	HV17B	SR
CHARGING PUMP RM	HV18B	SR
MECHANICAL PENETRATION RM	HV19B	SR
MECHANICAL PENETRATION RM	HV20B	SR
AUX. CHARGING PUMP RM	HV21B	SR
AUX. BLDG CONTROLLED AREA EMER. EXHAUST ACU RM	HV22B	SR
AUX. BLDG CONTROLLED AREA EMER. EXHAUST ACU RM	HV23B	SR
GENERAL ACCESS AREA	HV36	NSR

Figure 9.4.5-3 Auxiliary Building Controlled Area HVAC System Flow Diagram (3 of 3)



NOTES

REACTOR CONTAINMENT FAN COOLERS, REACTOR CAVITY AHU, RECIRCULATION FANS, ASSOCIATED COMPONENTS AND DUCTWORK ARE NON-SAFETY RELATED AND SEISMIC CATEGORY Ⅱ.

Figure 9.4.6-1 Reactor Containment Building HVAC System Flow Diagram

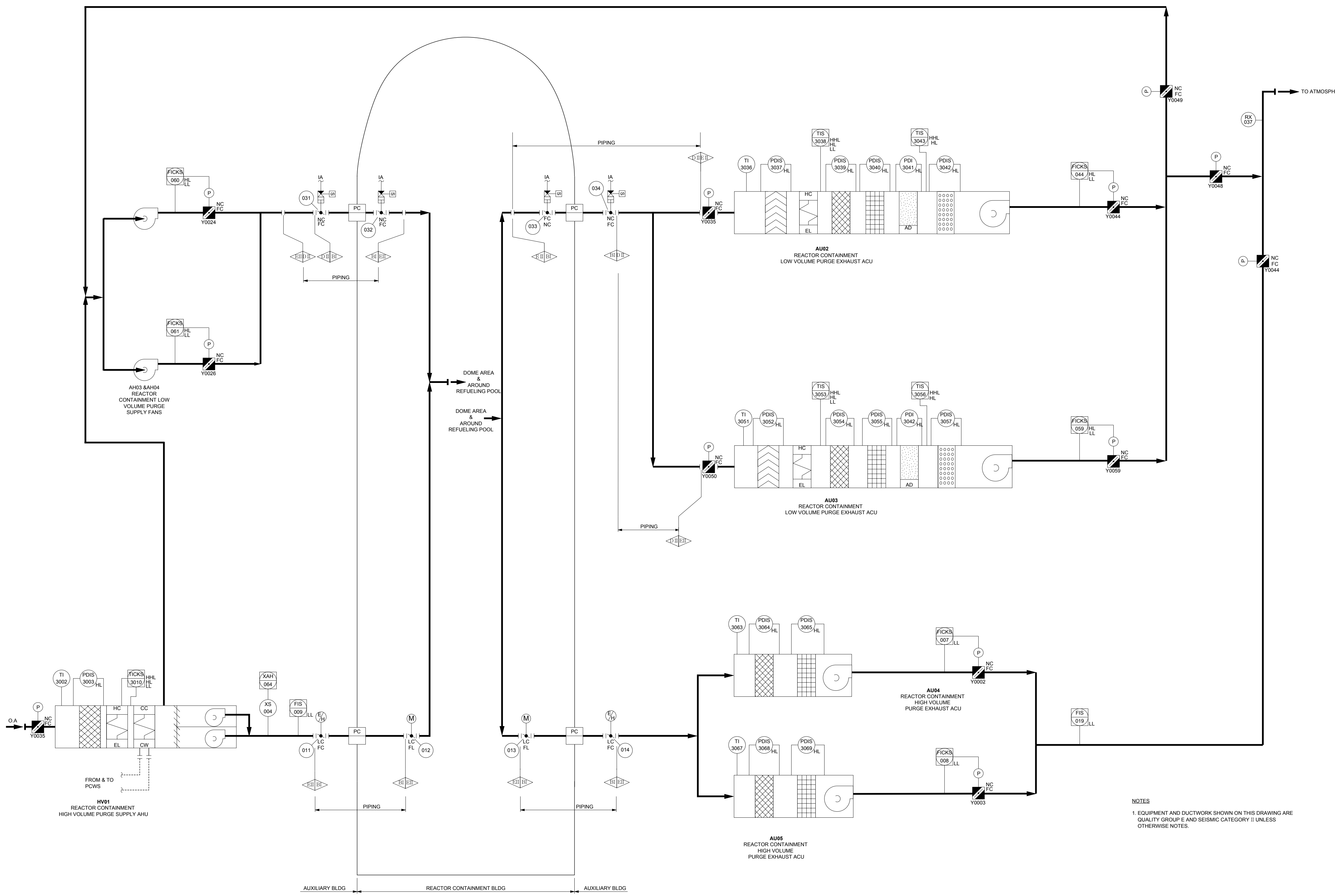


Figure 9.4.6-2 Reactor Containment Building Purge System

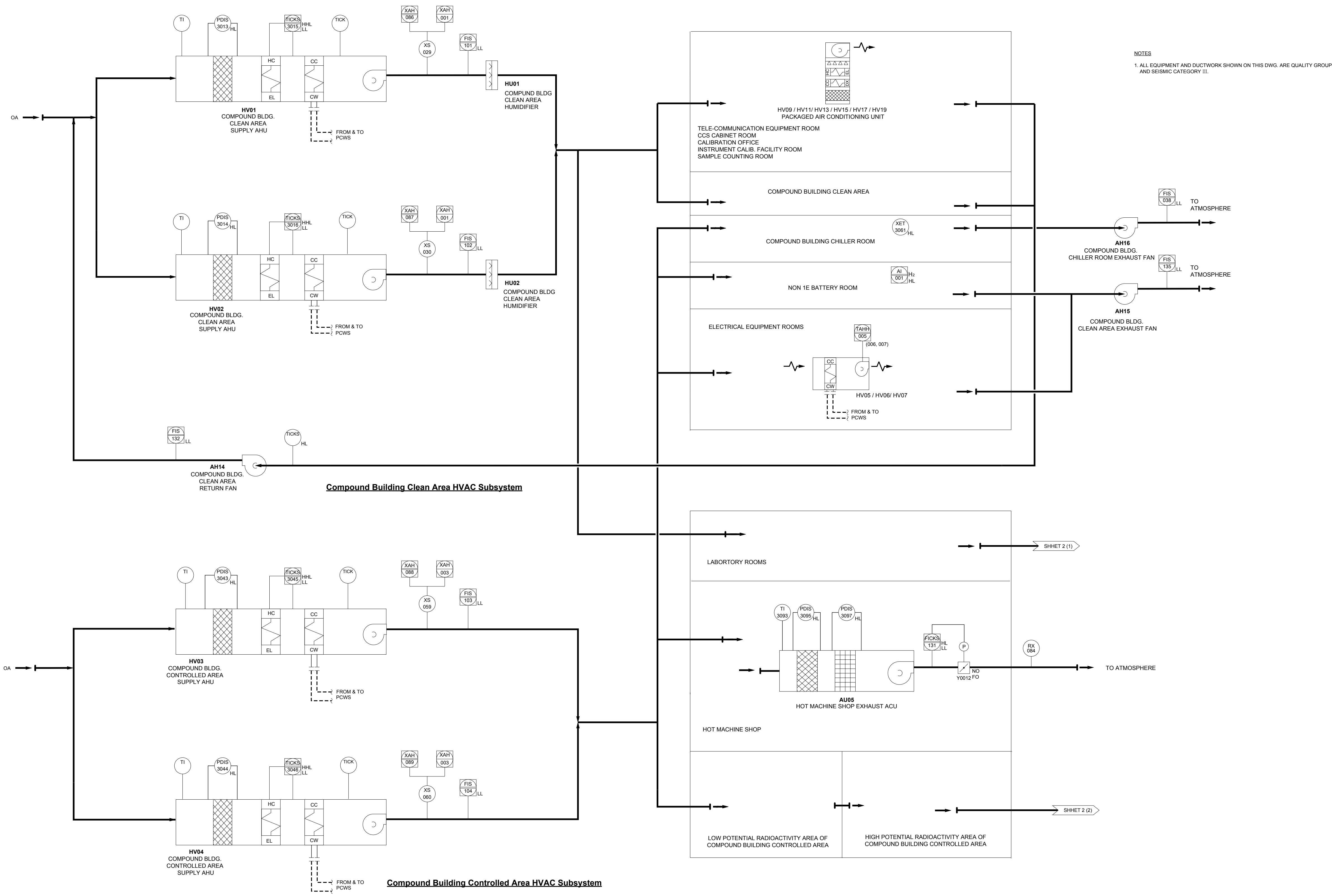


Figure 9.4.7-1 Compound Building HVAC System (1 of 2)

NOTES

1. ALL EQUIPMENT AND DUCTWORK SHOWN ON THIS DWG. ARE QUALITY GROUP E AND SEISMIC CATEGORY III.

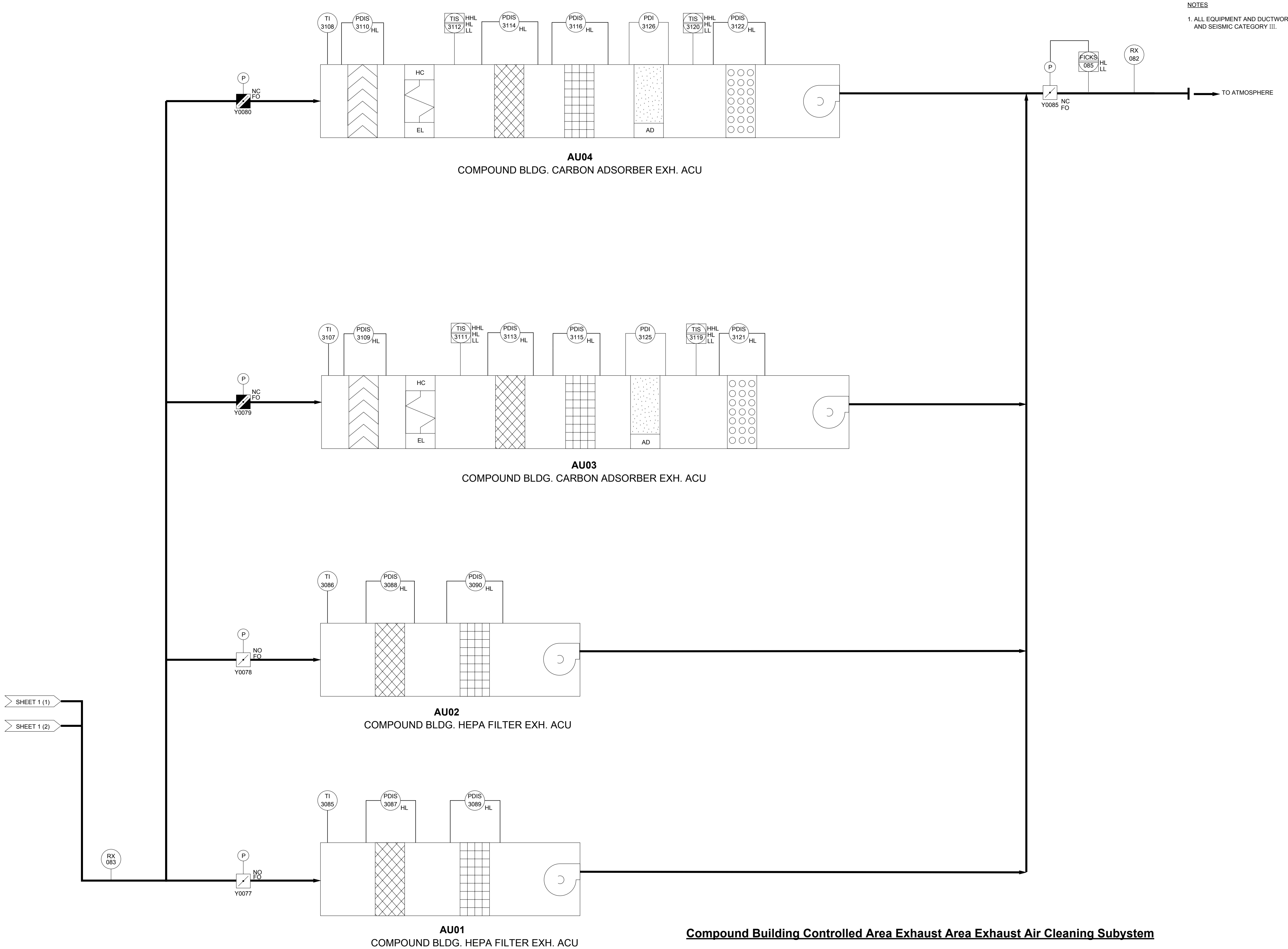


Figure 9.4.7-1 Compound Building HVAC System (2 of 2)

9.5 Other Auxiliary Systems

9.5.1 Fire Protection Program

The primary objectives of the APR1400 fire protection program (FPP) are to minimize both the probability of occurrence and the consequences of a fire. To meet these objectives, the FPP is designed to provide reasonable assurance, through defense-in-depth, that any fire that occurs does not prevent the performance of necessary safe-shutdown functions, and the radioactive releases to the environment in the event of a fire will be minimized. This concept of defense-in-depth provides the following:

a. To prevent fires from starting

b. To rapidly detect, control, and extinguish those fires that may occur

c. To provide protection for structures, systems, and components (SSCs) important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant

d. Fire protection systems are designed so that any system failure or inadvertent operation does not adversely impact the ability of the SSCs important to safety to perform their safety functions

The FPP consists of the following elements:

a. Comprehensive identification and analysis of fire and explosion hazards

b. Organization and staff positions responsible for FPP management and implementation of the FPP

c. Administrative policy, procedures, and practices for training of general plant personnel; control of fire hazards; inspection, testing, and maintenance of fire protection systems and features; control of plant design and modification; control of fire system outages and impairments; and FPP quality assurance

d. Automatic fire detection, alarm, and suppression systems, including fire water supply and distribution systems

e. Manual suppression capability including portable fire extinguishers; standpipes; hydrants; hose stations; fire department connections; fire brigade organization, training, qualification, equipment, and drills; emergency plans and procedures; and, if applicable, offsite mutual aid capabilities

f. Building design for fire protection including layout of fire areas, fire barrier design and qualification testing, interior finish, electrical system design, ventilation system design, drainage systems, and other systems and features for minimizing the threat of fire

g. Post-fire safe shutdown analysis and procedures that demonstrate that the plant can achieve and maintain safe shutdown in the event of a fire

h. Probabilistic risk assessment (PRA) that identifies relative fire risks and vulnerabilities

Because the FPP is an operational program with implementation milestones for various individual elements as noted in SECY-05-0197 (Reference 10), those elements of the FPP that are not fully implemented until the completion of the plant will be addressed as an operational program.

This section addresses design features and elements of the FPP to meet the criteria of General Design Criterion (GDC) 3 and enhanced fire protection criteria for new reactor designs as documented in SECY 90-016 (Reference 1) and SECY 93-087 (Reference 2).

The COL applicant is to address organization, training, qualification of personnel, implementation of FPP elements such as establishment of the fire brigade, implementation of a combustible and ignition source control program, firefighting procedures, development of inspection and test procedures and pre-fire plans, and quality assurance. See COL Item 9.5(1).

9.5.1.1 Design Bases

To satisfy 10 CFR 50.48, "Fire Protection" (Reference 9) and NRC fire protection guidance promulgated in NRC RG 1.189, Rev. 2 (Reference 20), the APR1400 is designed to:

a. Minimize the potential for fire and explosions by controlling, separating, and limiting the quantities of combustibles and sources of ignition, and by preventing the spread of fire by subdividing plant buildings into fire areas separated by fire barriers and into fire zones or compartments, which are capable of substantially confining fire impact

b. Provide the capability to rapidly detect, control, and promptly extinguish fires that do occur

c. Provide 3-hour fire-rated barriers between redundant divisions of safety-related equipment

d. Prevent release of radioactive contamination

e. Provide designs that failure or inadvertent operation of the fire protection system (FPS) cannot prevent plant safety functions from being performed or adversely impact the operation of safety-related equipment

f. Use noncombustible and heat resistant materials wherever practicable throughout the unit, particularly in locations such as the containment and control room

g. Provide MCR and RSR, which are physically separated, electrically isolated, and provide redundant shutdown capability

h. Separate redundant trains of safety-related equipment used to mitigate the consequences of a design basis accident so that a fire in one train does not damage the redundant train

i. Achieve the cold shutdown regardless of inoperable condition of any fire area and without any manual actions in any fire-involved areas or operator entry into those areas

j. Provide ventilation systems so that smoke, hot gases, or fire suppressants do not migrate from one fire area to another so that they could adversely affect safe-shutdown capabilities, including operator actions

k. Prevent the failure of structural supports and building structural members caused by heat from a fire so that safe-shutdown capabilities are not affected

l. Provide floor drains in safety-related areas to remove expected firefighting water flow

m. Provide fire-fighting personnel access and escape routes for personnel protection

n. Provide communications (Subsection 9.5.2) and emergency lighting system (Subsection 9.5.3)

Appropriate industry codes and standards are referred for the design, construction, and operation of the APR1400. A list of the industry codes, standards, and guidance documents that are the basis for the FPP is described in Subsection 9.5.11. The codes and standards related to the design and installation, operation and test of FPSs and features of the APR1400 are those NFPA codes and standards in effect 180 days prior to the submittal of the DC application under 10 CFR 52 (Reference 15). Deviations to any NFPA codes and standards are identified and justified in the fire hazards analysis. These deviations are not to degrade the performance of the FPSs or features.

The fire safe shutdown analysis (FSSA) provides reasonable assurance that a fire at any location does not affect redundant safe shutdown components. It also provides reasonable assurance that redundant safe shutdown components such as instruments and valves are separated to the extent practicable as stipulated in SECY 93-087 (Reference 2). Cables used for safe shutdown functions are separated to the extent practical. In areas where the redundant safe shutdown cables do not meet the separation criteria of NRC RG 1.189, at least one train is protected with 3-hour rated fire-insulating material.

The APR1400 has two separate and redundant safety divisions. One safety division can achieve safe-shutdown from the MCR, which eliminates the need for any operator manual actions that would require operators to enter a fire-involved area. Since the remote shutdown console is electrically isolated from the MCR, it can accomplish the essential shutdown actions if the MCR becomes unavailable because of fire. No other operator manual actions or recovery actions are required for safe shutdown, which can be achieved from MCR or RSR.

Possible fire induced failures, including multiple spurious actuations, are addressed in post-fire safe-shutdown circuit analysis in accordance with the guidance of NRC RG 1.189, Rev. 2, which stipulates that any and all possible failures and spurious actuations caused by the failures, including combinations of multiple failures or operations that could prevent safe-shutdown, be addressed in the analysis.

Separation of redundant electrical cables from each other by 3-hour fire barriers and utilization of digital I&C systems and fiber optic cables as recognized in the SRP 9.5.1.1 (Reference 3), Appendix A, Subsection 6.2, minimize the potential of fire induced multiple spurious operations. The post-fire safe shutdown circuit analysis provides reasonable assurance that at least one success path of safe shutdown is not impaired by fire damage.

The fire prevention, control, detection, and suppression features of the APR1400 design provide reasonable assurance of plant and personnel safety in the event of a fire. The Fire Hazard Analysis (FHA) for the APR1400 (see Appendix 9.5A) evaluates the adequacy of fire protection design provided for systems and plant areas important to safety.

9.5.1.2 System Description

The FPP is designed in accordance with

a. 10 CFR 50.48, "Fire Protection"

b. 10 CFR 50, Appendix A, GDC 3, "Fire Protection"

c. 10 CFR 50, Appendix A, GDC 5, "Sharing of Structures, Systems, and Components"

d. 10 CFR 50, Appendix A, GDC 19, “MCR”

e. 10 CFR 50, Appendix A, GDC 23, “Protection System Failure Modes”

f. 10 CFR 52, “Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants”

g. 10 CFR 52.47(a)(4), “Contents of Applications”; technical information

h. 10 CFR 52.97(b), “Issuance of Combined Licenses”

i. 10 CFR 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste”

The APR1400 design complies with specific guidance in Section 9.5.1.1 of the Standard Review Plan (SRP) (NUREG 0800), which provides acceptance criteria for meeting the requirements of the NRC regulations. In accordance with SRP Section 9.5.1.1, the FPP complies with the guidance of NRC RG 1.189 or NFPA 804 (Reference 4). However, if RG 1.189 and NFPA 804 guidance conflicts, NRC RG 1.189 takes precedence for the FPP.

Table 9.5.1-1 is a point-by-point comparison of the conformance of the APR1400 FPP with the guidelines of NRC RG 1.189. Table 9.5.1-2 is a point-by point comparison of the conformance of the FPP with the guidelines of NFPA 804.

FPS is composed of fire detection and fire extinguishing systems such as standpipe and hose station, hydrant, sprinkler, water spray, clean agent, foam extinguishing system, and portable extinguishing equipment. The FPS flow diagrams are shown in Figures 9.5.1-1 through 9.5.1-9.

FPS is largely categorized into four systems:

a. Fire detection system

b. Water supply system including fire tank, pump, and yard fire main and distribution system. The detailed water supply system and water distribution system are described in Subsections 9.5.1.2.2 and 9.5.1.2.3.

c. Automatic firefighting systems

d. Manual firefighting systems

The FPS is in function during plant operating modes, including a loss offsite power and classified as a non-safety-related, non-seismic system for normal operation.

FPS detects fires and provides the capability for automatic extinction in some fire areas, and manual extinction in all areas. FPS is accomplished by utilizing manual and automatic water, foam, and clean agent extinguishing systems during normal conditions. If a fire occurs in a safety-related area during and after a seismic event, the seismic Category I water suppression system operates manually to suppress the fire. Provisions are made to supply water to standpipes and hose connections for manual fire fighting in areas containing equipment required for safe plant shutdown in the event of a safe shutdown earthquake (SSE) with failure of the normal FPS in safety-related areas.

Seismic design is applied for the safety-related areas such as auxiliary building, EDG building, and containment building. The seismic Category I water system includes two 100 percent capacity seismic fire water tanks and pumps located in the auxiliary building. In addition, the containment isolation valves and associated piping for the FPS are designed as safety related (safety Class 2) and seismic Category I. The normal fire protection water supply line to the seismic Category I fire hose and standpipe system header contains a check valve that isolates the normal fire protection water supply from the seismic Category I header upon loss of system pressure due to a seismic event.

The fire water supply piping is filled with water and pressurized by jockey pump to allow immediate startup of a fire pump without water hammer effects. Fire detection and alarm circuits are normally energized and are constantly monitored for system trouble or loss of power.

When fire is detected, the fire detection system produces a local area alarm that is both audibly and visually identifiable to any personnel in the area and MCR. In areas where a pre-action sprinkler system is installed, the sprinkler activates after receiving the signal from the fire detection system. There are four types of automatic suppression systems for FPS. Each type of system is described in Subsection 9.5.1.2.5 in detail. When the pressure in the discharge pipe of the fire pump falls to the setpoint because of the opening of sprinkler nozzles or for other reasons, the electrical fire pump starts automatically, and if the pressure falls more to a preset point, the two standby diesel-driven pumps start automatically in consecutive order. The fire pumps continue to run until they are stopped manually. All fire pumps can be operated manually in MCR and RSR, but can stop only manually at the pump controller.

Portable fire extinguishers, fire hydrants, fire hose stations, and supporting equipment are provided for manual firefighting. Each type of manual suppression system is described in Subsection 9.5.1.2.5.

A ventilation system is provided for all fire areas to prevent migration of smoke, hot gases, or fire suppressant material into other fire areas. Fusible link fire dampers having a rating equal to the fire barrier are closed automatically on the high temperature. The ventilation system is described in Subsection 9.5.1.2.7 in more detail. Detailed design features to prevent and control migration of smoke, hot gases, or fire suppressant material into other fire areas and operator actions are described in FHA (Appendix 9.5A).

9.5.1.2.1 Facility Features for Fire Protection

Architectural Features

The plant areas are provided with adequate egress routes for personnel, which are arranged to meet the provisions of NFPA 101. For emergency situations, more than two means of egress are provided in power block structures except for the reactor containment building. The stairways used for egress in power block structures are enclosed by a minimum 2-hour fire-rated enclosure. The power block structures use noncombustible or fire-resistant material including masonry, metal siding, and interior finishes.

The fire compartment consists of walls, floors, ceiling, and assemblies to seal openings such as doors, dampers, penetration seal assemblies, and fire-rated insulation material.

The materials used for fire compartment are designed and installed to meet specific fire resistance ratings using assemblies qualified by fire tests. The qualification fire tests are conducted in accordance with NFPA 251 (Reference 77) or ASTM E119 (Reference 76).

Doors and door assemblies including frames and hinges installed in the fire compartment are qualified with the required fire resistance rating.

Openings through the fire compartment for pipes, conduits, and cable trays that separate fire areas are sealed to provide a fire resistance rating at least equal to that required for the fire compartment itself. Such penetration seals meet the requirements of ASTM E814-11a (Reference 73) or IEEE 634 (Reference 74).

Plant Arrangement

The plant is subdivided into separate fire areas by fire-rated structural barriers (i.e., walls, floors, and ceilings) to confine the effects of fires to a single area, thereby minimizing the potential for adverse effects from fires on redundant SSCs important to safety. Some fire areas are subdivided into fire zones based on physical separation or location of plant equipment. Fire zones are not necessarily isolated by complete fire barriers, but the fire zone boundaries are capable of substantially confining the adverse impact of a fire within the fire zone.

Fire barriers are provided in accordance with the guidance of NRC RG 1.189. Three hour fire rated barriers are noncombustible and surround fire areas containing safety-related components. The three hour fire-rated barriers provide complete separation of redundant safe shutdown equipment, electrical cables, instrumentation and controls, except where other important requirement conflicts with the need for separation, specifically:

a. In the MCR, fire barriers separating redundant safety trains are not provided because it is impractical to completely separate functional requirements of them. The risk of the fire in the MCR is minimized by the reduction of combustible materials. Continuous occupancy of operators provides confidence that fire will

be rapidly detected and suppressed by operators when a fire occurs. The fire detection systems and clean agent suppression system are designed to provide reasonable assurance that an MCR fire will be rapidly detected and suppressed. If a fire that brings about the evacuation of the MCR occurs, the plant safe shutdown can be achieved using independent controls in the RSR located in a separate fire area on a different elevation of the plant.

b. In the RSR, fire barrier separation between redundant safety trains is not provided because the RSR is not required for safe shutdown unless a fire that brings about the evacuation of the MCR occurs.

c. The reactor containment building (RCB) is a single fire area. Fire barrier separation necessary to define a fire area is impossible throughout the primary containment area because there are other design requirements to be satisfied. Fire protection features for redundant safe shutdown systems in the RCB provide confidence that at least one of two divisions of safe shutdown systems is free of fire damage in any fire zone. The quantity of combustible materials in the RCB is minimized. Redundant divisions of safe shutdown systems are separated by structural walls or by a horizontal distance. Cables of a safety-related division passing through a fire zone that has cables of another division may be protected by fire barriers or by a noncombustible radiant energy shield with a minimum fire rating of 30 minutes. FPS has the appropriate fire detection and suppression capabilities.

Outside of the MCR and the RCB, each of the redundant trains of safe shutdown is separated by 3-hour rated fire barriers. Each of the two divisions of systems in the auxiliary building and emergency diesel generator building is separated by 3-hour fire-rated barriers.

Openings and penetrations through fire barriers are protected in accordance with the guidance of NRC RG 1.189.

The FHA (Appendix 9.5A) contains a description of plant fire areas, fire zones, fire barriers, and the protection of barrier openings, as well as a description of the separation between redundant safe-shutdown components.

Electrical Cable Design, Routing, and Separation

Electrical cable, including fiber-optic cable and methods of raceway construction, are selected in accordance with NRC RG 1.189 guidance. Metal cable trays are used throughout the plant. Rigid metal conduit or other metal raceways are used for selected cable runs. Flexible metallic tubing may be used in short lengths for equipment connections.

The insulating and jacketing materials for electrical cables are selected to meet the fire and flame test requirements of IEEE Standard 1202 (Reference 27). Redundant safety division are installed in suitable raceways and are generally separated from adjacent safety division by 3-hour fire rated structural barriers such as reinforced concrete walls with 3-hour fire-rated dampers and penetration seals, and 3-hour fire-rated doors between compartments. In a limited number of cases, electrical division separation is obtained by enclosing cables trays and conduits with a fire protective envelope such as a fire-rated wrap system. The design, routing, and separation of cables and raceways are further described in Chapter 8.

Control of Combustible Materials

Combustible materials are defined as those materials that ignite, burn, support combustion, or release combustible vapors when exposed to fire or heat. The COL applicant is to establish the program to control the storage, use, and disposal of combustible material. See COL Item 9.5(1).

The APR1400 structures are composed of noncombustible material to the extent practicable. The selection of construction materials and the control of combustible materials are in accordance with the guidance of NRC RG 1.189 and Section 3.3 of NFPA 804. Some interior finish materials are of limited combustibles with the appropriate flame spread index in accordance with ASTM E-84 (Reference 75).

Bulk hydrogen storage cylinders are located outside. This system is designed to be isolated. To limit hydrogen accumulation to less than two percent concentration in safety related areas of the plant, the hydrogen compressed gas system piping within those areas

includes excess flow shutoff valves, and is designed to seismic Category I or II requirements.

Ventilation systems are provided to maintain the hydrogen concentrations in the battery rooms below 1 percent by volume, as described in Subsections 9.4.4 and 9.4.5.

The turbine lube oil reservoir room and the main turbine lube oil conditioner room, located in the T/B, are separated from other equipment by 3-hour rated fire barriers.

Outdoor oil-filled transformers are separated from other buildings in accordance with the guidance of NFPA 804. The COL applicant is to establish the specific measures for the design of outdoor oil-filled transformers. See COL Item 9.5(2).

The diesel fuel oil storage tanks for each EDG and AAC gas turbine generator (GTG) are separated from the adjacent fire areas by 3-hour rated fire barrier. Potential fuel leaks or spills from the storage tanks are confined within the dike surrounding the tanks. The diesel fuel oil tanks for each EDG/AAC GTG are located in a dike that has sufficient capacity to hold 110 percent the day tank capacity or are drained to a safe location.

Control of Radioactive Materials

Materials that collect and contain radioactivity, such as spent ion exchange resins, charcoal filters, and high-efficiency particulate air (HEPA) filters, are stored in closed metal tanks or containers that are located in areas free from ignition sources or combustibles. These materials are protected from exposure to fires in adjacent areas as well. Consideration is given to requirements for removal of decay heat from entrained radioactive materials.

Radioactive waste areas, storage areas, and decontamination areas are separated from other areas of the plant by fire barriers having at least 3-hour ratings. Automatic sprinklers or manual hose stations and portable extinguishers are used in all areas where combustible materials are located. Automatic fire detection annunciates and alarms in the MCR and alarms locally. Ventilation systems in these areas are capable of being isolated to prevent the release of radioactive materials to other areas or the environment. Water from firefighting activities drains to liquid radwaste collection systems.

9.5.1.2.2 Fire Protection Water Supply System

The fire water supply system is designed in accordance with the guidance of NRC RG 1.189 and the applicable NFPA codes and standards. The fire protection water supply system is sized such that it contains sufficient water for 2-hour operation of the largest sprinkler system plus a 1,900 L/min (500 gpm) manual hose stream allowance to support fire suppression activities, or at least 1,135,500 L (300,000 gal) in ground-level storage tanks. Fire pumps, water storage tanks and piping are designed to provide a fully adequate water supply to water suppression systems and fire hose standpipe systems in both safety-related and nonsafety-related areas with one fire pump and one water storage tank out of service. Redundant water supply capability is provided.

There are three 50 percent capacity fire pumps. One fire pump is driven by an electrical motor and the other two pumps are driven by a diesel engine. Two of three pumps provide a minimum flow and pressure to supply the largest design demand of any sprinkler system and manual hoses. Each fire pump starts automatically on a progressively decreasing pressure signal inside the fire main. The fire pumps continue to run until they are manually stopped. Firefighting activities continue until the fire is extinguished. Suppression systems are manually stopped.

An electric motor driven jockey pump provides system pressure maintenance to avoid starting of the main fire pumps in the absence of a fire. The electric motor-driven fire pump, electric motor-driven jockey pump, their associated controllers, piping, and fittings are located in the other fire pump area. The electric motor-driven fire pump is powered by a non-Class 1E bus. Backup power is provided by the site alternate AC power source and electrically protected so that fire in the power house does not interrupt pump operation.

The fire pumps are located in the yard area in a non-seismic and non-safety-related structure. The fire pump house is a steel-framed structure and is subdivided into three separate fire areas by a 3-hour rated fire barrier. Each diesel-driven fire pump and its associated controller, fuel tank, piping, and fittings are located in one of the fire pump areas.

The two fresh water storage tanks are arranged so that the pumps can take suction from either or both tanks. Piping between the fire water sources and the fire pumps is in accordance with NFPA 20 (Reference 23). A failure of one tank or its piping cannot cause both tanks to drain. Each fire tank (fresh water storage tanks) has an automatic filling

system supplying fresh water from the raw water system. Use of fresh water precludes potential system problems and deterioration associated with raw water (e.g., biological organism invasion such as Asiatic clams and microbiologically induced corrosion). The makeup system is designed to refill each tank within 8 hours.

Fuel supply tank(s) for diesel driven fire pump have a capacity at least equal to 5.07 L per kW (1 gal per hp), plus 5 percent volume for expansion and 5 percent volume for sump in accordance with NFPA 20.

In addition to the normal fire protection water supply system, in order to meet NRC RG 1.189, position 3.2.1, a seismic Category I fire protection water supply system is also provided. It services a seismic Category I fire hose and standpipe system located in the containment building, the auxiliary building and the emergency generator building. Permanent provision for operators to connect to the emergency containment spray system is installed to provide external water source after severe accident. The COL applicant is to address the site-specific or non-standard featured fire water supply system in accordance with the guidance of NRC RG 1.189 and the applicable NFPA 20 (See COL item 9.5(2)).

9.5.1.2.3 Fire Water Supply Piping, Yard Piping, and Yard Hydrants

Fire protection water is distributed by an underground yard main loop, designed in accordance with the guidance of NFPA 24 (Reference 24). The yard main loop also includes a building interior header that distributes water to suppression systems within the main plant buildings.

Piping is “looped” around the power block and cross-connected within the auxiliary building, the compound building, the turbine building so that sprinkler systems have redundant water supply flow paths.

There are branch feeds to outliner supporting structures, such as the essential service water structure, the raw water source intake structure, alternate AC building, auxiliary boiler building, switch yard control building, and cooling tower areas.

Fire protection water suppression and hose station connections to the water distribution system are arranged so that a single impairment does not isolate primary and secondary protection for any area.

Sectional isolation valves are located throughout the water distribution system to provide reasonable assurance that any portion of the distribution system that serves buildings containing safety-related systems, equipment, and components is repaired without isolating primary and secondary fire protection.

Hydrants are provided on the yard main in accordance with the guidance of NFPA 24. They are located at intervals of up to 76 m (250 ft) in accordance with NFPA 804. They provide hose stream protection for every part of each building and two hose streams for every part of the interior of each building not covered by standpipe protection. The lateral connection to each hydrant is controlled by an underground isolation valve. Curb boxes are provided for each hydrant isolation valve.

Hose houses are provided in accordance with the guidance of NFPA 24. They are located at intervals of not more than 305 m (1,000 ft) along the yard main in accordance with NRC RG 1.189.

Fire protection piping within safety related structures containing safety-related components are normally designed in accordance with seismic Category II requirements. Outdoor fire water piping and water suppression systems located in unheated areas of the plant are protected from freezing. The COL applicant is to address the site-specific or non-standard featured fire water distribution system in accordance with the guidance of NRC RG 1.189 and the applicable NFPA 24. See COL Item 9.5(2).

9.5.1.2.4 Manual Suppression Means

In general, complete reliance is not placed on the automatic sprinkler system. Backup manual fire suppression systems (such as hoses and portable extinguishers) are provided throughout the plant to limit the extent of fire damage.

Standpipe and Hose Systems

For all power block buildings, Class III standpipe and hose systems are installed in accordance with NFPA 14 (Reference 25). The Class III standpipe system provides 40 mm (1.5 inch) hose stations to supply water for use by trained personnel and 65 mm (2.5 inch) hose connections to supply a large volume of water use by fire departments.

Individual standpipes are at least 100 mm (4 in) in diameter for multiple hose connections.

Fire hose and standpipe systems that are located in the containment building, EDG building, and auxiliary building meet seismic Category I requirements. The primary water supply to this hose and standpipe system is from the normal non-seismic fire protection water distribution system. There are two 68,137 L (18,000 gal) seismic Category I classified water storage tanks and two 568 L/min (150 gpm) seismic Category I classified pumps that are also connected to this common seismic Category I fire hose and standpipe system. The pump and water storage tank are located in the auxiliary building and provide 284 L/min (75 gpm) each to any two fire hose stations in the auxiliary building, EDG building, and containment building for two hours. In the event of loss of normal fire protection water distribution system following a seismic event, the seismic Category I fire water supply system supplies the specified volume and pressure to any two fire hoses in the safety-related portions of the station.

This common fire hose standpipe system is isolated from the normal fire protection water supply by check valves. The above system is required to comply with NRC RG 1.189, position 3.2.1.

Hose stations are located so that any location where safety-related equipment may be damaged by fire can be reached with one effective hose stream.

Hose stations are equipped with 40 mm (1.5 in) and 65 mm (2.5 in) fire hoses, which are a maximum of 30.5 m (100 ft) long.

The COL applicant is to address the site-specific or non-standard featured manual fire suppression system in accordance with the guidance of NRC RG 1.189 and the applicable NFPA 14. See COL Item 9.5(2).

Portable Fire Extinguishers

Portable fire extinguishers are located and arranged in accordance with NFPA 10, "Standard for Installation and Use of Portable Fire Extinguishers" (Reference 22).

Fire extinguishers are located to be accessible. Locations are clearly marked to be prominently visible. They are also readily accessible for use in high radiation areas but are not located within those areas unless the FHA indicates that a specific requirement exists.

The COL applicant is to address apparatus for plant personnel and fire brigades such as portable fire extinguisher, self contained breathing apparatus. See COL Item 9.5(3).

9.5.1.2.5 Automatic Extinguishing Systems

The automatic FPSs are provided in accordance with the guidance of NRC RG 1.189, and the applicable NFPA codes and standards and the FHA with consideration of the unique aspects of each application, including building characteristics, material of construction, environmental conditions, fire area contents, and adjacent structures.

The selection of automatic suppression systems for each plant area is in accordance with the guidance of NFPA 804. Water systems are preferred, but the use of automatic water-based suppression in radiation areas is minimized because of the possible spread of contamination.

A clean agent gaseous fire suppression system is used for selected areas with heavy cable fire loading under the MCR room, computer room and electrical equipment room. Halon and carbon dioxide are not used for the FPS in the APR1400.

The FHA describes the fire suppression systems provided for each area.

Automatic Water Suppression Systems

Automatic water suppression systems are installed in areas as stipulated in NRC RG 1.189 in accordance with the requirements of NFPA 13 (Reference 29) and NFPA 15 (Reference 30).

Pre-action sprinkler systems are used where leaking or inadvertent actuation of water-filled sprinkler systems produce undesirable consequences, such as water discharge on equipment important to continued plant operation. Sprinkler heads are normally closed and are actuated by heat-sensitive elements. Actuation temperatures of these elements are based on the individual location and application.

The types of automatic sprinkler and automatic water spray systems used for the APR1400 are briefly described below:

a. Wet pipe

   The sprinklers in these systems are attached to pipes containing pressurized water at all times. Individual sprinklers in the vicinity of a fire are set off by heat, allowing water to flow through them immediately.

   Wet-pipe systems are used wherever temperatures are high enough to prevent freezing. System operation is terminated manually by shutting off the water supply valve.

b. Pre-action

   These systems contain an additional fire-detection device that recognizes a fire before the sprinklers are activated. The sprinklers are attached to a pipe containing air that may or may not be pressurized.

   When the detection device senses a fire, it opens the pre-action valve, allowing water to flow through the pipes before the sprinklers are open by the fire. When the heat activates the sprinklers, water flows through immediately, as in a wet-pipe system.

Pre-action systems are usually employed in areas that are at risk for serious water damage due to damaged sprinkles or piping. System operation is terminated manually by shutting the water supply valve.

c. Deluge sprinkler or water spray system

In these systems, sprinklers or spray nozzles are open at all times. They are connected to a dry pipe network that is connected to a deluge valve that is connected to the main water supply.

The fire detector is installed in the same area as the sprinkler/spray nozzles and controls the deluge valve. When it is activated, the deluge valve opens, allowing water to flow through all the sprinklers/spray nozzles.

The purpose of a deluge system is to quickly wet down an entire hazard area to prevent a fire from spreading. They are usually used in facilities that contain hazardous materials such as flammable liquids, chemicals, and explosives.

System operation is terminated manually by shutting the water supply valve.

d. Foam suppression system

A foam system is used to protect buildings that contain combustible materials and other hazards that a normal water-based FPS could not suppress.

The foam system suppresses the fire by separating the fuel from the air. The foam system is designed in accordance with NFPA 16 (Reference 21).

Automatic Gaseous Suppression Systems

Environmentally friendly fire suppression clean agents are used for the heavy fire loading or raised-floor compartments where access for firefighting may be difficult. A clean agent is supplied for the fire protection of the cables under floors in the MCR habitability area, computer room area, and electrical equipment rooms. The system is designed according to NFPA 2001 (Reference 32).

9.5.1.2.6 Fire Detection and Fire Alarm System

Fire detectors and alarms are specifically selected for each location based on potential fire hazard, need for timely actuation, ambient conditions, ventilation, and ceiling height, as described in the FHA in accordance with the guidance of NRC RG 1.189 and NFPA 72 (Reference 31).

Fire detection and alarm systems are generally provided in accordance with the guidance of NFPA 804 as modified by NRC RG 1.189 stipulations. Fire detectors are to be provided for areas containing safety-related equipment, including the containment building, and activate fire alarms.

The types of fire detectors for the APR1400 are as follows:

a. Heat detectors: designed to operate at predetermined ambient temperature

b. Photoelectric smoke detectors: designed to operate in the presence of particles of combustion

c. Flame detectors: designed to operate by detection of infrared, visible, or ultraviolet radiation

Manual pull stations are addressable and are located as determined by FHA. Either manual pull stations or individual fire detectors can activate the central control panel, which initiates alarm and annunciation in the MCR, central alarm station (CAS), and locally in the vicinity of the activated device. The central fire control panel is located in the MCR for operator convenience.

The fire detection and alarm system is powered from a non-Class 1E 120 VAC distribution panel fed from a permanent non-Class 1E bus, which receives non-Class 1E onsite standby power from the alternate AC source in the event of loss of offsite power (LOOP). The central fire control panel contains backup batteries capable of supplying power to detection system for 24 hours consistent with requirements of NRC RG 1.189. This system is described in Subsection 8.3.2.1.

9.5.1.2.7 Building Ventilation

The heating, ventilation, and air-conditioning (HVAC) systems supply fresh air to personnel working in the plant during normal plant operation, remove radioactive materials, and restrict radioactive releases to the environment (Section 9.4).

Fire dampers are installed in fire-rated barriers and have the same fire resistance rating as the barrier.

Fire dampers in ventilation system are fusible link type to close automatically against full airflow, on high temperature to limit the spread of fire and combustion products. Fire dampers serving certain safety-related, smoke-sensitive areas are also closed in response to an initiation signal from the fire detection system. In selected areas such as MCR, auxiliary controlled areas, the fire alarm system provides interface with the HVAC systems such as to shut down HVAC operation upon a fire alarm signal. Smoke is removed from the fire area as described in the FHA (Appendix 9.5A). Fire and smoke control are recognized as important elements of the overall FPP. The ventilation systems are designed in accordance with NFPA 90A (Reference 40).

The smoke control design philosophy is to allow for smoke venting from any plant area without spreading to adjacent areas, to maintain plant habitability for operator protection and to provide reasonable assurance of protection of the public.

Ventilation systems are division-specific so that fire or smoke in an area containing a safety-related division of equipment cannot migrate through the ventilation ducts to an area containing the redundant division of safety-related equipment.

For safety of the remainder of the fire area, the smoke from the area of fire origin is exhausted continuously until the fire damper is closed due to high room temperature.

Smoke and gases containing radioactive materials are routed through a filter train installed HEPA filter or charcoal adsorber beds to the unit vent.

The MCR is on a separate ventilation system from RSR. Since the stairways between the elevations are maintained pressurized, smoke cannot migrate between the two areas. Thus, the pathways to the RSR are free of smoke originating from an MCR fire.

9.5.1.3 Safety Evaluation

9.5.1.3.1 Fire Hazard Analysis

The FHA evaluates the potential for the occurrence of fires within the plant and describes how fires are detected and suppressed. It also demonstrates that safe shutdown can be achieved following a fire. The detailed FHA is included in Appendix 9.5A.

The FHA is conducted for each fire area or zone throughout the plant. The FHA includes fire area/zone drawings and a discussion of the analysis methodology. It also provides the following information for each fire area/zone in the plant:

a. A description of the fire areas/zones and fire protection features including fire barriers, as well as fire detection and suppression capabilities.

b. Identification of the type, quantity of the in-situ and anticipated transient combustible materials, and fire loading.

c. A description of major electrical and mechanical equipment located within the fire area/zone.

d. Evaluation of the design basis fire, which is defined as the fire that would occur when all combustible materials within the fire area are ignited.

e. Evaluation of the effect on SSC important to safety due to inadvertent operation of fire suppression system.

9.5.1.3.2 Safe Shutdown Analysis

The fire safe shutdown analysis (FSSA) is performed according to the following assumptions:

a. The FSSA includes the effects of the worst-case spurious actuation.

b. Fire is not postulated to be concurrent with simultaneous, coincidental failures of safety systems, other plant accidents, or the most severe natural phenomena.

c. Fire renders all equipment in any fire area (excluding the control room and reactor containment) inoperable, recognizing post-fire reentry for repairs and operator actions is not possible, according to the enhanced fire protection criteria of NRC RG 1.189.

d. Inside containment, cables for safe shutdown are separated to the extent practicable. In areas where the redundant safe shutdown cables do not meet the separation criteria of NRC RG 1.189, at least one division is free of fire damage by fire protection measures.

The following design basis objectives are met in order to provide reasonable assurance that the safe shutdown performance goals are satisfied:

a. Maintain RCS pressure boundary integrity

b. Provide reasonable assurance of the reactivity control function maintains cold shutdown conditions

c. Provide reasonable assurance that reactor coolant makeup is available to maintain reactor coolant level within the level indication of the pressurizer

d. Maintain RCS decay heat removal function

e. Provide direct reading of process variables necessary to perform and control reactivity, reactor coolant pressurizer level, and decay heat removal

f. Maintain support functions (process cooling, lubrication) for equipment required for safe shutdown

The FSSA demonstrates that one success path of two safety SSCs that is used to bring the reactor to safe shutdown conditions remains free of fire damage. As required by NRC RG 1.189, fire barriers, physical separation with no intervening combustibles, and/or automatic detection and suppression provide this protection. The FSSA is included in Appendix 9.5A.

For an MCR fire, the RSR is used as alternative shutdown capability. A fire in the MCR is the only fire scenario that requires the RSR to be used. Shutdown from the MCR is accomplished for fires originating in all other fire areas. For the MCR fire, both shutdown paths (i.e., Division I and Division II) are available to safely shut down and maintain cold shutdown from the RSR. Subsection 7.4.1.1 contains a discussion of the transfer of control from the MCR to the RSR. Each of these systems includes adequate controls and instrumentation in the MCR and at the RSR to provide reasonable assurance that safe shutdown can be achieved. Subsection 7.4.1.1 describes the instrumentation and controls in the RSR that are required to bring the plant to safe shutdown conditions.

The COL applicant is to provide a milestone for completing a final FHA and FSSA on the basis of the final plant cable routing, fire barrier ratings, fire loading, ignition sources, and equipment arrangement. The initial FHA and FSSA for design certification state the assumptions and requirements. The final FHA and FSSA include evaluation results of them based on final design data. In addition, in the final FHA and FSSA, a detailed post-fire safe shutdown circuit analysis is included, uses a methodology that is similar to NEI 00-01, Rev. 3 (Reference 19). The final FHA and FSSA are carried out and documented as a part of update for the COL application and maintained in the licensing basis for the specific site. See COL Item 9.5(4).

9.5.1.4 Inspection and Testing Requirements

The FPSs are inspected and tested prior to initial startup. Preoperational testing is described in Section 14.2.

The FPS, including pumps and sprinklers, is initially tested by the manufacturer in accordance with the guidance of related NFPA codes, to verify pressure integrity and performance. Inservice test during plant operation is performed to applicable NFPA codes and standards in accordance with the guidance of NRC RG 1.189.

9.5.1.5 Instrumentation Requirements

The fresh water storage tank is equipped with two local liquid level-indicating transmitters.

The level transmitter provides a signal to the component control system for interlock, and level alarms in the MCR and RSR. The fresh water storage tank temperature is monitored and alarmed in the MCR and RSR. The motor-driven non-Class 1E fire pump is automatically started upon receiving a signal of low pressure in the pump discharge piping.

The diesel-driven fire pump fuel storage tank is monitored locally for level. Water supply valves are monitored for position.

After starting of the fire pump, if the pressure remains low, the diesel-driven fire pumps start sequentially. The run status of the fire pumps are indicated on the display in the MCR and RSR, and the fire pumps are operable from the MCR.

The COL applicant is to address requirements that are site specific and not included in the APR1400 DCD. See COL Item 9.5(2).

9.5.2 Communication Systems

The communication systems provide reliable and effective interplant communications and plant-to-offsite communications during normal plant operations, transient, fire, accident conditions, including loss of offsite power and security-related events. The various communication systems provide independent and alternate paths to provide reasonable assurance of the capability to communicate with plant and offsite personnel and organizations during all operating or emergency conditions.

Data communications are addressed in Section 7.9.

9.5.2.1 Design Bases

The communication systems and components are selected and designed to operate within the following environments, as applicable:

a. Extremely noisy locations, up to 115 dB sound pressure level

b. Ambient temperatures ranging from -30 °C to + 70 °C (-22 °F to + 158 °F)

c. Humid and oily locations

d. Hazardous areas (10 CFR 50, Appendix A, GDC 4)

e. Outdoors (where indicated)

f. Indoor areas with thick concrete walls or other obstructions

g. With personal wearing protective equipment

h. Areas having constant vibration

The communication systems are classified as non-safety-related. Each communication system provides an independent mode of communication. These various communication systems are independent of each other to provide effective communications. A failure of one system does not affect the other systems.

Each communication system is designed in accordance with applicable codes and standards regarding environmental conditions, such as weather, moisture, noise level, electromagnetic interference (EMI), and radio frequency interference (RFI). In areas of high noise levels, acoustic booths and visual alerting are used. The communication systems equipment are qualified for their application using the guideline of EPRI NP-5652 (Reference 64), “Guideline for the Utilization of Commercial-Grade Items in Nuclear Safety-Related Applications” and EPRI TR-106439 (Reference 65), “Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications.”

Respiratory protection devices may be required in fire and radiological events. Communication equipment used in conjunction with respiratory equipment is designed and selected consistent with the guidelines provided in Electric Power Research Institute (EPRI) NP-6559 (Reference 62).

The communication systems are normally powered from a permanent non-safety (PNS) bus backed up by the AAC source during a LOOP, and from one of the two dedicated 16 hour rated non-safety-related batteries (normal and standby) in case of either AAC GTG failure during a LOOP or SBO condition.

Communication systems are based on meeting the relevant requirements of the following regulations:

a. Appendix E to 10 Part 50, Emergency Planning and Preparedness for Production and Utilization Facilities

   Emergency facilities and equipment include at least one onsite and one offsite communications system with each system having a backup power source in accordance with 10 CFR 50, Appendix E, Part IV, E(9) (Reference 57).

   The wireless communication system, paging phone system, alarm address system, telephone system, and sound powered telephone system provide onsite communications. The onsite communications systems have a backup power source.

   Offsite communication consists of communication subsystems to provide emergency communication links from the emergency operation facility (EOF) to the onsite MCR and technical support center (TSC) as well as to the NRC, offsite local law enforcement or military agencies and other federal, state, and local government agencies. A backup power source is provided for the offsite communication systems. The COL applicant is to provide a description of the offsite communication system that interfaces with the onsite communication system, including type of connectivity, radio frequency, normal and backup power supplies, and plant security system interface (COL 13.3(1)).

b. 10 CFR 50.34(f)(2)(xxv), Emergency Response Facilities

The emergency response facilities include the technical support center (TSC), the operational support center (OSC), and the emergency operations facility (EOF) in accordance with 10 CFR 50.34(f)(2)(xxv) (Reference 58). The COL applicant is to address the emergency response facilities (COL 13.1(1)).

c. 10 CFR 50.47(a)(8), Equipment and Facilities to Support Emergency Response

Adequate emergency facilities and equipment to support the response are provided and maintained in accordance with 10 CFR 50.47(b)(8) (Reference 59). The COL applicant is to provide details of emergency response facilities and associated communication capabilities (COL 9.5(6)).

d. 10 CFR 50 Appendix A – General Design Criteria

GDC 1, 2, 3, and 4 apply to structures, systems, and components important to safety. The communication systems are classified as non-Class 1E systems, and therefore serve no safety-related functions. GDC 19 requires equipment at appropriate locations outside the MCR to be provided for prompt hot shutdown of the reactor with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures. While there is communication equipment located in the remote shutdown room, the communication equipment is not required to function for hot or cold shutdown of the reactor.

However, communication systems are selected and designed in accordance with the guidance provided in 10 CFR 50 Appendix A, GDC 1, GDC 2, GDC 3, GDC 4, and GDC 19 (Reference 39) to provide reasonable assurance that the facility can operate without undue risk to the health and safety of the public.

e. 10 CFR 73.55(j), Requirements for Physical Protection of Licensed Activities in Nuclear Power Reactors Against Radiological Sabotage – Communications Requirements.

Security communication measures are included as part of the site's communication systems as required by 10 CFR 73.55(j) to support the following functions:

1) Maintaining continuous communications capability with onsite and offsite resources to provide reasonable assurance of effective command and control during both normal and emergency situations.

2) Individuals assigned to each alarm station are capable of calling for assistance in accordance with security plans and procedures.

3) All on-duty security force personnel are capable of maintaining continuous communication with an individual in each alarm station.

4) Non-portable communications equipment required by regulations is powered from an uninterruptible power supply (UPS) so that it remains operable in the event of a loss of normal power.

f. 10 CFR 50.55a

10 CFR 50.55a is not applicable as communication systems are not defined as having a safety function in accordance with NRC RG 1.29. Each communication system is designed such that a failure of one system would not disable the remaining systems.

g. Codes and Standards

1) IEEE Std 269, “IEEE Standard Methods for Measuring Transmission Performance of Analog and Digital Telephone Sets, Handsets, and Headsets,” 2002.

2) IEEE Std 344, “Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations,” 2004.

3) IEEE Std 487, “IEEE Recommended Practice for the Protection of Wire-Line Communication Facilities Serving Electric Supply Locations,” 2000.

4) IEEE Std 1613, “IEEE Standard Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations,” 2003.

5) ANSI/ANS-8.3, “Criticality Accident Alarm System,” 2003.

6) NEMA 250, “Enclosures for Electrical Equipment,”2004.

7) NFPA 70, “National Electrical Code (NEC),” 2011.

8) NFPA 72, “National Fire Alarm Code,” 2007.

9) EPRI TR-102323, “Guidelines for Electromagnetic Interference Testing of Power Plant Equipment,” Revision 3.

10) MIL-STD-810F, “Environmental Engineering Considerations and Laboratory Tests.”

11) IEEE/ANSI C63.12, “American National Standard Recommended Practice for Electronic Compatibility Limits,” 1999.

12) IEC61000-4-2, “Electromagnetic Compatibility (EMC) Testing and Measurement Techniques- Electrostatic Discharge Immunity Test,” 2008.

13) IEC61000-4-3, “Electromagnetic Compatibility (EMC) Testing and Measurement Techniques- Radiated, Radio Frequency, Electromagnetic Field immunity Test,” 2010.

14) IEC61000-4-5, “Electromagnetic Compatibility (EMC) Testing and Measurement Techniques – Surge Immunity Test,” 2005.

15) ANSI/TIA-603-C-2004, “Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards”

9.5.2.2 System Description

The following buildings within the APR 1400 facility contain communication systems:

a. Reactor containment building

b. Turbine generator building

c. Auxiliary building

d. Compound building

e. Emergency diesel generator building

f. Alternate ac diesel generator building

g. ESW pump house

h. CCW HX building

i. Central alarm system building

j. Guard house buildings

The communication systems consist of the following independent subsystems:

a. Plant Communication systems

   1) Paging phone system

   2) Evacuation alarm address system

   3) Public address system

   4) Sound powered telephone system

5) Telephone system

6) Plant time synchronizing system

7) LAN and VPN system

8) Wireless communication system

b. Offsite Communication systems

1) Commercial telephone

2) Local law enforcement communications

3) Emergency telephone system

4) Satellite telephone system

The design and selection of the communication systems consider environment conditions including weather, moisture, noise levels, and electromagnetic/radio frequency interface that might interfere with effective communication for vital areas.

9.5.2.2.1 Plant Communication Systems

9.5.2.2.1.1 Paging Phone System

The paging phone system consists of handset stations and loud speaker assemblies located throughout the plant. The handset station has its own amplifier and volume control. Each station has a 1 (or 2) channel paging capability and multiple parties for simultaneous bidirectional voice communications between two or more areas.

Paging phones are located at operator stations, near major equipment, and near stairways. Page and party lines are available for communication between the remote shutdown console room, MCR, and other areas that require operator action during emergency shutdown operations.

The party-line communication is used to enable personnel to respond to voice pages or initiate party-line communication with select recipients. This method of communication is useful for personnel that may be responding to a voice page, whereby the address announcement indicates what channel should be used for subsequent party-line conversation. Party line handsets are distributed throughout the plant at fixed locations for easy access. Noise-canceling headphones with directional microphones or acoustic booths are provided in areas of the plant that are subject to high ambient noise conditions.

The paging phone system serves as the backup evacuation alarm address system. This generates audio messages and broadcasts them over speakers during normal or emergency condition in conjunction with the evacuation alarm address system.

9.5.2.2.1.2 Evacuation Alarm Address System

An evacuation alarm system provides area alarm for radiation and fire accidents and also a public address capability. The evacuation alarm address system consists of main amp, alarm speaker, and evacuation switch board. An evacuation alarm address system is provided using sirens located throughout the plant. The sirens and tone generator are manually activated from the evacuation switchboard.

The alarm message that is relayed plant-wide is a signaling tone to either alert the staff or provide status. A tone generator produces five warning tones: (1) pulse, (2) siren, (3) yelp, (4) warble, and (5) steady. Tones are activated by a number of external sources, including fire equipment, or by manually closing user-supplied contact switches. Higher priority tones can be programmed to override those of lower priority. In areas with high noise levels, beacon lighting is provided to complement the siren or tone. An automatic loudspeaker volume control is used for dedicated areas with a highly fluctuating noise level.

The backup evacuation alarm broadcast system is manually initiated in conjunction with the paging phone system, if the normal system fails.

9.5.2.2.1.3 Public Address System

Independent public address system is provided for the plant with provisions to merge the systems for “all call” operation. The system consists of control mixer, amplifiers, and loud speakers.

9.5.2.2.1.4 Sound-Powered Telephone Systems

Sound powered jacks are installed throughout the plant as an aid for testing and calibration of instrument and control circuits. A separate sound powered telephone system is interconnected by means of public addressing for direct communication between the refueling areas and the MCR. The sound powered telephone system is capable of simultaneous, bidirectional communication with three channels.

The system consists of portable headsets with carrying cases and extension cords, jacks, a switching box for connecting different areas, and portable multichannel equipment. The sound powered telephone system for each zone has three channels. The zones are capable of being interconnected via a switching box in the MCR.

Sound power jack locations include instrument racks, major equipment, start-up and overhaul operator stations, and refueling areas:

The function of the sound-powered telephone system is to provide a communication system between plant locations as follows:

a. MCR

b. TSC

c. Refueling areas

d. Turbine-generator operating deck

e. Remote shutdown room

f. Electrical and I&C equipment areas

g. Other high maintenance active areas

The sound-powered telephone system provides a backup communications mechanism during all modes of plant operations. Portable handsets are provided with sufficient cable and extensions to allow personnel to use the system at any point within the plant.

9.5.2.2.1.5 Telephone System

This system consists of desk-type telephones and signal addition units located throughout the plant and plant site. This system is available for allowing interplant communications during normal, abnormal, and accident conditions. This system is a backup to the paging phone system.

a. Private automatic branch telephone exchange

   The plant private automatic branch telephone exchange (PABX) is connected to the offsite commercial telephone system and allows for normal and emergency communications. Emergency communication lines are connected directly to specific telephones located in critical areas of the plant, such as MCR, technical support center (TSC), and security alarm stations. The PABX is interfaced to the plant wireless communication system, thereby allowing personnel with plant radios to originate telephone communications if necessary.

b. Internal telephone

   The internal telephone system functions as a backup system for the paging phone system providing simultaneous bidirectional communications between various plant areas. Signaling is accomplished by speakers located near each station that emit an audible frequency. A speaker and lamp are provided in high noise areas to alert the operator being called. Acoustic booths are also provided in these areas. The internal telephone locations include operator stations, major control panels, and operator's offices. The main distribution frame of the telephone

system consists of several distribution sections. The incoming lines of one division are collected together in the same section.

c. External telephone

The external telephone systems provide a convenient means of communication between major buildings and offsite. Switching and distribution equipment for the external telephone system is compatible with the other neighbor unit.

d. PABX power source

The PABX is powered from the plant non-safety-related load group and consists of independent battery chargers and batteries for each PABX node. The batteries have the capability to operate the plant telephone system for approximately 16 hours following loss of normal alternating current (ac) power.

9.5.2.2.1.6 Plant Time Synchronizing System

The plant time synchronizing system consists of a master clock and subsidiary clocks. The master clock is located in the communication equipment room and subsidiary clocks are located throughout the plant. The master clock provides standard time synchronizing signals to necessary plant equipment.

9.5.2.2.1.7 Local Area Network System and Virtual Private Network

The local area network (LAN) system is a computer network that spans a relatively small area. The LAN consists of routers, backbone switches, workgroup switches, servers, clients, network interface cards, and fiber-optic/twisted pair cables. The plant LAN links up plant terminals with construction and the head office host computers. LAN system is located in the MCR, TSC, OSC, etc. The virtual private network (VPN) system is a private network across public networks like the Internet. It enables a server computer to send and receive data across shared or public networks as if they were an integral part of the private network with all the functionality, security, and management policies of the private network. This is done by establishing a virtual point-to-point connection through the use of dedicated connections, encryption, or a combination of the two. The VPN

system provides plant with the capability of communicating to other units and the head office. Plant VPN links the plant computer terminals with the head office host computers. The COL applicant is to provide LAN and VPN system (COL 9.5(8)).

9.5.2.2.1.8 Wireless Communication System

The wireless communication system is designed to provide a stand-alone method of plant-wide communication between designated personnel equipped with, or having access to wireless two-way radios. This subsystem is the primary source of communications for emergency personnel such as security and fire brigade. The wireless communication system is comprised of transmitters, receivers, antennas, amplifiers, and radio base station equipment. Antennas and amplifiers are distributed throughout the plant to enable seamless radio coverage. Repeaters are used to allow seamless radio coverage throughout the plant. Antennas and cables interconnecting the repeaters to the base station equipment are located in a manner to facilitate improved radio signal penetration into areas that are not properly served by the primary antenna. Radio coverage is provided throughout the plant, although radio usage in certain instrumentation and control (I&C) areas is restricted due to potential EMI and RFI considerations. These areas have posted warning signs. The wireless communication system is designed, installed, and tested so that I&C system circuits are not adversely impacted by EMI and RFI from transmitting sources.

The transmitters, receivers, antennas, amplifiers, and radio base station equipment are robust, highly reliable, and capable of withstanding the harsh environment of the facility. Physical separation of the cabinets increases protection against a single accident or fire from affecting multiple modes of communication throughout the plant.

Communication equipment used for fire protection activities are protected from exposure to fire damage in accordance with NRC RG 1.189 (Reference 20). The fire brigade radio communication system is in accordance with NRC RG 1.189 (Reference 20). The fire brigade radio system consists of a base unit, mobile units, and portable units in the site specific. The COL applicant is to provide the fire brigade radio system (COL 9.5(7)). The security radio system consists of a base unit, mobile units, and portable units. The COL applicant is to provide the security radio system which consists of a base unit, mobile units, and portable units (COL 9.5(12)).

Wireless communications equipment used with respiratory protective equipment complies with the requirements in NRC RG 8.15 (Reference 63) and the guidance provided in EPRI NP-6559 (Reference 62).

9.5.2.2.2 Offsite Communication System

9.5.2.2.2.1 Commercial Telephone

Plant-to-offsite communication during normal operation is through a commercial telephone system, with extensions installed at a limited number of locations throughout the plant. The system provides direct dialing to locations outside the plant and also between extensions within the plant.

9.5.2.2.2.2 Local Law Enforcement Communications

Radio or microwave transmitted two-way voice communication, either directly or through an intermediary, between local law enforcement authorities and the site as required by 10 CFR 73.55 (j)(4)(i) is provided on a 'site specific' basis due to the unique nature of each local law enforcement agency.

The COL applicant is to address the local law enforcement communications including dedicated conventional telephone and radio transmitted two-way communication system (COL 9.5(13)).

9.5.2.2.2.3 Emergency Telephone System

The emergency communication system uses two-way (incoming and outgoing) emergency communications from onsite to offsite facilities and agencies, a minimum of two independent communications links are provided. The onsite facilities provided with the emergency communications links are the main control room (MCR), remote shutdown room (RSR), technical support center (TSC), operations support center (OSC), and the security alarm stations. The offsite facilities include the emergency operations facility (EOF), NRC resident office, and federal, state and local government agencies (including local law enforcement) as identified in the emergency response plan. The two independent communications links are as follows:

a. Dedicated hotline telephones that provide direct communications to the selected locations in an off-hook condition. The provisions for hotline telephones are incorporated into the design of the onsite digital telephone subsystem.

b. Provisions for two-way radio communications via the portable wireless communication subsystem for personnel with access to specific wireless radios onsite and for the offsite personnel.

The COL applicant is to provide the emergency offsite communication system including dedicated hotline, local law enforcement radio equipment, and wireless communication system (COL 9.5(9)).

9.5.2.2.2.4 Satellite Telephone System

A satellite telephone system is connected to the plant telephone system to fulfill the needs after a beyond design basis external event. This system is tied directly into the plant telephone exchange (PBX) as an alternate source of outside telephone lines for the plant.

This system provides an automatic alternate communication path for outside connections to the public switched telephone network. The satellite telephone equipment includes a roof mounted antenna and transceiver.

9.5.2.3 Safety Evaluation

The communication systems are not required for the safe shutdown or for mitigating a design basis accident. The systems have no safety-related function, but they have to support effective operations as well as coordinate on-site and off-site responses during abnormal or emergency events. Various communication systems are used to minimize the complete loss of on-site and off-site communications.

9.5.2.4 Inspection and Testing Requirements

The communication systems are inspected and tested prior to initial startup. Preoperational testing is described in Section 14.2. To verify the functionality of the systems by standby power and battery sources, the loss of ac power tests are performed. It

will test communications among MCR, TSC, principal stats and emergency operation center, and radiological field assessment in conformal requirement of 10 CFR 50.47 (b)(6) (Reference 59).

9.5.2.5 Instrumentation Requirements

No special instrumentation is required for the communication systems.

9.5.3 Lighting Systems

The lighting systems provide for adequate lighting during normal, transients, fires, accidents, and the loss of all ac power. The lighting systems are composed of normal, emergency, and security lighting systems. These lighting systems maintain adequate illumination levels during normal and off-normal conditions.

9.5.3.1 Design Bases

The lighting systems are designed not to be completely lost in normal and off-normal conditions including electrical equipment faults, LOOP, and SBO. The lighting systems are not required to mitigate the consequences of a DBE. Therefore, the lighting systems are non-Class 1E systems.

a. Normal lighting power is supplied from non safety-related auxiliary power buses. Normal lighting is provided in the entire plant during normal plant operation.

b. Emergency lighting is provided in areas required for safe shutdown of the plant, restoring the plant to normal operation, fire fighting, and safe movement of people to the access and egress routes during plant off-normal condition and loss of normal power supply.

c. Emergency lighting system is composed of emergency ac and emergency dc lighting systems. Emergency ac lighting is supplied from Class 1E buses. Isolation is provided from the Class 1E sources by a Class 1E isolation device located at the motor control center feed to the emergency lighting distribution panel.

d. Emergency dc lighting system is composed of the lighting powered from the non-Class 1E 125V dc station battery and the lighting powered by an individual 8 hours rated self-contained battery pack units in accordance with NRC RG 1.189 (Reference 20).

e. No aluminum lighting fixtures are located in reactor containment building (RCB). The mercury containing lamps such as high-intensity discharge (HID), florescent lamps and mercury lamps are not used in fuel handling areas or RCB.

f. Exit sign lighting fixtures are provided at the egress routes.

g. Portable lighting units are provided at designated areas for access and egress to areas where emergency lighting is not installed.

h. Supporting structures of lighting in safety-related areas are designed not to be damaged during or after a safe shutdown earthquake (SSE).

i. The lighting systems provide adequate illumination levels, which are indicated illumination levels in NUREG 0700 (Reference 33) and IESNA lighting handbook (Reference 38), in various plant areas during normal and off-normal conditions.

9.5.3.2 System Description

The lighting systems consist of the following:

a. Normal lighting system

b. Emergency lighting system

c. Security lighting system

Normal lighting, emergency ac lighting, and security lighting systems are powered by 480 Vac buses through dry-type 480-208/120 V transformers. The lighting system power is distributed to the each lighting fixtures through a lighting distribution panels.

a. Normal lighting system

The normal lighting system provides general illumination throughout the plant. It is energized from non-Class 1E 480 Vac buses and permanent non-safety buses as long as power is available from the standby auxiliary transformers or unit auxiliary transformers. The normal lighting includes incandescent, fluorescent, high-pressure sodium, halogen, light-emitting diode (LED), and ceramic metal halide fixtures.

b. Emergency lighting system

The emergency lighting system is located in operating areas to perform emergency operations and provide safe personnel access and egress pathways when the normal lighting system is lost. The emergency lighting system is subdivided into 2 categories as follows.

1) Emergency ac lighting system

The emergency ac lighting system is always turned on and combines with the normal lighting to provide adequate illumination levels that support operation and maintenance activities during normal plant operation. The emergency ac lighting system is provided in the MCR, radwaste control room, emergency TSC, OSC, RSR, EDG room, Class 1E battery room, Class-1E SWGR room, and their access aisles for the safety-related equipment. Emergency ac lighting system is energized from Class 1E 480 Vac bus backed up by the Class 1E EDG and the non-Class 1E AAC source to provide reasonable assurance that the emergency lighting ac system is available during a LOOP. Emergency ac lighting provides more than 10 foot-candles of illumination at the above designated areas.

2) Emergency dc lighting system

The emergency dc lighting consists of emergency dc lighting fixtures fed from 8 hour rated non-Class 1E 125 Vdc station batteries and self-contained

battery pack lighting fixtures fed from receptacles for normal or emergency ac lighting.

The emergency dc lighting fixtures are powered by the non-Class 1E 125 Vdc station batteries upon loss of emergency ac lighting power and are provided to the areas where emergency ac lights are provided.

The emergency dc lighting powered from the station batteries provides more than 10 foot-candles of illumination.

The self-contained battery lighting fixtures are provided in areas needed for operation of safe-shutdown equipment and for access and egress route thereto. The self-contained battery lighting fixtures are equipped with sealed-beam, an 8-hour battery, and a battery charger. The power is automatically provided from the self-contained battery upon loss of normal or emergency ac lighting power.

The self-contained battery lighting provides more than 0.1 foot-candles of illumination at the areas where emergency ac lightings are provided.

c. Security lighting system

A minimum illumination level of 0.2 foot-candles is provided and measured horizontally at ground level in the isolation zones and appropriate exterior areas within the protected area. The security lighting is powered from offsite and backed up by the AAC source upon loss of offsite power.

The COL applicant is to provide offsite power for the security lighting system.

9.5.3.3 Safety Evaluation

The normal lighting is not available during LOOP, SSE, and SBO conditions.

a. The emergency ac lighting is normally turned on and supplements the normal lighting. The emergency dc lighting is normally turned off.

b. During LOOP, SSE, and SBO, the emergency ac lighting fed from the Class 1E 480 Vac bus is interrupted until the power supply to the Class 1E ac buses is restored. During this period, emergency dc lighting powered from the station battery or the individual self-contained battery provides adequate illumination for safe shutdown operations and for movement of personnel to the access and egress routes.

c. Emergency ac or dc lighting provides a minimum illumination level of 10 foot-candles in the MCR and RSR. Emergency dc lighting provides illumination when emergency ac lighting is lost.

d. For firefighting, the self-contained battery lightings provide emergency lighting for safe movement of the personnel to the access and egress routes.

e. The self-contained battery lightings located in Class 1E equipment areas meet seismic Category I requirements. The self-contained battery lightings located in all other areas meet seismic Category II requirements.

f. The emergency ac lighting powered from the Class 1E sources is classified as non-Class 1E circuits. Lighting circuits are electrically isolated from Class 1E circuits by the use of isolation devices and separation distance as indicated in IEEE Std. 384-1992.

g. Lamps with mercury content are not to be installed in the fuel handling areas and inside the containment.

9.5.3.1 Inspection and Testing Requirements

The lighting system is inspected and tested prior to plant operation. Preoperational testing on the lighting systems is performed during initial startup as described in Subsections 14.2.12.1.80 and 14.2.12.1.81.

The normal lighting circuits are normally energized and require no periodic testing. The emergency lighting is inspected and tested periodically.

9.5.3.2 Instrumentation Requirements

There is no specific instrumentation associated with the lighting systems.

9.5.4 Emergency Diesel Engine Fuel Oil System

The emergency diesel engine fuel oil system (EDEFOS) provides for the required storage capacity and continuous supply of fuel oil to each of the four Class 1E emergency diesel generators (EDGs) to safely shut down the plant and maintain a safe shutdown condition following a design basis accident (DBA) concurrent with a loss of offsite power (LOOP) by supplying power to essential loads. Diesel fuel for each emergency diesel generator is supplied by fuel oil transfer pumps from a fuel oil storage tank to a fuel day tank.

9.5.4.1 Design Bases

a. The EDEFOS is designed to provide storage capacity of at least a 7-day supply of fuel oil for the operation of the emergency diesel generator at its continuous rating, plus a margin to allow for periodic testing for each diesel engine, in accordance with ANSI/ANS 59.51.

b. The EDEFOS is designed to supply fuel oil at all times under the most severe environmental conditions expected at the site following a LOOP. The design of the EDEFOS complies with NRC RG 1.137.

c. The EDEFOS is designed and fabricated to codes consistent with the quality group classification assigned by NRC RG 1.26 and the seismic category assigned by NRC RG 1.29. The power supply and control functions are in accordance with NRC RG 1.32.

d. The EDEFOS is protected from the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, tsunamis, floods, and external missiles.

e. Each EDEFOS remains functional after a safe shutdown earthquake (SSE) and performs its intended functions following a postulated hazard, such as internal and external missiles, pipe break, or pipe whip.

f. Each EDEFOS is designated as safety related and is not shared by other diesel generators. The safety functions are accomplished, assuming a single active component failure coincident with a LOOP, in terms of four redundant and independent trains of 100 percent EDGs, as recommended in NUREG/CR-0660.

g. The active components of the EDEFOS are tested during plant operations. Provisions are made to allow inservice inspection of components to be carried on at an interval specified in the ASME Section XI.

h. The EDEFOS is designed to be capable of detecting and controlling system leakage by putting appropriate monitors and confining fuel oil leaks and spills in and around the system, components and structures.

i. The EDEFOS is capable of being filled with fuel oil from an external source within 7 days following a DBA, without interruption of diesel engine operations.

9.5.4.2 System Description

9.5.4.2.1 General Description

The EDEFOS is shown in Figure 9.5.4-1. The system is intended to operate during and after a DBA and is designated as safety Class 3, seismic Category I, and electrical Class 1E. The EDEFOS and components comply with the requirements of NFPA 30 and 37 for fire protection.

The EDEFOS has four diesel fuel storage structures, two in the auxiliary building (AB) and the other two in emergency diesel generator building (EDGB). The EDEFOS is located in a seismic Category I building, which provides protection from the effects of natural phenomena and missiles.

Each diesel fuel storage structure is a reinforced, missile-protected underground vault separated into an oil storage bay and an equipment area. The oil storage bay is separated from the equipment area by 3-hour rated fire barriers to the height of oil spill upon tank rupture. The oil storage bay contains a diesel fuel oil storage tank and necessary piping.

The diesel fuel storage structure is designed to allow personnel access for maintenance, inspection, and testing of components located within the structure during various modes of plant operation.

Each diesel fuel oil storage tank has a fill connection with a locking cap that is locked to prevent entry of moisture. The fill connection terminates in a box allowing replenishment of diesel fuel from outside supply sources without stopping operation of diesel generators. The fill connection is located above flood level to prevent floodwater from entering the EDEFOS.

There are two motor-driven fuel oil transfer pumps for each EDG set and each pump is capable of transferring oil from the diesel fuel oil storage tank to its corresponding day tank at sufficient pressure and flow to cover the maximum demand. The fuel oil transfer pumps take suction from the fuel oil storage tanks through duplex fuel oil strainers, and they are located in the fuel oil storage tank structure in such a way that sufficient net positive suction head (NPSH) is available under all design conditions, including a pump runout.

9.5.4.2.2 Component Description

9.5.4.2.2.1 Diesel Fuel Oil Storage Tanks

Each diesel fuel oil storage tank is designed for a 7-day supply to its associated EDG, without relying on the associated fuel oil day tank inventory, plus a margin for periodic testing of the associated EDG. The diesel fuel oil storage tanks are designed and fabricated in accordance with ASME Section III.

Fittings are provided for tank level instrumentation, venting, sampling, and water removal. Flanged openings are provided as manholes for access to the tank interior and the tank bottom is constructed so that a low-point sump exists for collection and drainage of any water or sediment that may be present.

Each diesel fuel oil storage tank is located inside a concrete structure to contain oil spills, and it is equipped with a vent line with a flame arrester and a level transmitter. A

sufficient space around each diesel fuel oil storage tank is provided for inspection, maintenance, and repair of the system.

Each diesel fuel oil storage tank has a fill connection with a locked-closed isolation valve and is capped and locked to prevent entry of moisture. The fill connection is to allow replenishment of fuel from an outside supply source without interrupting operation of the EDG. The fuel oil storage tank fill connection is located above flood level to prevent flood water from entering the EDEFOS.

The sample connection is capped and locked to prevent entry of moisture. Access is provided for taking oil samples, venting of the diesel fuel oil storage tank when being filled, and maintaining a simplex strainer associated with the fill line.

The diesel fuel oil storage tanks are fabricated of carbon steel material, and the exterior surfaces of the tanks are painted for corrosion protection.

9.5.4.2.2.2 Diesel Fuel Oil Transfer Pumps

Two 100 percent transfer pumps are installed in each train of the EDEFOS, whose power is supplied from the same train of Class 1E EDG. This is intended to have more flexibility and operation options in case one of pumps is in failure. In addition, these pumps are protected from intrusion of foreign matter in the fuel oil conveyed in the piping through a common duplex basket strainer.

9.5.4.2.2.3 Diesel Fuel Oil Transfer Pump Duplex Strainers

Each duplex basket strainer is installed in the fuel line to its fuel transfer pumps to filter any fine particulates contained in the fuel, and the filtering is done online. The elements, constituting an assembly of duplex basket strainer, are designed to have such capacity that is met under the assumption that two transfer pumps operate simultaneously. The duplex basket strainers are provided with remote and local instrumentation for monitoring a differential pressure through strainers. In case the differential pressure is beyond the limits, the strainers are to be replaced with alternate ones.

9.5.4.2.2.4 Diesel Fuel Oil Transfer Pump Discharge Check Valves

A check valve is installed on the downstream of transfer pumps to prevent backflow and it can be tested during a system operation.

9.5.4.2.2.5 Diesel Fuel Oil Day Tanks

A cylindrical day tank is provided for each EDG. Each day tank provides fuel oil for at least 60 minutes plus a minimum additional margin of 10 percent for each EDG when loaded to the continuous rating. The tank elevation provides reasonable assurance that there is adequate NPSH on the engine-driven fuel oil pump at all times. The tanks are vented, through a flame arrester, to the outside air. The overflow and drain connections on the day tanks are piped to the diesel fuel oil storage tanks.

A sampling connection is provided to the bottom of each tank for periodic sampling of the fuel oil for quality and for drawing off any accumulated condensation and sediment. The exterior surfaces of the day tanks are painted for corrosion protection.

Instrumentation is provided as described in Subsection 9.5.4.6. When the setpoint level is reached, fuel oil is automatically added to the day tank by the transfer pump from the diesel storage tank.

9.5.4.2.2.6 Piping and Valves

Piping for the EDEFOS is safety Class 3, seismic Category I, except for a portion of the piping leading to vents, fills, and drains, which is seismic Category II or III, and is made of carbon steel. The exterior surfaces of the piping are painted for corrosion protection. The fuel oil storage tank is interconnected to the day tank through the overflow line of day tank.

There are provisions in the design to prevent entrance of water into the diesel oil storage tank during adverse environmental conditions, including maximum expected flood conditions. These include a vent line with a flame arrester, which is goose-necked downward, and the fill connections that are capped and penetrate building walls at elevations well above the flood level.

The maximum probable flood level does not exceed the elevations of the vent and fill connections, which are not subject to flood conditions. Any connections do not allow the entry of water into the system during adverse environmental conditions.

9.5.4.2.2.7 Flame Arrestors

Flame arresters are installed in the vent lines at the fuel oil storage and day tanks to prevent potentially explosive mixtures from igniting and also insects from flying or crawling into the vent piping and fouling the fuel in the tanks during standby and operating modes.

9.5.4.3 System Operation

The operating modes of the EDEFOS (normal, startup, shutdown, and abnormal) do not correspond to any specific plant operating modes. However, the system is in standby during all plant operating modes. The system may be taken out of service for repair or maintenance.

9.5.4.3.1 System Normal Operation

Each diesel fuel oil storage tank is filled with diesel fuel oil by tank trucks through a filling connection. The valve, located on each diesel fuel oil storage tank overflow line, is opened during filling operations and is closed at all other times. A level indicator, located near the fill connection, allows the operator to monitor tank level during the filling operations to prevent overfilling of the tank.

Whenever the oil level of a fuel oil day tank is low and the local hand switch is in “Auto” position, one diesel fuel oil transfer pump in each train supplies diesel fuel oil from the diesel fuel oil storage tank to the diesel fuel oil day tank until the day tank level is high.

9.5.4.3.2 System Startup and Shutdown

During all plant operating modes, the diesel fuel oil transfer pumps are placed in auto-mode. Under this mode, one transfer pump in each train is automatically started by a “low” level signal of the day tank. The transfer pump will continue to operate until the high level is sensed on the day tank.

During testing, the diesel fuel oil transfer pumps can be manually operated by a hand switch on the diesel generator local control panel.

9.5.4.3.3 System Abnormal Operation

In the event that one diesel fuel oil transfer pump fails to start or trips in a train, the other pump in the train is automatically started.

An emergency fill connection is provided in each train to allow diesel fuel oil to be pumped directly from truck into the diesel fuel oil day tank, bypassing the diesel fuel oil storage tank and the diesel fuel oil transfer pumps.

In the event that the operating transfer pump fails to stop at day tank "high" level, the flow rate delivered by the transfer pump is greater than the fuel consumption rate of the diesel generator, so that the surplus diesel fuel oil is returned to the diesel fuel oil storage tank by gravity through a day tank overflow line.

9.5.4.4 Safety Evaluation

With the exception of the fill and vent connections, the EDEFOS is located inside the EDGB and AB.

a. The EDEFOS consists of four redundant and independent trains. The trains are physically and electrically separated so that any sharing of systems or components important to safety does not exist. This provides reasonable assurance that even if a single active failure occurs in a train, it does not prevent other systems or components in other trains from performing their intended safety functions.

b. The safety-related portions of the EDEFOS are designed to remain functional after an SSE. They are powered from Class 1E sources. In the event that a station blackout (SBO) takes place, all ac powers are out at the plant, including Class 1E emergency power generated by emergency diesel generators, and the EDEFOS is also shut down. To cope with this situation, a non-Class 1E AAC GTG is provided as a standby power source and used to meet the load requirements for coping with SBO.

c. Portions of the EDEFOS outward from the fuel oil storage structures are designed to withstand the effects of man-made mistakes and natural phenomena. The fuel oil storage tanks and day tanks have one fill line and one vent line that are exposed to the outside air, respectively. The design considers sufficient features and administrative controls to be taken on these lines to protect against possible damage from vehicles, tornadoes, hurricanes, tsunamis, missiles, floods, extreme cold temperatures, and accidental contaminations.

d. The fill and sample lines of fuel oil storage tanks are locked-closed with isolation valves, and their connections are capped and locked to prevent entry of moisture. The fuel oil storage tanks are vented to atmosphere, and the end of the vent lines is placed at an elevation higher than the maximum flood level.

e. The vent lines of fuel oil storage tanks and day tanks are fitted with a flame arrester to protect the tanks from an external open fire. The end of the goose-necked vent is covered with a fine-meshed screen to prevent insects and debris from entering the vent. The seismic Category I portions of EDEFOS fuel oil piping, located between the diesel fuel storage structure and the AB and EDGB, are routed in concrete pipe chases to prepare for any possible contamination arising from fuel oil leakage, and a protective coating is applied to the fuel oil storage tanks and day tanks to avoid any corrosion.

f. The capacity of each fuel oil storage tank is sufficient for at least 7 days of EDG operation at its continuous rating.

g. An overflow line is mounted on each fuel oil storage tank, and this overflow line has a valve that is normally closed, except for during filling operations, when it is open. In addition, a level indicator is located near the fill connection to permit the operator to monitor tank levels during filling operations. This provides reasonable assurance that fuel oil does not flow out of the tanks during filling operations.

h. Prior to adding or refilling fuel oil to fuel oil storage tanks, the fuel oil storage structures are heated up and maintained at a suitable temperature above the cloud point of fuel oil. The heatup is done by using electric unit heaters, and the overall maintenance process is described in the fuel oil program.

i. Each train is provided with an emergency fill connection to allow fuel oil to be directly pumped from an outside fuel source into the day tank, bypassing the fuel oil storage tank and transfer pump.

9.5.4.5 Inspection and Testing Requirements

The EDEFOS is tested prior to initial startup. Preoperational testing is described in Section 14.2. The EDEFOS is tested periodically along with the complete EDG system. This test demonstrates the performance, and structural and leaktight integrity, of each system component.

Inservice inspection of piping is performed in accordance with the requirements of ASME Section XI.

The operability of EDEFOS may be demonstrated during tests of the emergency diesel generator, or testing may be performed by operation of the system in recirculation mode (bypassing day tank) and sending fuel through the recirculation line back to the fuel oil storage tank.

The fuel oil in the storage tank and day tanks is periodically sampled to verify quality as defined in the EDG fuel sampling and testing program. Prior to addition of new fuel oil into the storage tanks, samples will be tested for specific gravity, cloud point, viscosity, and water and sediment content in accordance with ASTM D975 limits. Accumulated moisture and sediment are removed periodically, via the sump drain, to minimize degradation of the fuel oil.

The COL applicant is to specify that adequate and acceptable sources of fuel oil are available, including the means of transporting and recharging the fuel storage tank, following a design basis accident (COL 9.5(10)).

Equipment and components are readily available for inspection and maintenance. Provisions are made to pressure test portions of the system. The EDEFOS can be tested independently of each EDG by draining the day tanks to the levels that automatically start the pumps. The pump flow rate is verified by monitoring the day tank level indicators.

The exterior surfaces of the fuel oil storage tanks and day tanks are painted with a primer and finish coat system for corrosion protection. The inspection on the interior surfaces of the tanks is done when the tanks are emptied and cleaned. Buried fuel oil system piping is inspected by means of a visual examination at each end of the buried piping for evidence of leakage.

9.5.4.6 Instrumentation Requirements

Each diesel engine is provided with sufficient instrumentation to monitor the operation of the fuel oil system. Alarms are separately annunciated on the local control panel, which also signals an EDG common trouble alarm in the MCR and RSR. The fuel oil system is provided with the following instrumentation and alarms:

a. Fuel oil storage tanks

   1) Low-level and high-level alarm

   2) Low-low level alarm

   3) Level indication, 0 to 100 percent

b. Fuel oil day tank

   1) High-high level alarm

   2) Low-level alarm

   3) Low-low level alarm

c. Fuel oil strainers

   1) High differential pressure alarm – Alerts the operator to take corrective action by manually switching over to the alternate clean strainer.

   2) Inlet and outlet pressure indication

d. Fuel oil filter

1) High differential pressure alarm – automatic self-cleaning

2) Differential pressure indication

3) Outlet pressure indication

4) Low fuel oil pressure alarm

9.5.5 Emergency Diesel Engine Cooling Water System

The emergency diesel engine cooling water system (EDECWS) provides cooling water to the engine. EDECWS portions are housed within their respective diesel engine compartments, receiving heat from components essential for proper operation of the diesel engines and additional parts of the system and transferring the heat to the CCW system of a heat sink. The system includes all valves, heat exchangers, pumps, and piping up to the engine interface.

9.5.5.1 Design Bases

The EDECW is designed in accordance with the requirements of GDC 2, 4, 5, 17, 44, 45, 46, and SRP 9.5.5 (Reference 67).

The EDECWS meets the following design basis:

a. The EDECWS is designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed, and consistent with the quality group classification assigned by NRC RG 1.26 (Reference 47) and the seismic category assigned by NRC RG 1.29 (Reference 48) as discussed in Section 3.2.

b. The EDECWS is protected from the effects of natural phenomena such as earthquakes, tornadoes, hurricane, and floods as discussed in Sections 3.7, 3.3, and 3.4, respectively.

c. The EDECWS is protected from externally and internally generated missiles, and pipe break as discussed in Sections 3.5 and 3.6, respectively.

d. There are four separate and independent EDG trains so that the consequences of a single active failure in an EDECWS or the loss of a cooling source, assuming a loss of offsite power (LOOP), do not lead to a loss of more than 1 EDG. Each EDG has a separate and independent EDECWS.

e. The EDECWS meets the recommendations of NUREG/CR-0660 (Reference 49). All engine cooling water temperatures are controlled by means of three-way thermostat for directing the engine water to the bypass or cooler as required and of the Amot brand or equal with an expanding wax type temperature sensitive element.

f. Provisions are made to allow for periodic inspection of safety-related components and equipment. Each diesel engine is provided with sufficient instrumentation and alarms to monitor the operation of the EDECWS.

g. The capability to isolate system or piping components is provided, if required to maintain the system safety function. This includes the isolation of portions of the system for excessive leakage or component malfunction.

h. Each EDG is capable of operating without CCW for at least 3 minutes at no load following startup and for 1 minute at full load during its normal operation.

i. The EDECWS has the capability to detect and control system leakage.

j. Provisions are to provide reasonable assurance that normal protective interlocks do not preclude engine operation during emergency conditions.

h. Cooling water of the EDECWS is treated by a chemical injection for preventing long-term corrosion and organic fouling.

9.5.5.2 System Description

9.5.5.2.1 General Description

The EDECWS is shown schematically in Figure 9.5.5-1.

Each diesel engine is equipped with a closed-cycle cooling system, which is subdivided into the low-temperature (LT) water subsystem and the high-temperature (HT) water subsystem.

The system has a boundary division between the safety and non-safety related sections. The non-safety related section is part of the preheating water circuit, which consists of an electric preheater and preheating pump that are active during engine standby and the water treatment tank / pump skid to treat the coolant quality by adding corrosion inhibitor.

The remainder is safety related, and is cooled by the CCW system with heat exchangers to provide the necessary cooling to dissipate heat from the diesel engine coolant and lubricating oil to maintain temperatures within normal operating limits during engine operation conditions.

The LT water subsystem is a closed-circuit cooling system designed to transfer heat from the supercharging air cooler and the engine lube oil system to the CCW. The LT water subsystem consists of an engine-driven LT water pump, two supercharging air coolers, an LT water expansion tank, an LT/CCW heat exchanger, a lube oil/LT water heat exchanger, and a three-way thermostat valve.

The HT water system is a closed-circuit cooling system designed to transfer heat from the engine and turbocharger to the CCWS. The HT system consists of an engine-driven HT water pump, two turbochargers, a three-way thermostat valve (recommendation of NUREG/CR-0660), an HT/CCW heat exchanger, an HT water expansion tank, a preheating HT water pump, an electric heater, and a lube oil / preheating water heat exchanger.

A water treatment tank with pump and associated recirculation piping are provided to be suitable for mixing with a timer to provide reasonable assurance of mixing of chemicals and feed to HT and LT water expansion tanks, respectively.

The EDECWS is designed to remain functional during and after an SSE, and all essential components are fully protected from floods, natural phenomena missiles, internally generated missiles, pipe breaks and whip, jet impingement, and interaction with non-seismic systems in the vicinity. The EDECWS is designated as a vital system and components of the system as located within seismic Category I structures. The EDECWS has valve arrangements to provide component isolation capability in the event of system leakage.

The layout of the piping and components provides sufficient space to permit inspection, cleaning, maintenance, and repair of the system.

9.5.5.2.2 System Operation

The EDECWS maintains the temperature of the diesel engine within an optimum operating range during standby and during full-load operation to provide reasonable assurance of its fast starting and load-accepting capability and to reduce thermal stresses.

The engine-driven LT water pump drives water through the cold side of the lube oil/LT water heat exchanger to cool lube oil. Part of the LT water is circulated to two supercharging air coolers to cool the compressed combustion air. Water leaving the lube oil/LT water heat exchanger and two supercharging air coolers are circulated to the hot side of the LT/CCW heat exchanger cooled by the CCW. The LT water after LT/CCW heat exchanger is returned to the suction of the pump.

The HT water flows from the engine-driven HT water pump into the cylinder block to cool the cylinder liners and cylinder heads. Part of the cooling water is circulated to the cooling chamber of the turbochargers. After cooling the turbochargers and cylinder heads, the water flows through the thermostatic valve, which controls cooling water temperature by diverting flow between two different water passages.

A motor-driven preheating pump and electric heater circulate electrically heated warm water through the system while the engine is not running, to maintain the engine coolant at a preset temperature, and to enhance quick-starting capability by reducing lubrication oil viscosity and undue thermal stress on the mechanical portions of the engine during emergency starts.

An expansion tank is provided in each cooling water subsystem to accommodate coolant expansion and venting due to temperature changes and to compensate for system losses due to minor leaks and evaporation. The expansion tanks are equipped with a low-level alarm, which is set below the normal operating water level. The water between the alarm set levels down to the minimum water level is available for system makeup during 7 continuous days of operation without refilling. The engine-driven circulation pumps receive suction head from the respective expansion tank.

Air pockets produced from the cooling water system due to temperature rise are collected into the expansion tanks through the degassing tank or degassing piping, which is installed in a location for trapping air pockets easily. The collected air pockets and vapor in the expansion tanks are vented through vent piping to atmosphere. The system is monitored for expansion tank level and system temperature alarms. Leakage in the EDECWS is made up by gravity from the expansion tanks. Two expansion tanks are manually filled from a common water treatment tank/pump skid connected to the demineralized water makeup distribution system.

In the event of a failure in the cooling water system such as rupture of a pipe, the engine trips under test conditions but continues to run under emergency accident conditions.

The three-way thermostat valve splits the cooling water flow so only as much water passes through the heat exchanger as needed to maintain the proper water outlet temperature. The remainder bypasses the heat exchanger and returns directly to the water pump so that the total water flowing through the pump and engine remains essentially constant regardless of the ambient temperature of engine loading.

9.5.5.3 Safety Evaluation

The portions of the EDECWS that are required for the performance of its safety function are classified as safety-related, seismic Category I, safety Class 3. The EDECWS is designed to quality standards consistent with the quality group classification assigned by NRC RG 1.26 and the seismic Category assigned by NRC RG 1.29.

Each EDG unit is housed separately in a structure designed to seismic Category I requirements. Each EDG has a separate and independent EDECWS so that the EDECWS

performs the safety function under accident conditions, assuming a single active component failure. The four trains of the EDG provide reasonable assurance that a single active failure in an EDECWS does not lead to a loss of more than one EDG. The three-way thermostat valve meets the recommendation of NUREG/CR-0660.

The safety-related portion of the EDECWS provides the necessary cooling to dissipate heat from the diesel engine coolant and lubricating oil to maintain temperatures within normal operating limits during engine operation condition.

The EDECWS is initially tested prior to initial operation. Periodic inspection and functional testing are also performed along with the complete EDG system in accordance with the Technical Specifications.

9.5.5.4 Inspection and Testing Requirements

System components and piping are tested to pressures designated by ASME Section III Class 3 (Reference 50) for safety-related items. Inspection and functional testing are performed prior to initial operation as described in Section 14.2; thereafter, the system operability is tested along with the complete EDG system during regularly scheduled tests in accordance with the Technical Specifications as described in Chapter 16. This testing demonstrates the performance of active components, leaktightness, operability, and the capability of the system to function as intended under accident conditions.

Piping is inservice inspected in accordance with the requirements of ASME Section XI (Reference 51).

9.5.5.5 Instrumentation Requirements

Each diesel engine is provided with sufficient instrumentation and alarms to monitor the operation of the cooling water system.

The following instruments are provided at the diesel generator engine and engine panel.

a. Temperature indicator (TI) for LT water at the outlet of lube oil/LT water heat exchanger

b. TI for LT water at the inlet of lube oil/LT water heat exchanger

c. TI for HT water at the outlet of the lube oil/preheating water heat exchanger

d. TI for HT water at the outlet of the engine

e. TI for LT water at the outlet of supercharging air coolers

f. TI for CC water at the inlet of HT/CC water heat exchanger

g. TI for HW water at the outlet of the engine-driven HT water pump

h. Pressure indicator (PI) for LT water at the outlet of the engine-driven LT water pump

i. PI for HT water at the outlet of the engine-driven HT water pump

j. PI for HT water at the outlet of the motor-driven preheating water pump

Alarms are separately annunciated on the local control panel, which also signals an EDG common trouble alarm in the main control room (MCR) and remote shutdown room (RSR). The following temperature, pressure, and level alarms annunciate when they exceed their setpoints.

a. Low-pressure jacket water

b. Low-pressure jacket water during preheating

c. Low-pressure at the outlet of the engine-driven LT water pump

d. Low-pressure at the outlet of the engine-driven HT water pump

e. Low-temperature jacket water out

f. High-temperature jacket water out

g. High-high temperature jacket water out

h. Low expansion tank water level for LT water

i. High expansion tank water level for LT water

j. Low expansion tank water level for HT water

k. High expansion tank water level for HT water

The high-high temperature alarm initiates a diesel engine trip if the diesel engine is in the test mode to prevent damage to the diesel engine. If this type of alarm is received during an emergency mode (e.g., LOOP, LOCA), the trip signal is locked out and the diesel engine continues to run. A high-high alarm in the emergency condition alerts the operator to prepare to switch over to the redundant EDG.

The diesel engine jacket water outlet temperature is also recorded by a multipoint recorder and monitored by a multi-channel pyrometer (in the manual mode). Both the recorder and pyrometer are located on the control panel in the EDG room.

The periodic testing and maintenance of the diesel engine cooling water system instruments is controlled by a preventive maintenance program. This program provides reasonable assurance that instruments are periodically calibrated and tested to maintain reliability.

9.5.6 Emergency Diesel Engine Starting Air System

The emergency diesel engine starting system (EDESS) provides fast-start capability for the diesel engine by using compressed air to rotate the diesel engine until combustion begins and it accelerates under its own power.

9.5.6.1 Design Bases

The EDESS is designed in accordance with the requirements of GDC 2, 4, 5, 17, and SRP 9.5.6 (Reference 68).

The EDESS meets the following design basis:

a. The EDESS is designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed, and consistent with the quality group classification assigned by NRC RG 1.26 (Reference 47) and the seismic category assigned by NRC RG 1.29 (Reference 48) as discussed in Section 3.2.

b. The EDESS is protected from the effects of natural phenomena such as earthquakes, tornadoes, hurricane, and floods as discussed in Sections 3.7, 3.3, and 3.4, respectively.

c. The EDESS is protected from externally and internally generated missiles, and pipe break as discussed in Sections 3.5 and 3.6, respectively.

d. There are four separate and independent trains of the EDG so that the consequences of a single active failure in the EDESS, assuming a LOOP, do not lead to a loss of more than one EDG. Each EDG has a separate and independent EDESS. Air driers are refrigerant type in accordance with the recommendations of NUREG/CR-0660 (Reference 49).

e. Provisions are made to allow for periodic inspection of safety-related components and equipment. Each diesel engine is provided with sufficient instrumentation and alarms to monitor the operation of the EDESS.

f. The capability to isolate system or piping components is provided, if required to maintain the system safety function. This includes the isolation of portions of the system for excessive leakage or component malfunction.

g. As a minimum, the safety-related portion of the EDESS is capable of storing sufficient air to crank a cold diesel engine five times without recharging the receivers. The air starting system capacity is determined as follows: duration of each cranking cycle is approximately 3 seconds, consists of two to three engine revolutions, or air start requirements per engine start provided by the engine manufacturer are used, whichever air start requirements are more demanding.

h. Alarms alert operating personnel if the air receiver pressure falls below the minimum allowable value.

i. The EDESS has provisions for the periodic or automatic blowdown of accumulated moisture and foreign material in the air receivers and other system critical points.

j. Starting air is dried to a dew point of not more than 10 °C (50 °F) when installed in a normally controlled 21 °C (70 °F) environment; otherwise, the starting air dew point should be controlled to at least 5.5 °C (10 °F) less than the lowest expected ambient temperature.

k. The EDESS brings the EDG up to rated speed, ready for load sequencing, within 20 seconds after receipt of the start signal.

9.5.6.2 System Description

9.5.6.2.1 General Description

The EDESS is shown schematically in Figure 9.5.6-1.

The EDESS consists of two redundant sets of equipment, each completely independent of the other for successful operation. A cross-connecting line with a normally closed valve is provided between the two redundant starting air systems. The set of equipment is a motor-driven compressor package, an air receiver, valves, instrumentation and control system, piping, and devices to crank the engine. Controls for starting the EDG system are discussed in Section 8.3.

The EDESS has boundary divisions between a safety-related portion downstream of and including the check valve on the air compressor discharge, and the remaining non-safety related portion. The check valve also provides reasonable assurance that a broken line from any of the compressors does not affect the air receiver.

A motor-driven air compressor is provided for each starting air receiver, respectively. An air compressor package consists of a compressor, a compressed air cooling fan, an air dryer,

and filter. The air dryer dries starting air to a dew point of not more than 10 °C (50 °F) when installed in a normally-controlled 21 °C (70 °F) environment; otherwise, the starting air dew point is controlled to at least 5.5 °C (10 °F) less than the lowest expected ambient temperature.

The EDESS has two starting air receivers. The starting air receiver capacity for each redundant diesel engine is sufficient for a minimum of five successful engine starts without the use of the air compressor. Each air receiver is furnished with inlet/outlet shutoff valves, pressure gauge, drain valve with provisions for the periodic blowdown or automatic blowdown of accumulated moisture and foreign material in the air receivers, safety valve, and sensing element for low pressure alarm.

Relief valves in the compressor package, on the overspeed air receiver tank and the starting air receiver tank, protect the starting air system from over pressurization.

A common tie-line with one overspeed air receiver and rack is provided for the required system function and EDG overspeed tripping.

The safety-related equipments of the EDESS are designed as ASME Section III Class 3 and seismic Category I requirements to remain functional during and after an SSE, and all essential components are fully protected from floods, natural phenomena missiles, internally generated missiles, pipe breaks and whip, jet impingement, and interaction with non-seismic systems in the vicinity. The EDESS is designated as a vital system and components of the system as located within seismic Category I structures.

The EDESS minimizes the potential for air leakage by incorporating welded and flanged connections. The schematic shows valve arrangements to provide component isolation capability in the event of system leakage.

The EDESS has valve arrangements to provide component isolation capability in the event of system leakage.

The layout of the piping and components provides sufficient space to permit inspection, cleaning, maintenance, and repair of the system.

9.5.6.2.2 System Operation

The starting air compressors receive power from a non-Class 1E electrical bus that is connected to the permanent non-safety bus during normal operation. During a LOOP, the starting air compressors are powered from the AAC power source. Each compressor compresses ambient air from within the engine room and then discharges compressed air. The heat of compression is removed by an air cooling fan.

To minimize the accumulation of moisture, the EDESS is equipped with a multi-stage drying and filtering unit located in line between the air cooling fan and the receiver tank to supply air with a dew point at least 5.5 °C (10 °F) lower than the lowest expected ambient temperature.

Two starting air receiver tanks for each diesel engine provide storage capacity that is sufficient to allow five successful diesel engine starts without the use of the compressor.

The diesel engine is rotated using compressed air from both air receivers through the energized start solenoid valves and the individual air distributors for each engine bank until combustion begins and it accelerates under its own power, and then closes the starting valves by using a speed switch.

To protect the EDG unit from excessive overspeed (115 percent of nominal speed) resulting from an improperly adjusted control system or governor failure, the overspeed trip device immediately operates to automatically shut off fuel oil or otherwise stop the diesel engine. This mechanism is separate from the regular governor apparatus and the regular governor drive.

There are two types of the diesel engine trips. Normal mode trips are active only during periodic testing of the EDG to prevent damage to the diesel engine. These trips are locked out during the emergency mode (i.e., LOOP or LOCA) to allow the diesel engine to continue to run should alarm conditions exist. Normal mode trips are activated upon the following:

a. Loss of excitation

b. Generator overvoltage/undervoltage

c. Generator phase imbalance

d. Generator overload/underfrequency

e. Generator voltage restrained overcurrent

f. Generator bearing high temperature

g. Generator overcurrent

h. Excitation fault

i. Generator ground overvoltage

j. Generator reverse power

k. Engine overspeed

l. Generator differential protection

m. LT water pressure low

n. Engine lube oil pressure low

o. Engine lube oil level low

p. Engine crankcase pressure high

q. Engine fuel oil day tank level low-low

r. Engine fuel oil pressure low

Emergency mode trips remain active during various EDG operational modes (test and emergency) to shut down the engine should a setpoint be exceeded. Emergency mode trips are activated upon the following:

a. Engine overspeed

b. Generator differential protection

c. Emergency stop

d. Stop lever

9.5.6.3 Safety Evaluation

The portions of the EDESS that are required for the performance of its safety function are classified as safety-related, seismic Category I, safety Class 3. The EDESS is designed to quality standards consistent with the quality group classification assigned by NRC RG 1.26 and the seismic Category assigned by NRC RG 1.29. The non-safety portion of the system, including the air dryer packages and the starting air compressors, are classified as non-safety related, seismic Category II, safety Class NNS.

Each EDG unit is housed separately in a structure designed to seismic Category I requirements. Each EDG has a separate and independent EDESS so that the EDESS performs the safety function under accident conditions, assuming a single active component failure. The four trains of the EDG provide reasonable assurance that a single active failure in an EDESS does not lead to a loss of more than one EDG. Air driers of refrigerant type meet the recommendations of NUREG/CR-0660. The safety-related portion of the EDESS has the capability of starting the diesel engine and storing sufficient air to crank a cold diesel engine five times without recharging the receivers. The EDESS has drain valves to blow down periodically accumulated moisture in the air receivers. The system has sufficient instrumentation to monitor the system parameters and alarm to alert operating personnel.

The EDESS is initially tested prior to initial operation. Periodic inspection and functional testing are also performed along with the complete EDG system in accordance with the Technical Specifications.

9.5.6.4 Inspection and Testing Requirements

System components and piping are tested to pressures designated by ASME Section III Class 3 (Reference 50) for safety-related items. Inspection and functional testing are performed prior to initial operation as described in Section 14.2; thereafter, the system is periodically tested along with the complete EDG system in accordance with the Technical Specifications as described in Chapter 16. This testing demonstrates the performance of active components, leaktightness, operability, and the capability of the system to function as intended under accident condition.

Piping is inservice inspected in accordance with the requirements of ASME Section XI (Reference 51).

Periodic blowdown of the starting air tanks is done to check for moisture. The frequency is determined based upon operating experience.

9.5.6.5 Instrumentation Requirements

Each starting air receiver is equipped with a set of pressure switches that automatically control the operation of the air compressor on its associated train, starting the compressor on low pressure and stopping the compressor on high pressure. Pressure gauges are located on the tanks for local indication. A separate pressure switch on the local control panel alarms if the starting air receiver pressure falls below the allowable set value.

The following instruments are provided at the diesel generator engine and engine panel:

a. Pressure indicator (PI) for compressed air at the starting air receiver

   Starting air system alarms are annunciated separately on the local control panel and annunciate an EDG common trouble alarm in the main control room (MCR)

and remote shutdown room (RSR). The following pressures annunciate when they exceed setpoints:

1) Low pressure at the air receiver

2) Low pressure at the overspeed air receiver

The periodic testing and maintenance of emergency diesel engine starting air system instruments is controlled by a preventive maintenance program. This program provides reasonable assurance that instruments are periodically calibrated and tested to maintain reliability.

9.5.7 Emergency Diesel Engine Lubrication System

The emergency diesel engine lubrication system (EDELS) stores and delivers clean lubricating oil to the diesel engine, its bearings and crankshaft, turbocharger bearings, and other moving parts during engine operation. By means of heaters, the EDELS delivers warmed oil to the engine during standby to provide reasonable assurance of its fast-starting and load-accepting capability.

9.5.7.1 Design Bases

The EDELS is designed in accordance with the requirements of GDC 2, 4, 5, 17, and SRP 9.5.7 (Reference 69).

The EDELS meets the flowing design basis:

a. The EDELS is designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed, and consistent with the quality group classification assigned by NRC RG 1.26 (Reference 47) and the seismic Category assigned by NRC RG 1.29 (Reference 48) as discussed in Section 3.2.

b. The EDELS is protected from the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, and floods as discussed in Sections 3.7, 3.3, and 3.4, respectively.

c. The EDELS is protected from externally and internally generated missiles, and pipe break as discussed in Sections 3.5 and 3.6, respectively.

d. There are four separate and independent trains of the EDGs so that the consequences of a single active failure in the EDELS, assuming a LOOP, do not lead to a loss of more than one EDG. Each EDG has a separate and independent EDELS.

e. Provisions are made to allow for periodic inspection of safety-related components and equipment. Each diesel engine is provided with sufficient instrumentation and alarms to monitor the operation of the EDECWS.

f. The capability to isolate system or piping component is provided, if required to maintain the system safety function. This includes the isolation of portions of the system for excessive leakage or component malfunction.

g. Sufficient system protective measures are provided to maintain required oil quality during engine operation.

h. The diesel engine crankcase is equipped with protective measures (e.g., relief ports) to prevent unacceptable crankcase explosions and to mitigate consequences of such events.

i. The EDELS has a keep-warm oil lubricating system to maintain engine lubricating oil passages in a warmed and filled state, and to circulate lubricating oil to the diesel engine during standby to enhance starting capability in conditions under which the engine-driven lube oil pump can pressurize the system quickly following engine starts.

j. Each EDELS is completely independent of other diesel engines so that a single failure does not cause a loss of the required minimum diesel generator capacity as specified in ANSI/ANS-59.52 (Reference 52).

k. Onsite lubricating oil storage capacity for each diesel engine is sufficient for 7 days of operation after any design basis accident and a continuous loss of offsite power as specified in ANSI/ANS-59.52.

l. Provisions are made to provide reasonable assurance that normal protective interlocks do not preclude engine operation during emergency conditions.

m. Provisions are made for cooling the system and removing system heat load.

9.5.7.2 System Description

9.5.7.2.1 General Description

The EDELS is shown schematically in Figure 9.5.7-1.

Each EDG has a separate, independent lubrication system consisting of lube oil/LT water heat exchanger, lube oil / preheating water heat exchanger, full-flow filter, engine-driven lube oil pump, three-way thermostat valve, prelube oil pump, lube oil makeup tank, controls, and instrumentation.

Each diesel engine is provided with an engine-driven lube oil pump, which draws oil from the engine lube oil sump tank and discharges it through the lube oil/LT water heat exchanger to the engine. The engine lube oil lubricates and cools various engine components. The oil flows through a full-flow filter before entering the engine. A pressure-regulating valve on the oil header maintains proper oil pressure by relieving excess oil back to the lube oil sump tank.

Each diesel engine is provided with a motor-driven prelube oil pump that is non-safety related and of the positive displacement type. One lube oil/preheating water heat exchanger is provided to keep the oil warm with the preheating water heated by the HT water electric heater during standby.

The generator outboard bearing has a self-contained lubricating oil reservoir. This bearing requires no pressurized lubricant.

The lube oil makeup tank, which has sufficient capacity for 7 continuous days of the EDG-rated full-power operation, is provided with individual fill, drain, and vent lines located outdoors. Oil vapor from the engine is vented outdoors through a flame arrester via an oil separator. Each diesel engine is provided with a lube oil sump tank.

The EDELS is designed to seismic Category I requirements to remain functional during and after an SSE, and all essential components are fully protected from floods, natural phenomena missiles, internally generated missiles, pipe breaks and whip, jet impingement, and interaction with non-seismic systems in the vicinity. The EDELS is designated as a vital system and components of the system are located within seismic Category I structures.

The EDELS has valve arrangements to provide component isolation capability in the event of system leakage.

The layout of the piping and components provides sufficient space to permit inspection, cleaning, maintenance, and repair of the system.

9.5.7.2.2 System Operation

The safety-related function of the EDELS is to store and supply the clean lube oil to the engine to lubricate and cool various engine components such as bearings, crankshaft, turbocharger, and other moving parts.

During diesel engine operation, the engine-driven pump draws oil from the engine sump tank and delivers it through the lube oil/LT water heat exchanger to the engine. The oil flows through a full-flow filter before entering the engine. The lube oil/LT water heat exchanger provides the necessary cooling to dissipate heat from the engine coolant and lubricating oil.

A pressure-regulating valve on the oil header maintains proper oil pressure by relieving excess oil back to the lube oil sump tank.

In standby mode, the motor-driven prelube oil pump draws oil from the engine sump tank and delivers it through the lube oil/preheating water heat exchanger and the full-flow filter to the engine. The lube oil/preheating water heat exchanger keeps the lubricating oil warm. During engine operation, the prelube oil pump is shut down. Prelubrication of the engine with warm lubricating oil provides reasonable assurance of rapid, reliable starting and load capability while minimizing bearing wear.

The diesel engine crankcase is vented to the atmosphere through the roof of the building via a lube oil separator. The engine lube oil sump tank is vented to the atmosphere through the roof. The crankcase is equipped with blowout panels to prevent high pressures from damaging the diesel engine.

Lubricating oil leakage is detected by routine surveillance, low-level alarm in the lube oil sump tank, and low engine inlet pressure and alarm. System leakage into the lube oil system through the lube oil/LT water heat exchanger is minimized by the normal operating pressure of the lube oil being higher than the LT water pressure. Oil leakage from the diesel engine is collected in a sump in the EDG room. Corrections are made in accordance with applicable operating and maintenance procedures.

Makeup to the engine lube oil sump tank by gravity is manually initiated from the lube oil makeup tank. The oil feed line from the lube oil makeup tank is raised above the makeup tank floor to prevent any accumulated water from entering the diesel engine lube oil sump tank.

The three-way thermostat valve splits the lube oil flow so only as much water passes through the heat exchanger as needed to maintain the proper lube oil outlet temperature. The remainder bypasses the heat exchanger and returns directly to the water pump so that the total lube oil flowing through the pump and engine remains essentially constant regardless of the ambient temperature of engine loading.

9.5.7.3 Safety Evaluation

The portions of the EDELS that are required for the performance of its safety function are classified as safety-related, seismic Category I, safety Class 3. The EDELS is designed to quality standards consistent with the quality group classification assigned by NRC RG 1.26

and the seismic category assigned by NRC RG 1.29. Each EDG unit is housed separately in structure that is designed to seismic Category I requirements. Each EDG has a separate and independent EDELS so that the EDELS performs the safety function under accident conditions, assuming a single active component failure. The four trains of the EDG provide reasonable assurance that a single active failure in an EDELS is not lead to a loss of more than one EDG. The three-way thermostat valve meets the recommendation of NUREG/CR-0660 (Reference 49). The EDELS performs its safety-related function to store and supply the clean lube oil to the engine to lubricate and cool various engine components.

The EDELS is initially tested prior to initial operation. Periodic inspection and functional testing are also performed along with the complete EDG system in accordance with the Technical Specifications.

9.5.7.4 Inspection and Testing Requirements

System components and piping are tested to pressures designated by ASME Section III Class 3 (Reference 50), Class 3 for safety-related items. Inspection and functional testing are performed prior to initial operation as described in Section 14.2; thereafter, the system is periodically tested along with the complete EDG system in accordance with the Technical Specifications as described in Chapter 16. This testing demonstrates the performance of active components, leaktightness, operability, and the capability of the system to function as intended under accident conditions.

Piping is inservice inspected in accordance with the requirements of ASME Section XI (Reference 51).

The lube oil in the lube oil makeup tank is periodically inspected to determine the purity of the oil. Parameters are monitored, including viscosity, neutralization number, and percentage of water. Any accumulated water detected in the bottom of the makeup tank is removed. If degradation of the oil is detected, the oil is drained out for disposal.

9.5.7.5 Instrumentation Requirements

Each diesel engine is provided with sufficient instrumentation and alarms to monitor the operation of the lube oil system.

The following instruments are provided at the diesel generator engine and engine panel.

a. Temperature indicator for lube oil at the inlet of the engine

b. Pressure indicator (PI) for lube oil before full-flow filter

c. PI for lube oil after full-flow filter

Alarms are separately annunciated on the local control panel, which also signals an EDG common trouble alarm in the main control room (MCR) and remote shutdown room (RSR).

The following temperature, pressure, and level annunciate when it exceed setpoints.

a. Low lube oil temperature at the inlet of the full-flow filter

b. High lube oil temperature at the inlet of the full-flow filter

c. High differential pressure of full-flow filter

d. Low lube oil makeup tank level

e. High lube oil makeup tank level

f. Low-low lube oil level in the lube oil sump

g. Low pressure for lube oil at the engine inlet during preheating and normal operation

h. High pressure for the crankcase

i. Low-low pressure for lube oil at the engine inlet

EDG bearing temperature is monitored by the diagnostic monitoring and display system (DMDS), and alarmed on the local control panel and EDG common trouble alarm in the MCR and RSR. High-high bearing temperature initiates a trip of the engine.

The diesel engine lube oil sump tank is equipped with a local level indicator along with a low-level alarm to alert the operator to take corrective action.

The full-flow filters are equipped with differential pressure switches. Automatic filters are self-cleaned at high differential pressure. An alarm is provided when filters are bypassed by a pressure-regulating valve.

The diesel engine is equipped with both temperature and pressure monitoring systems with separate alarm and trip switches to alert the operator of abnormal operating conditions. During standby, low prelube oil pressure and low HT water temperature are alarmed to alert the operator to take corrective action. If a trip setpoint is exceeded while the diesel engine is operating during the test mode, an alarm is annunciated and a diesel engine trip automatically shuts down the diesel engine to prevent incurring any damage. However, if such an alarm is received during the emergency mode (i.e., LOOP or LOCA), the trip is locked out and the diesel engine continues to run. The alarms alert the operator to prepare to switch over to the redundant EDG.

The engine inlet lube oil temperature is also recorded by a multi-point recorder and is monitored by the DMDS.

The periodic testing and maintenance of the emergency diesel engine lube oil system instruments are controlled by a preventive maintenance program. This program provides reasonable assurance that instruments are periodically calibrated and tested to maintain reliability.

9.5.8 Emergency Diesel Engine Combustion Air Intake and Exhaust System

The safety function of the emergency diesel engine combustion air intake and exhaust system (EDECAIES) is to supply an adequate quantity of combustion air of reliable quality

and exhaust combustion products to the atmosphere for the emergency diesel engine following a loss of offsite power (LOOP).

9.5.8.1 Design Bases

The EDECAIES is designed in accordance with the requirements of GDC 2, 4, 5, 17, and SRP 9.5.8 (Reference 70).

The EDECAIES meets the flowing design basis:

a. The EDECAIES is designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed, and consistent with the quality group classification assigned by NRC RG 1.26 (Reference 47) and the seismic category assigned by NRC RG 1.29 (Reference 48) as discussed in Section 3.2.

b. The EDECAIES is protected from the effects of natural phenomena such as earthquakes, tornadoes, hurricane, and floods as discussed in Sections 3.7, 3.3, and 3.4, respectively.

c. The EDECAIES is protected from externally and internally generated missiles, and pipe break as discussed in Sections 3.5 and 3.6, respectively.

d. Each emergency diesel generator (EDG) has a separate and independent EDECAIES so that a single active failure of any component in one EDECAIES, assuming a LOOP cannot result in a complete loss of more than one EDG.

e. Provisions are made to allow for periodic inspection of safety-related components and equipment.

f. The EDECAIES meets the following design criteria:

    1) NUREG/CR-0660 (Reference 49), ”Enhancement of Onsite Emergency Diesel Generator Reliability.”

a) Engine combustion air is through piping directly from outside the building with the air intake sufficiently (20 ft) above ground level and filtered to preclude any degradation of continuous engine function.

b) The EDG room ventilation system is separate from the EDECAIES.

c) Engine exhaust gas is vented through a stack and not circulated back into the diesel generator room, fuel oil storage room, or any part of the power plant.

d) The emergency power supply equipment floors are painted with concrete or masonry type paint in all rooms to prevent concrete abrasive dust from becoming airborne and causing malfunctions of electric contacts.

2) Each diesel engine has an independent and reliable combustion air intake and exhaust system sized and physically arranged to permit continuous operation of each EDG at the maximum rated power output.

3) The combustion air intake system is provided with air intake filters to reduce the maximum airborne particulate concentration over the entire time period requiring emergency power.

4) Suitable design precautions preclude degradation of the diesel engine power output from exhaust gases and other diluents that could reduce oxygen content below acceptable levels.

9.5.8.2 System Description

9.5.8.2.1 General Description

The emergency diesel engine combustion air intake and exhaust system is shown in Figure 9.5.8-1.

The EDECAIES consists of silencer, filter, expansion joints, air inlet duct, air exhaust piping, and instrumentation.

The EDECAIES is designed as equipment class 3, seismic Category I to remain functional during and after a safe shutdown earthquake (SSE), and all essential components are fully protected from the effects of natural phenomena in accordance with GDC 2, internally and externally generated missiles, pipe breaks and whip, jet impingement, and to withstand environmental effects in accordance with GDC 4, and interaction with non-seismic systems in the vicinity of the combustion air intake and exhaust system.

The EDECAIES and its components are located within seismic Category I structures. The exhaust duct and vent stack are protected from external missiles. The combustion air intake opening is located approximately 6.10 m (20 ft) above grade level to minimize the intake of dust in the EDG engine. The diesel engine exhaust gases are discharged to the atmosphere through a stack in a direction away from the engine air intake with sufficient separation, thereby minimizing the effects of the engine exhaust being drawn into the combustion air inlet.

The EDG room ventilation air is drawn through a separate duct and exhausted through a separate return duct system as discussed in Section 9.4.5.

9.5.8.2.2 System Operation

Upon initiation of the diesel engine start, the combustion air is directly taken from outside through an intake filter and air duct and enters the diesel engine through the turbocharger and the supercharging air coolers.

The turbocharger, driven by the hot exhaust gases on one side, compresses the combustion air and forces it into the supercharging air cooler. The supercharging air cooler removes heat from the compressed combustion air, decreasing the air temperature to force more air into the individual cylinders, thereby increasing engine horsepower. Low temperature (LT) water flows through the tube side and its temperature increases.

The exhaust gases are exhausted from the diesel engine to an exhaust silencer and then vented to the atmosphere through the stack. The design of exhaust piping and silencer does not exceed the manufacturer's recommended backpressure on the diesel engine.

9.5.8.3 Safety Evaluation

The EDECAIES portions that are required for safety function performance are classified as safety-related, seismic Category I, safety Class 3.

Each EDG unit is housed separately in a seismic Category I structure. Each EDG has a separate and independent EDECAIES so that the EDECAIE performs the safety function under accident conditions, assuming a single active component failure. The four trains of the EDG provide reasonable assurance that a single active failure in an EDECAIES does not lead to a loss of more than one EDG and therefore, independence and redundancy requirements of onsite ac power supplies are met. The duct for room ventilation air is separate from that for the EDECAIES. The system provides combustion air directly from the outside to the diesel engine. The combustion intake opening is located at a minimum of 6.10 m (20 ft) above grade level to minimize the intake of dust in the EDG room. The diesel exhaust gases are discharged to the atmosphere in a direction away from the outside air inlet with sufficient separation to minimize the effects of exhaust gas drift to the outside air inlet.

The safety-related portion of the EDECAIES provides an adequate quantity of combustion air and an exhaust path for the diesel engine during engine operation condition.

The quality and properties of the intake air are monitored to provide reasonable assurance that the engine will function in all ambient conditions.

The EDECAIES is initially tested prior to initial operation. Periodic inspection and functional testing are also performed along with the complete EDG system in accordance with the Technical Specifications.

Hydrogen and nitrogen gases are stored at a sufficient distance from the EDG room so that there is no threat to the proper operation of the diesel engines under an accidental release of hydrogen or nitrogen gases.

9.5.8.4 Inspection and Testing Requirements

System components and piping are tested to pressures designated by ASME Section III Class 3 (Reference 50), Class 3 for safety-related items. Inspection and functional testing are performed prior to initial operation as described in Section 14.2; thereafter, the system is periodically tested along with the complete EDG system in accordance with the Technical Specifications as described in Chapter 16. This testing demonstrates the performance of leaktightness, operability, and the capability of the system to function as intended under accident condition.

Piping is inservice inspected in accordance with the requirements of ASME Section XI (Reference 51).

9.5.8.5 Instrumentation Requirements

Each diesel engine is provided with sufficient instrumentation and alarms to monitor the combustion air intake and exhaust system.

Pressure indication and a switch are provided on the local panel to determine the pressure drop across individual air intake filters. A multi-point recorder on the DMDS records the individual cylinder exhaust temperatures and the inlet and outlet turbocharger exhaust temperatures and automatically monitors each cylinder temperature and compares it to the average temperature of the other cylinders. High or low exhaust temperature does not initiate a trip of the engine.

9.5.9 Gas Turbine Generator Facility

A 100 percent non-Class 1E AAC gas GTG provides the standby power source for coping with station blackout in accordance with the requirements of 10 CFR 50.63 (Reference 71), and NRC RG 1.155 (Reference 72). The non-Class 1E AAC GTG is designed with sufficient independence, redundancy, operation flexibility, and enhanced reliability to perform its function assuming a LOOP or SBO. The AAC GTG is physically separated and electrically isolated from the Class 1E EDG. The major components of the Non-Class 1E AAC GTG are a combustion turbine, reduction gearbox, generator and auxiliaries,

provided as a packaged unit, and mounted on the base skid and enclosed in a metal enclosure.

9.5.9.1 Design Basis

The GTG meets the following design basis:

a. The AAC GTG is designed to have sufficient capacity to provide power for the set of required shutdown load (non design-basis accident) to bring the plant to safe shutdown during SBO.

b. The AAC GTG is designed to attain the rated voltage and frequency, and is ready to accept load within 2 minutes after receipt of a start signal in the event of SBO.

c. The AAC GTG is designed to start automatically and be connected manually to the two PNS non-class 1E 4.16kV buses M and N in the event of LOOP.

d. The reliability of the GTG is at least 0.95 as calculated in accordance with EPRI NSAC-108 (Reference 73).

e. The AAC GTG fuel oil storage tank has sufficient capacity to continuously operate the respective AAC GTG at full load for 24 hours as acceptable SBO duration required by NRC RG 1.155, Position C.3.1. The coping duration and coping analyses are addressed further in Section 8.4.

f. The non-Class 1E AAC GTG engine, generator, and all auxiliary systems are designed as non-seismic and non-safety related.

9.5.9.2 System Description

The AAC GTG system is shown schematically in Figure 9.5.9-1.

The non-Class 1E AAC GTG is provided as a standby power source and can be used to meet the load requirements for coping with SBO, and is adequate to meet the requirements

of NRC RG 1.155. The non-Class 1E GTG consists of a completely packaged, fully assembled, and skid-mounted unit with the following supporting auxiliary systems:

a. Fuel oil storage and transfer system

b. Starting system

c. Lubrication system

d. Combustion air intake and exhaust system

e. GTG enclosure ventilation system

The fuel oil storage and transfer system consists of two redundant 100 percent capacity fuel oil transfer pumps, one fuel oil storage tank, and one fuel oil day tank, and associated valves, piping, and instrumentation for supplying fuel oil to the AAC GTG. The fuel oil transfer pumps take suction from the fuel oil storage tank through a strainer. The fuel oil storage tank is adequately sized to provide fuel oil for continuous operation of the AAC GTG at full load for 24 hours plus a margin to allow periodic testing and subsequent refill of the fuel oil day tank.

The fuel oil day tank has a capacity equivalent to at least 60 minutes plus a minimum additional margin of 10 percent for the AAC GTG operation at the continuous rating without replenishing. The fuel oil day tank is located so that fuel oil is fed to the combustion turbine through the engine-driven fuel oil pumps by gravity. Overflow from the day tank flows back to the fuel oil storage tank. When low level in the fuel oil day tank is sensed by the low-level switch, one out of two oil transfer pumps starts automatically. The transfer pump continues to operate until high level alarm from the fuel oil day tank is sensed. In the event a transfer pump fails to start or trips, the other pump is automatically started.

The lubrication system is provided to deliver clean lubricating oil with the engine-driven pumps to the AAC GTG components such as engine bearing and reducing gear bearings. The lube oil coolers are supplied to remove heat from the engine and speed reducer oil during operation. The cooler is of the air-cooled type with an electric motor-driven fan.

A lube oil keep-warm pump and heater are not required since fast starting is still met under cold conditions.

The AAC GTG can be independently started with several diverse starting methods. Several technologies commonly used as the starting methods are compressed air starter, small diesel engine, DC motor, and electro hydraulic starter. The COL applicant is to provide a reliable starting method for the AAC GTG (COL 9.5 (5)).

The combustion air intake and exhaust system is provided to supply clean air to the combustion turbine and to exhaust the combustion turbine exhaust gas. The system consists of piping, duct, and silencer.

Ventilation with fans is necessary to dissipate heat and thus to limit the temperature inside the enclosure. There are three heat sources: exhaust air from generator (air cooing type), exhaust air from oil cooler (air cooling type), and heat radiation from the surface of the combustion turbine.

The COL applicant is to provide the system design information of AAC GTG building HVAC system including flow diagram, if the AAC GTG building requires the HVAC system (COL 9.5(15)).

9.5.9.3 Safety Evaluation

The AAC GTG has no safety function.

All components of the AAC GTG are housed in the AAC GTG building, which is a separated seismic Category III structure and appropriately protected against weather-related events.

The fuel oil storage tank capacity is based on continuous operation of the AAC GTG at its rated load for 24 hours plus margin for periodic testing. Two redundant 100 percent capacity fuel oil transfer pumps are provided to supply fuel oil. If one transfer pump fails to start or trips, the other pump is automatically started.

Refer to Subsection 8.3.1.1 for a description of AAC GTG operation following SBO.

9.5.9.4 Inspection and Testing Requirements

A fuel oil storage tank and a day tank receive nondestructive examination (NDE) in accordance with the ASME Section VIII (Reference 73) requirements incidental to routine construction tests and inspections. Fuel oil samples, as specified by ASTM D975 (Reference 56), are tested upon delivery for deteriorated products. System components and piping are tested at the pressures designated by the appropriate codes.

9.5.9.5 Instrumentation Requirements

Pressure instruments installed on the transfer pump discharge line initiate an alarm on the local control panel on low pump discharge line pressure. The alarm indicates that fuel oil is not being pumped to the fuel oil day tank. A level instrument on the fuel oil storage tank is provided to initiate low-low, low, and high alarms at the local control panel. The instrumentation for the AAC GTG and supporting auxiliary systems are designed to provide continuous indication of the AAC GTG system parameters. The parameters are displayed and annunciated on a local control panel. Any alarm annunciated on the local control panel initiates a common trouble alarm in the MCR to warn the operator of any abnormal condition in the GTG. Generator output voltage, current, kVA, power factor, Hz are also displayed in the MCR.

9.5.10 Combined License Information

COL 9.5(1) The COL applicant is to establish a fire protection program, including organization, training, and qualification of personnel, administrative controls of combustibles and ignition sources, firefighting procedures, and quality assurance.

COL 9.5(2) The COL applicant is to address the design and fire protection aspects of the facilities, buildings and equipment, and a fire protection water supply system, which are site specific and/or are not a standard feature of the APR1400.

COL 9.5(3)	The COL applicant is to describe the provided apparatus for plant personnel and fire brigades such as portable fire extinguishers, self-contained breathing apparatus, and radio communication systems.
COL 9.5(4)	The COL applicant is to address the final FHA and FSSA based on the final plant design, including a detailed post-fire safe-shutdown circuit analysis.
COL 9.5(5)	The COL applicant is to provide a reliable starting method for the AAC GTG.
COL 9.5(6)	The COL applicant is to provide details of emergency response facilities and associated communication capabilities.
COL 9.5(7)	The COL applicant is to provide the fire brigade radio systems.
COL 9.5(8)	The COL applicant is to provide the LAN and VPN system.
COL 9.5(9)	The COL applicant is to provide the emergency offsite communication system including dedication hotline, local law enforcement radio equipment, and wireless communication system.
COL 9.5(10)	The COL applicant is to specify that adequate and acceptable sources of fuel oil are available, including the means of transporting and recharging the fuel storage tank, following a design basis accident.
COL 9.5(11)	A COL applicant is to provide a description of the offsite communication system that interfaces with the onsite communication system, including type of connectivity, radio frequency, normal and backup power supplies, and plant security system interface.
COL 9.5(12)	The COL applicant is to provide the security radio system that consists of a base unit, mobile units, and portable units.

COL 9.5(13) The COL applicant is to provide the local law enforcement communications including dedicated conventional telephone and radio transmitted two-way communication system.

COL 9.5(14) The COL applicant is to provide electric power for the security lighting system.

COL 9.5(15) The COL applicant is to provide the system design information of AAC GTG building HVAC system including flow diagram, if the AAC GTG building requires the HVAC system.

9.5.11 References

1. SECY-90-016, "Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationship to Current Regulatory Requirements." @ (ML003707849)

2. SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs." @ (ML003707849)

3. NUREG-0800, Standard Review Plan, Section 9.5.1.1, "Fire Protection Program," Rev. 0, Feb 2009, U.S. Nuclear Regulatory Commission, Washington, D.C.

4. NFPA 804, "Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants," 2010 Edition, National Fire Protection Association, Quincy, MA.

5. NFPA 12, "Standard on Carbon Dioxide Extinguishing Systems," 2008 Edition, National Fire Protection Association, Quincy, MA.

6. NFPA 2001, "Standard for Clean Agent Fire Extinguishing Systems," 2008 Edition, National Fire Protection Association, Quincy, MA.

7. NFPA 80, "Standard for Fire Doors and Other Opening Protectives," 2010 Edition National Fire Protection Association, Quincy, MA.

8. ASTM E152, "Methods of Fire Tests of Door Assemblies."

9. 10 CFR 50.48, "Fire Protection," U.S. Nuclear Regulatory Commission.

10. SECY-05-0197, “Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria,” U.S. Nuclear Regulatory Commission, Washington, DC, October 28, 2005.

11. 10 CFR 50, “Fire Protection,” Appendix A, GDC 3, U.S. Nuclear Regulatory Commission.

12. 10 CFR 50, Appendix A, GDC 5, “Sharing of Structures, Systems, and Components,” U.S. Nuclear Regulatory Commission.

13. 10 CFR 50, Appendix A, GDC 19, “MCR,” U.S. Nuclear Regulatory Commission.

14. 10 CFR 50, Appendix A, GDC 23, “Protection System Failure Modes,” U.S. Nuclear Regulatory Commission.

15. 10 CFR 52, “Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission.

16. 10 CFR 52.47, “Contents of Applications; Technical Information.” U.S. Nuclear Regulatory Commission.

17. 10 CFR 52.97(b)(1), “Issuance of Combined Licenses.” U.S. Nuclear Regulatory Commission.

18. 10 CFR 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-level Radioactive Waste, and Reactor-related Greater than Class C Waste.” U.S. Nuclear Regulatory Commission.

19. NEI 00-01, “Guidance for Post Fire Safe Shutdown Circuit Analysis,” Rev.3, National Energy Institute, October 2011.

20. NRC RG 1.189, Rev. 2, “Fire Protection for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission, October 2009.

21. NFPA 16, “Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems,” 2007 Edition, National Fire Protection Association, Quincy, MA.

22. NFPA 10, “Portable Fire Extinguishers,” 2010 Edition, National Fire Protection Association, Quincy, MA.

23. NFPA 20, "Standard for the Installation of Stationary Pumps for Fire Protection," 2010 Edition, National Fire Protection Association, Quincy, MA.

24. NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances," 2010 Edition, National Fire Protection Association, Quincy, MA.

25. NFPA 14, "Standard for the Installation of Standpipe and Hose Systems," 2010 Edition, National Fire Protection Association, Quincy, MA.

26. NFPA 55, "Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks," 2010 Edition, National Fire Protection Association, Quincy, MA.

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67. Standard Review Plan Section 9.5.6, "Emergency Diesel Engine Starting System," Revision 3, March 2007.

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Table 9.5.1-1 (1 of 43)

Fire Protection Program Conformance with NRC RG 1.189

Position Number	Regulation Requirement	Conformance	Remarks
1. Fire protection	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	COL Item 9.5(1) COL applicants are responsible of the plan and procedures and other ETCH for operational program.
1.1 Organization, Staffing, and Responsibilities	The fire protection program should describe the organizational structure and responsibilities for its establishment and implementation. These responsibilities include fire protection program 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	COL	COL Item 9.5(1) COL applicants are responsible for this program.
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.	Conform	Initial FHA is included as Appendix 9A. COL is to update the FHA as necessary to reflect plant design and operational changes. COL Item 9.5(4)

Table 9.5.1-1 (2 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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 so that reasonable assurance of the capability to safely shut down the reactor is provided.	Conform/COL	Initial SSA is included as Appendix 9.5A. COL is to update the SSA as necessary to reflect plant design and operational changes.
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 RG fire protection requirements to provide reasonable assurance that the information is applicable and representative of the conditions for which the information is being applied.	COL	COL Item 9.5(2) COL applicants or licensees are responsible for this element.
1.5 Compensatory Measures	Temporary changes to specific fire protection features that may be necessary to accomplish maintenance or modifications are acceptable, provided interim compensatory measures, such as fire watches, temporary fire barriers, or backup suppression capability, are implemented. For common types of deficiencies, the technical specifications or the NRC-approved fire protection program generally note the specific compensatory measures. For unique situations or for measures that the approved fire protection program does not include, the licensee may determine appropriate compensatory measures. A licensee may opt to implement an alternative compensatory measure, or combination of measures, to the one stated in its fire protection program.	Conform/COL	COL Item 9.5(1)

Table 9.5.1-1 (3 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
1.6 Fire Protection Training and Qualifications	The fire protection program 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 fire protection program and the emergency procedures relative to fire protection.	Conform/COL	COL Item 9.5(1) This element is the responsibility of the COLA or licensee.
1.7 Quality Assurance	The overall plant QA plan should include the QA program for fire protection. For fire protection systems, the licensee should have and 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 50, unless the licensee has committed to include these systems under the plant's Appendix B program.	Conform/COL	Chapter 17 of DCD addresses QA including fire protection. QA program is included in COL Item 9.5(1).
1.8 Fire Protection Program Changes/Code Deviations	This section provides guidance relative to the regulatory mechanisms for addressing changes, deviations, exemptions, and other issues affecting compliance with fire protection regulatory requirements. Risk-informed, performance-based methodologies may be used to evaluate the acceptability of fire protection program changes; however, the licensee should use NRC reviewed and approved methodologies and acceptance criteria for this approach.	Only Information	This requirement is not applicable for DC application phase.

Table 9.5.1-1 (4 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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 fire hazards are adequately protected and managed and that fire consequences will be limited for those fires that do occur.	Information	
2.1 Control of Combustibles	Fire prevention administrative controls 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.	Out of DC scope but mandatory for the COLA or licensees.	COL Item 9.5(1) These elements are for the COLA or licensees.
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.	Out of DC scope but mandatory for the COLA or licensees.	COL Item 9.5(1) These elements are for the COLA or licensees.

Table 9.5.1-1 (5 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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 provide reasonable assurance of continued compliance with fire protection controls.	Out of DC scope but mandatory for the COLA or licensees.	COL Item 9.5(1) These elements are for the COLA or licensees.
2.4 Fire Protection System Maintenance and Impairments	The licensee should establish fire protection administrative controls to address the following: a. Fire protection features should be maintained and tested by qualified personnel. b. Impairments to fire barriers, fire detection, and fire suppression systems should be controlled by a permit system. c. Successful fire protection requires inspection, testing, and maintenance of the fire protection equipment. d. Fire barriers, including dampers, doors, and penetration seals, should be routinely inspected.	Out of DC scope but mandatory for the COLA or licensees.	COL Item 9.5(1)
3.0 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.	Conform	The FHA (Appendix 9.5A), NRC regulations, and NFPA codes and standards are used in the development of fire protection features for the APR1400.

Table 9.5.1-1 (6 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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 for fire protection water supplies.	Conform	
3.2. Fire Pumps	Fire pump installations should conform to NFPA 20 "Standard for the Installation of Stationary Pumps for Fire Protection" (Reference 88), and should meet the following criteria.	Conform	Two diesel pumps and one electrical motor pump are used.
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 installation.	Conform	
3.3 Automatic Suppression Systems	Automatic suppression 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.	Conform	Refer to Appendix 9.5A for areas where automatic suppression as determined by the FHA is to be installed.
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	Floor drains and raised equipment pedestals are used as well as spray shields where necessary to protect equipment that can suffer unacceptable damage from wetting.

Table 9.5.1-1 (7 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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	Sprinkler systems are designed per NFPA 13 and spray systems designed per NFPA 15.
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	If used, water mist suppression system is designed per NFPA 750.
3.3.1.3 Foam-Water Sprinkler and Spray Systems	Certain fires, such as those involving flammable liquids, respond well to foam suppression. Consideration should be given to the use of foam sprinkler and spray systems. Foam sprinkler and spray systems should conform to appropriate standards such as NFPA 16, "Standard for the Installation of Deluge Foam-Water Sprinkler and Foam-Water Spray Systems," and NFPA 11, "Standard for Low-, Medium-, and High-Expansion Foam."	Conform	
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.	Conform	

Table 9.5.1-1 (8 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
3.3.2.1 Carbon Dioxide Systems	Carbon dioxide extinguishing systems should comply with the requirements of NFPA 12. Where automatic carbon dioxide 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 carbon dioxide systems should be key locked and under strict administrative control.	N/A	
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 egress. Provisions for locally disarming automatic Halon systems should be key locked and under strict administrative control.	N/A	Halon fire extinguishing systems are not used for the APR1400.
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	
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/COL	Adequate manual hose stations and portable fire extinguishers are to be installed through the APR1400 by the COLA.

Table 9.5.1-1 (9 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
3.4.1 Standpipes and Hose Stations	Interior manual hose installations should be able to reach any location that contains, or could present a fire exposure hazard to, equipment important to safety with at least one effective hose stream. To accomplish this, 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 should be provided in all buildings on all floors. 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.	Conform/COL	This guidance is for manual hose stations and standpipes, which are to be installed throughout the APR1400 by the COLA. COL Item 9.5(2).
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).	Conform/COL	This guidance is for manual hose stations and standpipes, which are to be installed throughout the APR1400 by the COLA. COL Item 9.5(2). The COLA is to provide the specific and detailed design.

Table 9.5.1-1 (10 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
3.4.3 Manual Foam	For flammable and combustible liquid fire hazards, consideration should be given to the use of foam systems for manual fire suppression protection. These systems should comply with the requirements of NFPA 11.	Conform/COL	This guidance is for manual hose stations and standpipes, which are to be installed throughout the APR1400 by the COLA. COL Item 9.5(2). The COLA is to provide the specific and detailed design.
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 installed 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	This guidance is for manual hose stations and standpipes, which are to be installed throughout the APR1400 by the COLA. COL Item 9.5(2). The COLA is to provide the specific and detailed design.
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 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.	N/A	Acceptance criteria for operational plant licensed to operate before 1979.

Table 9.5.1-1 (11 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
3.5 3.5.1 ~3.5.2.3 Fire Brigade	A site fire brigade trained and equipped for firefighting should be established and should be on site at all times to provide reasonable assurance of 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.	COL	COL Item 9.5(1)
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, HVAC, lighting, and communication systems) important to effective fire prevention and protection.	Information only	
4.1.1 Combustibility of Building Components and Features	According to GDC 3, noncombustible and heat-resistant materials must be used wherever practicable 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.	Conform	Refer to Appendix 9.5A for the selection of fire areas, fire compartments, description of materials used for construction, and fire protection provided.
4.1.1.1 Interior finish	Interior finishes should be noncombustible.	Conform	

Table 9.5.1-1 (12 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
4.1.1.2 Testing and Qualification	Interior finishes should be noncombustible (see the "Glossary" section of this guide) or listed by an approving laboratory. a. Surface flame spread rating of 25 or less and a smoke development rating of 450 or less, when tested under American Society for Testing and Materials (ASTM) E84, "Standard Test Method for Surface Burning Characteristics of Building Materials." (Reference 104), b. Potential heat release of 8,141 kilojoules per kilogram (kJ/kg) (3,500 Btu per pound) or less when tested under ASTM D3286, "Standard Test Method for Gross Calorific Value of Coal and Coke by the Isoperibol Bomb Calorimeter" (Reference 105), or NFPA 259, "Standard Test Method for Potential Heat of Building Materials." (Reference 106) c. Floor covering critical radiant flux as determined by testing in accordance with NFPA 253, "Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source." (Reference 108)	Conform	Interior finishes conform to the items listed as acceptable without test in the text of this section of NRC RG 1.189 or meet the acceptable industry testing listed.
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 utilizing passive fire barriers to subdivide the plant into separate areas or zones.	Conform	Refer to Appendix 9.5A for details of fire area and fire compartment.

Table 9.5.1-1 (13 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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.	Conform	Refer to appendix 9.5A.
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 practicable on the basis of existing plant design and layout. (e.g., inside containment)	COL	
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.	Conform	Refer to Figure 1.2-XX (Later).
4.1.3.1 Cable Design	Electric cable construction should 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.” (This does not imply that cables passing either test will not require additional fire protection.) New reactor fiber optic cable insulation and jacketing should also meet the fire and flame test requirements of IEEE 383 or IEEE 1202.	Conform	

Table 9.5.1-1 (14 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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 only be used 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	
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 non-safety-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.	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.	Conform	The APR1400 design employs four redundant trains of safety systems used for mitigation of design basis accidents. Each train is completely separated by 3-hour rated fire barriers.

Table 9.5.1-1 (15 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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.	Conform	
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.	Conform	Refer to Appendix 9.5A for additional information.

Table 9.5.1-1 (16 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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.	Conform	The APR1400 design provides protection of HVAC filters and filter media from the damaging effects of a fire.
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.	Conform	Refer to Appendix 9.5A for a discussion of smoke removal for selected fire areas.
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 MCR evacuation, egress pathways and remote control stations should also be habitable. Consideration should be given to protection of safe-shutdown areas from infiltration of gaseous suppression agents. The capability to ventilate, exhaust, or isolate is particularly important to ensure the habitability of rooms or spaces that should be attended in an emergency. In the design, provision should be made for personnel access to and escape routes from each fire area.	Conform	

Table 9.5.1-1 (17 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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.	Conform	
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.	Conform	
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	
4.1.6.1 Egress Safety	Emergency lighting should be provided in support of the emergency egress design guidelines in outlined in Regulatory Position 4.1.2.3 of this guide.	Conform	

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Position Number	Regulation Requirement	Conformance	Remarks
4.1.6.2 Post fire Safe Shutdown	Lighting is vital to post-fire safe-shutdown and emergency response in the event of fire. The licensee should provide suitable fixed and portable emergency lighting.	Conform/COL	COL Item 9.5(4) Emergency lighting for post-fire safe shutdown will be confirmed by final SSA result.
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.	COL	
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.	COL	COL Item 9.5(1) to control transient hazards.
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. New reactor designs should be based on providing structural barriers between redundant safe shutdown success paths wherever feasible and should minimize the reliance on localized electrical raceway fire barrier systems, as described in Regulatory Position 4.2.3 of this guide. This approach is in accordance with the enhanced fire protection criteria for new reactors described in Regulatory Position 8.2 of this guide.	Conform	

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Position Number	Regulation Requirement	Conformance	Remarks
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 and Fire Barrier Walls," can be used as guidance for 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.	Conform	Refer to Appendix 9.5A.
4.2.1.2 Fire Doors	Building design should ensure that door openings are properly protected. These openings should be protected with fire doors that have been qualified by a fire test.	Conform	Refer to Appendix 9.5A.
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.	Conform	

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Position Number	Regulation Requirement	Conformance	Remarks
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.	Conform	Refer to Appendix 9.5A.
Testing and Qualification 4.2.1.5.a Structural fire barriers	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 E-119, “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 E-119 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 E-119 should be consulted with regard to the placement of thermocouples on the specimen.	Conform	

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Position Number	Regulation Requirement	Conformance	Remarks
4.2.1.5.b Penetration fire barriers	Penetration fire barriers - Penetration fire barriers should be qualified by tests conducted by an independent testing authority in accordance with the provisions of NFPA 251 or ASTM E-119. In addition, ASTM E-814, "Standard Test Method for Fire Tests of Through-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.	Conform	
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.	Conform	
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.	Conform	
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 5.5.a–c of this guide.	Conform	

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Position Number	Regulation Requirement	Conformance	Remarks
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	This guidance is not applicable for the APR1400.
4.3 Testing and Qualification of Electrical Raceway Fire Barrier Systems	Fire barriers relied on to protect post fire 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	Conform	The APR1400 uses 3-hour fire rated barriers between redundant trains of safety-related equipment. Only safety-related equipment is relied upon for post-fire shutdown.
5. Safe-Shutdown Capability	When considering the consequences of a fire in a given fire area during the evaluation of safe shutdown capabilities of the plant, it should be demonstrated that one success path of equipment and electrical circuits that can be used to bring the reactor to hot shutdown/standby conditions, remains free of fire damage.	Conform	The APR1400 is a new reactor design that complies with Position 8.2.

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Position Number	Regulation Requirement	Conformance	Remarks
5.1 Post fire 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	The APR1400 is a new reactor design that complies with Position 8.2.
5.2	For normal safe shutdown, redundant systems necessary to achieve cold shutdown may be damaged by a single fire, but damage should 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.	N/A	The APR1400 is a new reactor design that can achieve cold shutdown without equipment repairs being involved.
5.3 Fire Protection of Safe-Shutdown Capabilities	The post fire 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 post fire safe-shutdown circuits, when applied in conjunction with this NRC RG.	Conform/ COL	Refer to Appendix 9.5A. The final SSA is to be performed per COL Item 9.5(4).
5.3.1 Identification and Evaluation of Post fire Safe-Shutdown Circuits	The post-fire safe-shutdown analysis must ensure that one success path of shutdown SSCs remains free of fire damage for a single fire in any single plant fire area. The NRC acknowledges Chapter 3 of industry guidance document, NEI-00-01, Revision 1, in RIS 2005-30, as providing an acceptable deterministic methodology for analysis of post-fire safe-shutdown circuits, when applied in conjunction with the RIS.	Conform/ COL	Refer to Appendix 9.5A. The final SSA is to be performed per COL Item 9.5(4).

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Position Number	Regulation Requirement	Conformance	Remarks
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. Except in those circumstances in which alternative or dedicated shutdown systems are required, where equipment or cables (including electrical circuits that could prevent operation or cause maloperation caused by hot shorts, open circuits, or shorts to ground) of redundant success paths necessary to achieve and maintain hot-shutdown conditions are located within the same fire area outside the primary containment, the licensee should provide, for currently operating reactor plants, one of the following means of ensuring that one of the success paths (of SSCs for hot shutdown) is free of fire damage. (Regulatory Position 8.2 of this guide provides the protection requirements for redundant post fire safe-shutdown success paths in new reactor plants.)	Conform/ COL	Fire barriers are installed to provide separation of redundant safety trains. Automatic suppression is installed to minimize damage to safety-related equipment where applicable.
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).	Conform/COL	Refer to Appendices 9.5A and 9.5A. The final SSA is to be performed per COL Item 9.5(4).

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Position Number	Regulation Requirement	Conformance	Remarks
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.	COL	COL Item 9.5(1) COL Item 9.5(4)
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.	COL	COL Item 9.5(4)
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.	N/A	General examples for information

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Position Number	Regulation Requirement	Conformance	Remarks
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.	Conform	The APR1400 design considers the impact of high/low-pressure interfaces.
5.4.1 Alternative and Dedicated Shutdown Capability	Appendix R to 10 CFR 50 (Reference 1) 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 post fire shutdown. Since post fire 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.	N/A	The APR1400 is a new reactor design that complies with Position 8.2.
5.4.2 Associated Circuits of Concern	When alternative or dedicated shutdown systems are credited for achieving post fire 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 non-safety 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.	N/A	The APR1400 is a new reactor design.

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Position Number	Regulation Requirement	Conformance	Remarks
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, alternatively, by the following methods as applied to each type of associated circuit of concern.	N/A	Refer to Position 5.3.
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" (Reference 123), provides detailed guidance on achieving proper coordination.	N/A	
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 mal-operation 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).	N/A	Refer to Position 5.3.

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Position Number	Regulation Requirement	Conformance	Remarks
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	Refer to Position 5.3.
5.4.4 Control Room Fires	The MCR fire area contains the controls and instruments for redundant shutdown systems in close proximity. (Separation is usually a few inches) Remote shutdown capability for the MCR and its required circuits should be independent of the cables, systems, and components in the MCR fire area. The damage to systems in the MCR for a fire that causes evacuation of the MCR cannot be predicted. The licensee should conduct a bounding analysis to ensure that safe conditions can be maintained from outside the MCR.	Conform	The remote shutdown console, located in a separate fire area from the MCR, contains all controls necessary to safely achieve cold shutdown. When this remote shutdown console is used, MCR circuits are defeated so no adverse fire impact on safe-shutdown capability results.
5.5 Post fire 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 post-fire procedures should be validated.	COL	COL Item 9.5(1) COL Item 9.5(4)

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Position Number	Regulation Requirement	Conformance	Remarks
5.5.1 Safe-Shutdown Procedures	Post-fire 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 or plant emergency operating procedures.	N/A	The APR1400 is a new reactor design that complies with Position 8.2.
5.5.2 Alternative or Dedicated Shutdown Procedures	Procedures should be in effect that describe the tasks to implement remote 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 operations and high-impedance faults if such actions are necessary to affect safe shutdown.	COL	COL Item 9.5(4)
5.5.3 Repair Procedures	The licensee should develop procedures for performance of 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 prior to 72 hours, the procedures should support the required time for initiation of cold shutdown.	N/A	Repairs are not required to achieve cold shutdown. Cold shutdown is achieved through redundant safety trains of equipment through normal operating procedures.

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Position Number	Regulation Requirement	Conformance	Remarks
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 fire protection program should be reviewed to verify that fire protection systems, features, and procedures will minimize the potential for fire events to impact 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	Conform for APR1400 design features. COLA to address shutdown mode procedures under COL Item 9.5(1).
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.	Conform/COL	Refer to Appendices 9.5A

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Position Number	Regulation Requirement	Conformance	Remarks
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 non-inerted containments, one of the fire protection means specified in Regulatory Position 5.3, or one of the following, should be provided: a. Separation of cables and equipment and associated non-safety 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. c. Separation of cables and equipment and associated non-safety 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/COL	Refer to Position 4.1.3.3.
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.	Conform/COL	Refer to Appendix 9.5A.
6.1.1.3 Containment Fire Detection	Fire detection systems should alarm and annunciate in the MCR. 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.	Conform/COL	Refer to Appendix 9.5A for specific discussion on types of detection for specific areas.

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Position Number	Regulation Requirement	Conformance	Remarks
6.1.2 Control Room Complex	The MCR 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 MCR complex should have automatic water suppression and should be separated from the MCR by noncombustible construction with a fire-resistance rating of 1 hour. Ventilation system openings between the MCR 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 MCR. Carbon dioxide total flooding systems are not acceptable for these areas.	Conform	Automatic fire detection is provided. A very early warning fire detection system is provided in raised-floor compartments and MCR cabinets. The MCR raised-floor compartment is also provided with an automatic fire suppression system that discharges an environmentally friendly clean fire extinguishing agent that does not present a hazard to MCR personnel. 3-hour fire rated separation is provided for the MCR complex. No carbon dioxide systems are used in this area.

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Position Number	Regulation Requirement	Conformance	Remarks
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 b. Exposure fires involving combustibles in the general room area Portable Class A and Class C fire extinguishers should be located in the MCR. A hose station should be installed inside or immediately outside the MCR.	Conform/COL	A fire hose station is located in the corridor immediately outside the entrance to the MCR. The appropriate portable extinguishers are located within the MCR.
6.1.2.2 Control Room Fire Detection	Smoke detectors should be provided in the MCR, cabinets, and consoles. If redundant safe-shutdown equipment is located in the same MCR cabinet or console, additional fire protection measures should be provided. Alarm and local indication should be provided in the MCR. The outside air intake(s) for the MCR ventilation system should be provided with smoke detection capability to alarm in the MCR to enable manual isolation of the MCR ventilation system and, thus, prevent smoke from entering the MCR.	Conform	The APR1400 uses a very early warning smoke detection system (air aspirating) within the raised-floor area that also senses within the MCR console and cabinets. Intake air is sampled by smoke detection to alarm and smoke damper is closed automatically.
6.1.2.3 Control Room Ventilation	Venting of smoke produced by fire in the MCR 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 MCR should be available to the operators.	Conform	MCR smoke removal is provided by design. The smoke removal function is manually activated by MCR operators.

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Position Number	Regulation Requirement	Conformance	Remarks
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.	Conform	
6.1.4 Plant Computer Rooms	Computer rooms for computers performing functions important to safety that are not part of the MCR 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.	Conform	
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 MCR 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.	Conform	

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Position Number	Regulation Requirement	Conformance	Remarks
6.1.6 Alternative and Dedicated Shutdown Panels	Barriers having a minimum fire rating of 3 hours should separate panels providing remote shutdown capability from the MCR complex. Panels providing remote shutdown capability should be electrically isolated from the MCR 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 MCR. 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.	Conform	The remote shutdown room (RSR) is located in a separate fire area on a plant level above the MCR complex and is in a room formed by 3-hour fire rated barriers.
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 other areas of the plant by barriers having a minimum fire rating of 3 hours inclusive of all penetrations and openings.	Conform	Ventilation system prevents hydrogen gas buildup. System malfunction is alarmed.
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.	Conform	Refer to FHA (Appendix 9.5A).

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Position Number	Regulation Requirement	Conformance	Remarks
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- our 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 MCR and alarm locally. Hose stations and portable extinguishers should be readily accessible.	Conform	Refer to FHA (Appendix 9.5A).
6.2 Other Areas	Other areas within the plant may contain hazards or equipment that warrant special consideration relative 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 only	
6.2.1 New Fuel Areas	New Fuel Areas. Portable hand extinguishers should be located near this area. In addition, hose stations should be located outside but within hose reach of this area. Automatic fire detection should alarm and annunciate in the MCR and alarm locally. Combustibles should be limited to a minimum in the new fuel area. The storage area should be provided with a drainage system to preclude accumulation of water.	Conform	
6.2.2 Spent Fuel Area	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 MCR and to alarm locally.	Conform	

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Position Number	Regulation Requirement	Conformance	Remarks
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- heeled units sized according to the hazards) are acceptable. Automatic fire detection should annunciate and alarm in the MCR 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.	Conform	
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 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-level Radioactive Waste, and Reactor-Related Greater Than Class C Waste," 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.	N/A	Dry cask storage is not a feature required for the APR1400 plant.
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	

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Position Number	Regulation Requirement	Conformance	Remarks
6.2.6 Cooling Towers	Cooling towers should constructed of noncombustible construction 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/COL	COL Item 9.5(2). The COLA is to provide the cooling tower system.
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.	Conform	A compliant oil leakage collection system is provided for RCPs.
7.2 Turbine Generator Building	The TGB 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.	Conform	The AB wall separating the AB from the TGB areas meets 3-hour fire resistive construction requirements. Refer to FHA (Appendix 9.5A).

Table 9.5.1-1 (39 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
7.2.1 Oil Systems	The TGB contains large sources of combustible liquids, including reservoirs and piping for lube oil, seal oil, and electro hydraulic 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.	Conform	There is no safety-related equipment in the TGB. The TGB is separated from the AB by 3-hour barriers. Individual hazards within the TGB are separated based on the FHA (Appendix 9.5A).
7.2.2 Hydrogen System	Turbine generators may use hydrogen for cooling. Hydrogen storage and distribution systems should meet the guidelines provided in Regulatory Position 7.5 of this guide.	Conform	
7.2.3 Smoke Control	Smoke control should be provided in the T/B to mitigate potential heavy smoke conditions associated with combustible liquid and cable fires. Regulatory Position 4.1.4 provides specific guidance.	Conform	Smoke vents are used in TGB roof.
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 for interior locations; COL to address outdoors.	COL Item 9.5(2)

Table 9.5.1-1 (40 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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 (Reference 68) for additional guidance.)	Conform	
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.	Conform/COL	COL applicants are responsible for this guidance.
7.6 Nearby Facilities	The fire protection program 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.	COL to address the rest of the support facilities.	COL Item 9.5(2)

Table 9.5.1-1 (41 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
8.1 Fire Protection for New Reactors	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.	Conform	As an advanced nuclear plant, the APR1400 has integrated fire protection requirements into the planning and design phases of the plant.
8.2 Enhanced Fire Protection Criteria	New reactor designs should ensure that safe-shutdown can be achieved 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 MCR is excluded from this approach, provided the design includes an independent alternative shutdown capability that is physically and electrically independent of the MCR. The MCR 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	The APR1400 meets the enhanced fire protection provisions of SECY-93-087 as demonstrated in the FHA (Appendix 9.5A).

Table 9.5.1-1 (42 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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. Based on the discussion and recommendations of SECY-94-84, the passive decay heat removal systems must be capable of achieving and maintaining 215.6 °C (420 °F) or below for non-LOCA events. This safe-shutdown condition is predicated on demonstration of acceptable passive safety system performance.	N/A	The APR1400 plant uses four redundant active safety-related trains, including the RHR systems, to achieve cold shutdown in the event of a fire requiring plant shutdown within one of the safety-related trains.
8.4 Applicable Industry Codes and Standards	In general, the fire protection program for new light-water reactor 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 post-fire safe-shutdown capability and the mitigation of a radiological release resulting from a fire. However, the NRC RG has not formally endorsed NFPA 804 and some of the guidance in the NFPA standard conflicts with regulatory requirements. When conflicts occur, the applicable regulatory requirements and guidance, including the guidance in this NRC RG, will govern.	Conform	
8.5 Other New Reactor Designs	Fire protection programs for proposed new non-light-water reactor designs should meet the overall fire protection objectives and guidance provided in the applicable regulations and this NRC RG as they relate to safe shutdown and radiological release, as well as the specific fire protection requirements, as applicable.	N/A	The APR1400 is a light-water reactor.

Table 9.5.1-1 (43 of 43)

Position Number	Regulation Requirement	Conformance	Remarks
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," identifies fire protection as an "operation program." However, only those elements of the fire protection program that will not be implemented fully until the completion of the plant should be addressed as an operational program. This may include, but is not be limited to, the fire brigade, combustible and ignition source control program, procedures and prefire plans, and portable extinguishing equipment. The COL application is to identify the operational program aspects of the fire protection program 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 Item 9.5(1)
8.7 Fire protection for Non Power 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.	
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 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.	N/A	The APR1400 is a new plant that will obtain an initial operating license.

Table 9.5.1-2 (1 of 74)

APR1400 Fire Protection Program Conformance with NFPA 804

Paragraph	Standard Requirement	Conformance	Remarks
4.1 General	All elements of the site fire protection program shall be reviewed every 2 years and updated as necessary. Other review frequencies shall be permitted where specified in site administrative procedures and approved by the authority having jurisdiction.	COL	COL Item 9.5(1)
4.2 Management Policy Direction and Responsibility	A policy document shall be prepared that defines management authorities and responsibilities and establishes the general policy for the site fire protection program. The policy document shall designate the senior management person with immediate authority and responsibility for the fire protection program. The policy document shall define the fire protection interfaces with other organizations and assign responsibilities for the coordination activities. The policy document shall include the authority for conflict resolution.	COL	COL Item 9.5(1)

Table 9.5.1-2 (2 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
4.3 Fire Prevention Program	A fire prevention program shall be established and documented to include all of the following: a. Fire safety information for all employees and contractors, including as a minimum familiarization with plant fire prevention procedures, fire reporting, and plant emergency alarms, including evacuation b. Documented plant inspections, including provisions for handling of remedial actions to correct conditions that increase fire hazards c. Procedures for the control of general housekeeping practices and the control of transient combustibles d. Procedures for the control of flammable and combustible gases in accordance with NFPA standards e. Procedures for the control of ignition sources, such as smoking, welding, cutting, and grinding (see NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work) f. Fire prevention surveillance plan (see NFPA 601, Standard for Security Services in Fire Loss Prevention) g. Fire-reporting procedure, including investigation requirements and corrective action requirements	COL	COL Item 9.5(1)

Table 9.5.1-2 (3 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
4.4	A documented fire hazards analysis shall be made for each site. The analysis shall document all of the following: a. Physical construction and layout of the buildings and equipment, including fire areas and the fire ratings of area boundaries b.* Inventory of the principal combustibles within each fire subdivision c. Description of the fire protection equipment, including alarm systems and manual and automatic extinguishing systems d. Description and location of any equipment necessary to ensure a safe shutdown, including cabling and piping between equipment e. Analysis of the postulated fire in each fire area, including its effect on safe shutdown equipment, assuming automatic and manual fire protection equipment do not function f. 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 g. Analysis of the potential effects of other hazards, such as earthquakes, storms, and floods, on fire protection h. Analysis of the potential effects of an uncontained fire in causing other problems not related to safe shutdown, such as a release of contamination and impairment of operations i. Analysis of the post fire recovery potential j. Analysis for the protection of nuclear safety–related systems and components from the inadvertent actuation or breaks in a fire protection system k. Analysis of the smoke control system and the impact smoke can have on nuclear safety and operation for each fire area l. Analysis of the emergency planning and coordination requirements necessary for effective loss control, including any necessary compensatory measures to compensate for the failure or inoperability of any active or passive fire protection system or feature	Conform / COL Conform for initial APR1400 design, COL to update.	The APR1400 basic FHA is included in Appendix 9.5A. COL responsible for adding site specifics, and periodic review and updating; COL Item 9.5(4).

Table 9.5.1-2 (4 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
4.5 Procedures	A formal procedure system for all actions pertaining to the fire protection program shall be established, including all of the following: a. Inspection, testing, maintenance, and operation of fire protection systems and equipment, both manual and automatic, such as detection and suppression systems b. Inspection, testing, and maintenance of passive fire protection features, such as fire barriers and penetration seals c. Trend analysis requirements d. Provisions for entering areas with access restrictions e. Training requirements	COL	COL Item 9.5(1)
4.6 Quality Assurance	A quality assurance program shall be established in accordance with ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities, for all of the following aspects of the fire protection program related to nuclear safety: a. Design and procurement document control b.* Instructions, procedures, and drawings c.* Control of purchased material, equipment, and services d.* Inspection e.* Test and test control f.* Inspection, test, and operating status g.* Nonconforming items h.* Corrective action i.* Records j.* Audits The quality assurance program shall be documented in detail to verify its scope and adequacy.	COL	The APR1400 QA program is detailed in DCD Chapter 17. The QA program is in accordance with NRC RG 1.189, Position 1.7.

Table 9.5.1-2 (5 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
4.7 Fire Emergency Plan	A written fire emergency plan shall be established. As a minimum, this plan shall include the following: a. Response to fire and supervisory alarms b. Notification of plant and public emergency forces c. Evacuation of personnel d. Coordination with security, maintenance, operations, and public information personnel e. Fire extinguishment activities f. Post fire recovery and contamination control activities g. Control room operations during an emergency h. Prefire plan i. Description of interfaces with emergency response organizations, security, safety, and others having a role in the fire protection program, including agreements with outside assistance agencies, such as fire departments and rescue services	COL	COL Item 9.5(1)
4.8 Fire Brigade	A plant fire brigade shall be established as indicated in Chapter 6.	COL	COL Item 9.5(1)
5.2 Plant Inspections	The owner or a designated manager shall develop, implement, and update as necessary a fire prevention surveillance plan integrated with recorded rounds to all accessible sections of the plant. Inspections of the plant shall be conducted in accordance with NFPA 601, Standard for Security Services in Fire Loss Prevention. A prepared checklist shall be used for the inspection.		COL Item 9.5(1)

Table 9.5.1-2 (6 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
5.2 Plant Inspections	Areas of primary containment and high-radiation areas normally inaccessible during plant operation shall be inspected as plant conditions permit but at least during each refueling outage. The results of each inspection shall be documented and retained for 2 years. For those plant areas inaccessible for periods greater than 2 years, the most recent inspection shall be retained.		COL Item 9.5(1)
5.3. Control of Combustible Materials 5.3.1 Plant administrative procedures	Plant administrative procedures shall specify appropriate requirements governing the storage, use, and handling of flammable and combustible liquids and flammable gases. An inventory of all temporary flammable and combustible materials shall be made for each fire area, identifying the location, type, quantity, and form of the materials. Temporary but predictable and repetitive concentrations of flammable and combustible materials shall be considered. Combustibles, other than those that are an inherent part of the operation, shall be restricted to designated storage compartments or spaces. Consideration shall be given to reducing the fire hazard by limiting the amount of combustible materials. The storage and use of hydrogen shall be in accordance with NFPA 55, Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks. The temporary use of wood shall be minimized. Plant administrative procedures shall specify that if wood must be used in the power block, it shall be listed pressure-impregnated fire-retardant lumber.	COL	COL Item 9.5(1)

Table 9.5.1-2 (7 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
5.3.2 Housekeeping	Housekeeping shall be performed in such a manner as to minimize the probability of fire. Accumulations of combustible waste material, dust, and debris shall be removed from the plant and its immediate vicinity at the end of each work shift or more frequently as necessary for safe operations.		COL Item 9.5(1)
5.3.3 Transient Combustible Loading	Plant administrative procedures shall require the following: a. The total fire loads, including temporary and permanent combustible loading, shall not exceed those quantities established for extinguishment by permanently installed fire protection systems and equipment. b. Where limits are temporarily exceeded, the plant fire protection manager shall ensure that appropriate fire protection measures are provided. The fire protection manager or a designated representative shall conduct weekly walk-through inspections to ensure implementation of required controls. During major maintenance operations, the frequency of these walk-throughs shall be increased to daily. The results of these inspections shall be documented and the documentation retained for a minimum of 2 years. When the work is completed, the plant fire protection manager shall have the area inspected to confirm that transient combustible loadings have been removed from the area.		COL Item 9.5(1)

Table 9.5.1-2 (8 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
5.3.3 Transient Combustible Loading	Extra equipment shall then be returned to its proper location. The results of this inspection shall be documented and retained for 2 years. Only noncombustible panels or flame-retardant tarpaulins or approved materials of equivalent fire-retardant characteristics shall be used. Any fabrics or plastic films used, other than those complying with 5.3.3.4, shall be certified to conform to the large-scale fire test described in NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.		COL Item 9.5(1)
5.3.4.	Flammable and combustible liquid storage and use shall be in accordance with NFPA 30, Flammable and Combustible Liquids Code. Where oil-burning equipment, stationary combustion engines, or gas turbines are used, they shall be installed and used in accordance with NFPA 31, Standard for the Installation of Oil-Burning Equipment, or NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, as appropriate. Where oil-burning equipment, stationary combustion engines, or gas turbines are used, they shall be installed and used in accordance with NFPA 31, Standard for the Installation of Oil-Burning Equipment, or NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, as appropriate.	Conform for the APR1400 basic plant, and COL to implement program.	COL Item 9.5(1)

Table 9.5.1-2 (9 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
5.3.4.	Hydraulic systems shall use only listed fire-resistant hydraulic fluids, except as specified by 5.3.4.5. Where unlisted hydraulic fluids must be used, they shall be protected by a fire suppression system. The ignition of leaked or spilled liquid shall be minimized by the following methods: a.* Keeping the liquid from contact with hot parts of the steam system (wall temperature greater than or equal to ignition temperature), such as steam pipes and ducts, entry valve, turbine casing, reheater, and bypass valve b. Using suitable electrical equipment c. Sealing the insulation of hot plant components to prevent liquid saturation d. Using concentric piping e. Using liquid collection systems	Conform for the APR1400 basic plant, and COL to implement program.	COL Item 9.5(1)
5.4 Control of Ignition Sources 5.4.1 Plant Administrative Procedures	Plant administrative procedures shall require an in-plant review and prior approval of all work plans to assess potential fire hazard situations. Where potential fire hazards are determined to exist, special precautions shall be taken to define appropriate conditions under which the work is authorized.		

Table 9.5.1-2 (10 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
5.4.2 Hot Work	The owner or a designated manager shall develop, implement, and update as necessary a welding and cutting safety procedure using NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, and NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations, as a guide. Written permission from the fire protection manager or a designated alternate shall be obtained before starting activities involving cutting, welding, grinding, or other potential ignition sources. A permit shall not be issued until all of the following are accomplished: a. An inspection has determined that hot work can be conducted at the desired location. b. Combustibles have been moved away or covered. c. The atmosphere is nonflammable. d. A trained fire watch (with equipment) is posted for the duration of the work and for 30 minutes thereafter, to protect against sparks or hot metal starting fires. All cracks or openings in floors shall be covered or closed.	COL	COL Item 9.5(1)
5.4.3 Smoking	Smoking shall be prohibited at or in the vicinity of hazardous operations or combustible and flammable materials. “No Smoking” signs shall be posted in the areas specified in 5.4.3.1. Smoking shall be permitted only in designated and supervised safe areas of the plant. Where smoking is permitted, safe receptacles shall be provided for smoking materials.	COL	COL Item 9.5(1)

Table 9.5.1-2 (11 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
5.4.4 Temporary Electrical Wiring	All temporary electrical wiring shall comply with the following to minimize the ignition of flammable materials: a. Be kept to a minimum b. Be suitable for the location c. Be installed and maintained in accordance with NFPA 70, National Electrical Code, or ANSI/IEEE C2, National Electrical Safety Code, as appropriate d. Be arranged so that energy shall be isolated by a single switch e. Be arranged so that energy shall be isolated when not needed	COL	COL Item 9.5(1)
5.4.5 Temporary Heating Appliances.	Only safely installed, approved heating devices shall be used in all locations. Ample clearance shall be provided around stoves, heaters, and all chimney and vent connectors to prevent ignition of adjacent combustible materials in accordance with NFPA 211, Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances (connectors and solid fuel); NFPA 54, National Fuel Gas Code (fuel gas appliances); and NFPA 31, Standard for the Installation of Oil-Burning Equipment (liquid fuel appliances). Refueling operations of heating equipment shall be conducted in an approved manner. Heating devices shall be situated so that they are not likely to overturn. Temporary heating equipment, when utilized, shall be monitored and maintained by properly trained personnel.	COL	COL Item 9.5(1)

Table 9.5.1-2 (12 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
5.4.6	Open-flame or combustion-generated smoke shall not be used for leak testing.	COL	COL Item 9.5(1)
5.4.7	Plant administrative procedures shall specify appropriate requirements governing the control of electrical appliances in all plant areas.	COL	COL Item 9.5(1)
5.5 Temporary Structures 5.5.1.1 Exterior Buildings	Temporary buildings, trailers, and sheds, whether individual or grouped, shall be constructed of noncombustible material and shall be separated from other structures. Temporary buildings, trailers, and sheds and other structures constructed of combustible or limited-combustible material shall be separated from other structures by a minimum distance of 30 ft, unless otherwise permitted by 5.5.1.3. Where all portions of the exposed building (walls, roof) within 30 ft of the exposure constitute a rated fire barrier, the minimum separation distance shall be permitted to be reduced in accordance with Table 5.5.1.3. All exterior buildings, trailers, sheds, and other structures shall have the appropriate type and size of portable fire extinguishers.	COL	COL Item 9.5(1)
5.5.2 Exterior Temporary Coverings	Where coverings are utilized for protection of the outdoor storage of materials or equipment, the following shall apply: a. Only approved fire-retardant tarpaulins or other acceptable materials shall be used. b. All framing material used to support such coverings shall be either noncombustible or fire-retardant pressure-impregnated wood. c. Covered storage shall not be located within 30 ft of any building.	COL	COL Item 9.5(1)

Table 9.5.1-2 (13 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
5.5.3 Interior Temporary Facilities	All interior temporary structures shall be constructed of noncombustible, limited-combustible, or fire-retardant pressure-impregnated wood. Structures constructed of noncombustible or limited-combustible materials shall be protected by an automatic fire suppression system unless the fire hazard analysis determines that automatic suppression is not required. The structure shall be protected by an automatic fire suppression system if the structure is constructed of fire-retardant pressure-impregnated wood. The use of interior temporary coverings shall comply with the following criteria: a. Be limited to special conditions where interior temporary coverings are necessary b. Be constructed of approved fire-retardant tarpaulins Where framing is required, it shall be constructed of noncombustible, limited-combustible, or fire-retardant pressure-impregnated wood. All interior temporary facilities shall have the appropriate type and size of portable fire extinguisher.	COL	COL Item 9.5(1)

Table 9.5.1-2 (14 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
5.6 Impairments	A written procedure shall be established to address impairments to fire protection systems and features and other plant systems that directly affect the level of fire risk (e.g., ventilation systems, plant emergency communication systems). Impairments to fire protection systems shall be as short in duration as practicable. Appropriate post maintenance testing shall be performed on equipment that was impaired to ensure that the system will function properly. Any change to the design or function of the system after the impairment shall be considered in establishing the testing requirements and shall be reflected in the appropriate design documents and plant procedures.	COL	COL Item 9.5(1)
5.7 Testing and Maintenance	Upon installation, all new fire protection systems and passive fire protection features shall be preoperationally inspected and tested in accordance with applicable NFPA standards. Where appropriate test standards do not exist, inspections and test procedures described in the purchase and design specification shall be followed. Fire protection systems and passive fire protection features shall be inspected, tested, and maintained in accordance with applicable NFPA standards, manufacturers' recommendations, and requirements established by those responsible for fire protection at the plant. Inspection, testing, and maintenance shall be performed using established procedures with written documentation of results and a program of follow-up actions on discrepancies. Consideration shall be given to the inspection, testing, and maintenance of nonfire protection systems and equipment that have a direct impact on the level of fire risk within the plant.	Conform/COL	COL for modifications; The APR1400 initially to undergo preoperational testing of fire suppression systems. COL Item 9.5(1).

Table 9.5.1-2 (15 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
6 Manual Fire Fighting 6.1 Prefire Plans	Detailed prefire plans shall be developed for all site areas. Prefire plans shall detail the fire area configurations and fire hazards to be encountered in the fire area along with any safety-related components and fire protection systems and features that are present. Prefire plans shall be reviewed and, if necessary, updated at least every 2 years. Prefire plans shall be available in the control room and made available to the plant fire brigade.	COL	COL Item 9.5(1)
6.2. On-Site Fire-Fighting Capability	A minimum of five plant fire brigade members shall be available for response at all times. Fire brigade members shall have no other assigned normal plant duties that would prevent immediate response to a fire or other emergency as required. The brigade leader and at least two brigade members shall have training and knowledge of plant safety–related systems to understand the effects of fire and fire suppressants on safe shutdown capability. The fire brigade shall be notified immediately upon verification of a fire or fire suppression system actuation. Plant fire brigade members shall be physically qualified to perform the duties assigned. Each member shall pass an annual physical examination to determine that the fire brigade member can perform strenuous activity. The physical examination shall determine each member's ability to use respiratory protection equipment. Each fire brigade member shall meet training qualifications as specified in Chapter 6, Section 6.3.		

Table 9.5.1-2 (16 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
6.3. Training and Drills	Plant fire brigade members shall receive training consistent with the requirements contained in NFPA 600, Standard on Industrial Fire Brigades, or NFPA 1500, Standard on Fire Department Occupational Safety and Health Program, as appropriate. Fire brigade members shall be given quarterly training and practice in firefighting. A written program shall detail the fire brigade training program. Written records that include but are not limited to the following shall be maintained for each fire brigade member: a. Initial fire brigade classroom and hands-on training b. Refresher training c. Special training schools attended d. Drill attendance records e. Leadership training for fire brigades Drills shall be conducted quarterly for each shift to test the response capability of the fire brigade. Fire brigade drills shall be developed to test and challenge fire brigade response, including the following: a. Brigade performance as a team b. Proper use of equipment c. Effective use of prefire plans d. Coordination with other groups Fire brigade drills shall be conducted in various plant areas, especially in those areas identified by the fire hazards analysis to be critical to plant operation and to contain significant fire hazards. Drill records shall be maintained detailing the drill scenario, fire brigade member response, and ability of the fire brigade to perform the assigned duties. A critique shall be held after each drill.	COL	COL Item 9.5(1)

Table 9.5.1-2 (17 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
6.4. Fire-Fighting Equipment	The plant fire brigade shall be provided with equipment that enables its members to adequately perform their assigned tasks. Fire brigade equipment shall be tested and maintained. Written records shall be retained for review.	COL	COL Item 9.5(1)
6.5 Off-Site Fire Department Interface	A mutual aid agreement shall be offered to the local off-site fire department. Where possible, the plant fire protection manager and the off-site fire authorities shall develop a plan for their interface. The fire protection manager also shall consult with the off-site fire department to make plans for firefighting and rescue, including assistance from other organizations, and to maintain these plans. The local off-site fire department shall be invited to participate in an annual drill. Fire fighters from the off-site fire department who are expected to respond to a fire at the plant shall be familiar with the plant layout. The access routes to fires in the controlled area (to which access doors are locked) shall be planned in advance. The off-site fire department shall be offered instruction and training in radioactive materials, radiation, and hazardous materials that could be present. Plant management shall designate a plant position to act as a liaison to the off-site fire department when it responds to a fire or other emergency at the plant. Plant management shall ensure that the off-site fire department personnel are escorted at all times and emergency actions are not delayed.	COL	COL Item 9.5(1)

Table 9.5.1-2 (18 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
6.6 Water Drainage	The fire brigade shall have at its disposal the necessary equipment to assist with routing water from the affected area.	COL	COL Item 9.5(1)
6.7 Fire-Fighting Access	All plant areas shall be accessible for fire-fighting purposes. Prefire plans shall identify those areas of the plant that are locked and have limited access for either security or radiological control reasons. Provisions shall be made to allow access to the locked areas, including having security and health physics personnel respond to the fire area along with the fire brigade, if necessary. Health physics personnel shall confer with the fire brigade leader to determine the safest method of access to any radiologically controlled area.	COL	COL Item 9.5(1)
6.8. Radiation Shielding	Full advantage shall be taken of all fixed radiation shielding to protect personnel responding for fire suppression purposes. Health physics personnel shall advise the fire brigade leader of the best method for affording radiological protection.	COL	COL Item 9.5(1)
6.9 Smoke and Heat Removal	If fixed ventilation systems are not capable of removing smoke and heat, the fire brigade shall utilize portable ventilation equipment (Section 8.4).	COL	COL Item 9.5(1)
7.0 Nuclear Reactor Safety Considerations 7.2 Fire-Safe Shutdown Analysis (FSSA).	A fire-safe shutdown analysis shall be prepared and maintained for the operating life of the reactor, and shall include, as a minimum, all of the following: a. Fire hazards analysis b. Safe shutdown analysis c. Internal plant examination of external fire events for severe accident vulnerabilities	Conform/COL	The APR1400 is designed to allow safe- shutdown from two of three unaffected trains of safety-related equipment. See DCD Chapter 7, Section 7.4.
7.2.1 Fire Hazards Analysis	The fire hazards analysis shall include the criteria indicated in Chapter 4, Section 4.4.	Conform/COL	Refer to Appendix 9.5A.

Table 9.5.1-2 (19 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
7.2.2 Safe Shutdown Analysis	A safe shutdown analysis of the effects of a fire on those essential structures, systems, and components required to safely shut down the plant and maintain it in a safe shutdown condition shall be performed, including, as a minimum, the requirements of this section. A safe shutdown system available/unavailable calculation or table that provides the following shall be prepared and maintained for each fire area: a. The document shall identify all safe shutdown equipment that is operable or inoperable due to the effects of a fire in that fire area. b. The document shall demonstrate compliance with the requirements of Chapter 7, Sections 7.3 and 7.4. A shutdown logic diagram shall be available that identifies the conditions necessary to achieve and maintain safe shutdown capability in the event of a fire and those plant features necessary to realize these conditions, including auxiliary and support features.	Conform/COL	Refer to Appendix 9.5A.
7.2.3 Internal Plant Examination of External Fire Events for Severe Accident Vulnerabilities.	A risk assessment that estimates the potential risk from a fire in relation to the plant's core damage frequency shall be prepared.	COL	
7.2.3.1	An industry-accepted examination process shall be used for the risk assessment.	COL	
7.2.3.2	An acceptable risk assessment shall demonstrate that the probability of core damage as a result of an internal fire is less -6 than 1 × 10 per reactor year.	COL	
7.2.3.3	The internal plant examination of external fire events for severe accident vulnerabilities shall be used to evaluate the level of safety of the plant and shall not be used to reduce the overall plant fire protection design basis.	COL	

Table 9.5.1-2 (20 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
7.3 Design Basis Events and Requirements 7.3.1. Fire	Only one fire shall be assumed to occur at a given time, and for the purpose of a safe shutdown analysis, damage shall be assumed to occur immediately.	Conform/COL	SSA for the APR1400 is prepared in consideration of the guidance of 7.3.1.1 through 7.3.1.16. The COLA is to update the final SSA including PSSA circuits analysis.
7.3.1.2	All components, including electrical cables, that are susceptible to fire damage in a single fire area (except primary containment and annulus areas) shall be assumed to be disabled or to be spuriously actuated, whichever is the worst case.	Conform	
7.3.1.3	A fire shall not impair safe shutdown capability inside primary containment or annulus areas.	Conform	
7.3.1.4	The plant shall be assumed to be operating at 100 percent power, with all components in their normal configuration, when a postulated fire occurs; however, the analysis also shall consider changes in plant configurations during all normal modes of operation.	Conform	
7.3.1.5	A concurrent single active component failure independent of the postulated fire shall not be assumed to occur.	Conform	
7.3.1.6	Plant accidents or severe natural phenomena shall not be assumed to occur concurrently with a postulated fire, except as specified in 7.3.2.	Conform	
7.3.1.7	A loss of off-site power shall be assumed concurrent with the postulated fire only where the safe shutdown analysis (including alternative shutdown) indicates the fire could initiate the loss of off-site power.	Conform	

Table 9.5.1-2 (21 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
7.3.1.8	Fire-safe shutdown components shall be capable of performing all the following functions in the event of the postulated fire: a. Achieving and maintaining subcritical reactivity conditions in the reactor b. Maintaining the reactor coolant inventory such that plant safety limits are not violated c.* Establishing reactor decay heat removal to prevent fuel damage and to achieve and maintain cold shutdown conditions d. Providing support functions such as process cooling and lubrication necessary to allow operation of the FSSD components e. Providing direct readings of the process variables necessary to perform and control the FSSD functions	Conform	
7.3.1.9	During a post fire shutdown, the fission product boundary integrity shall be maintained within acceptable limits (e.g., fuel clad damage, rupture of any primary coolant boundary, or rupture of the primary containment boundary).	Conform	
7.3.1.10.1	An evaluation of spurious signals shall be performed based on the following: a. All components shall be assumed to be in their normal operating positions for the particular mode of operation being considered by the spurious signal evaluation. b. The evaluation shall consider the following cable failure modes: 1) A hot short in which individual conductors within a cable are shorted to individual conductors of a different cable such that a de-energized circuit might become energized by shorting to an external source of electrical power 2) An open circuit in which the cable failure results in the loss of electrical continuity 3) A short to ground in which a cable conductor shorts to grounded structures 4) A short circuit in which individual conductors within multiconductor cable short to each other	Conform	

Table 9.5.1-2 (22 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
7.3.1.10.2	Functional failure or damage modes of equipment and components that can spuriously operate shall be considered.	Conform	
7.3.1.11	The postulates specified in 7.3.1.11.1 through 7.3.1.11.5 shall be used in the analysis of fire-induced spurious actuation of equipment.	Conform	
7.3.1.11.1	FSSD capability shall not be adversely affected by simultaneous spurious actuation of all valves in a single high-to-low pressure interface line where the power or control circuits for the valves can be damaged by a postulated fire.	Conform	
7.3.1.11.2	For other than high-to-low pressure boundaries, FSSD capability shall not be adversely affected by spurious actuation or signal.	Conform	
7.3.1.11.3	Separate conditions shall be analyzed concurrent with the spurious actuation (s) or signal addressed in 7.3.1.11.1 and 7.3.1.11.2.	Conform	
7.3.1.11.4	All automatic functions (signal, logic, etc.) from the circuits that can be damaged by the postulated fire shall be assumed lost or assumed to function as intended, whichever is the worst case.	Conform	
7.3.1.11.5	All potential spurious signals shall be analyzed, but only one spurious signal shall be postulated to occur at a time for purposes of analysis, except for high-to-low pressure interface valves.	Conform	
7.3.1.12	For the purpose of analysis for cases involving high-to-low pressure interface, hot shorts involving three-phase ac circuits shall be postulated.	Conform	
7.3.1.13	For ungrounded dc circuits, if it can be shown that only two hot shorts of the proper polarity without grounding could cause spurious operation, no further evaluation shall be necessary, except for cases involving high-to-low pressure interfaces.	Conform	
7.3.1.14	All common power supply associated circuits of concern shall be isolated from FSSD circuits by coordinated circuit breakers or fuses.	Conform	

Table 9.5.1-2 (23 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
7.3.1.15.1	Protection for circuits associated by common enclosure shall meet the following criteria: a. Protection shall be demonstrated by ensuring that suitable electrical overcurrent protection devices are provided for all cables. b. Appropriate measures to prevent the propagation of fire, such as rated fire stops and seals in the raceway or enclosure, shall be provided.	Conform	
7.3.1.15.2	The overcurrent protection devices specified in 7.3.1.15.1 a. shall be located outside the fire area containing the common enclosure.	Conform	
7.3.1.16.1	A high-impedance fault shall be assumed to occur as a result of a fire.	Conform	
7.3.1.16.2	Evaluation of the impact of high-impedance faults on the ability to achieve and maintain safe shutdown shall be performed to demonstrate that sufficient capacity exists in the electrical protective system to preclude a trip of the main source breaker to the supply.	Conform	
7.3.2 Seismic/Fire Interaction	A risk assessment that demonstrates the potential risk from a seismically induced fire in relationship to the plant's core damage frequency shall be prepared and used as follows: a. The assessment shall be used to evaluate the level of safety of the plant. b. The assessment shall not be used to reduce the overall plant fire protection design basis. An industry-accepted examination process shall be used for the risk assessment.	COL	

Table 9.5.1-2 (24 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
7.4 Separation Criteria 7.4.1	One safety division of systems that is necessary to achieve and maintain safe shutdown from either the control room or emergency control station(s) shall be maintained free of fire damage by a single fire, including an exposure fire.	Conform/COL	SSA for the APR1400 is prepared in consideration of the guidance of 7.4.1 through 7.4.6.
7.4.2	One safety division of systems that is necessary to prevent the initiation of a design basis accident shall be maintained free of fire damage from a single fire that occurs outside the MCR.	Conform/COL	
7.4.3	Redundant cables, equipment, components, and associated circuits of nuclear safety–related or safe shutdown systems shall be located in separate fire areas, unless otherwise permitted by 7.4.3.1.	Conform	
7.4.3.1	Where redundant system separation inside containment cannot be achieved, other measures shall be permitted in accordance with Chapter 7, Section 7.6 to prevent a fire from causing the loss of function of nuclear safety–related or safe shutdown systems.	Conform	
7.4.3.2	The fire barrier forming the separate fire areas specified in Chapter 7, Subsection 7.4.3 shall have a 3-hour fire rating and automatic area-wide detection shall be installed throughout the fire areas, unless all the following criteria are met: a. The fire barriers forming the fire areas shall have a minimum fire-resistive rating of 1 hour. b. Automatic area-wide detection and suppression shall be installed throughout the fire areas. c. Structural steel forming a part of or supporting the fire barriers shall be protected to provide fire resistance equivalent to that of the barrier.	Conform	

Table 9.5.1-2 (25 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
7.4.3.3	Structural steel forming a part of or supporting the fire barriers shall be protected to provide fire resistance equivalent to that of the 3-hour fire-rated barrier specified in Chapter 7, Subsection 7.4.3.2.	Conform	
7.4.4	Fire areas separated by minimum 3-hour fire-rated barriers shall be established to separate redundant safety divisions and safe shutdown functions from fire hazards in non-safety or safe shutdown–related areas of the plant.	Conform	
7.4.5	In fire areas containing components of either a nuclear safety–related or safe shutdown system, special attention shall be given to detecting and suppressing fire that can adversely affect the system.	Conform	
7.4.6	Measures that shall be taken to reduce the effects of a postulated fire in a given fire area include the following: a. Limiting the amount of combustible materials (see Chapter 5, Section 5.3) b. Providing fire-rated barriers between major components and equipment to limit fire spread within a fire area (see Chapter 8, Section 8.1) c. Installing fire detection (see Chapter 9, Section 9.8) and fixed suppression systems (see Chapter 9, Section 9.6)	Conform	
7.5 Manual Actions	Procedures shall be developed for actions necessary to achieve FSSD. Operator actions necessary to achieve FSSD of the reactor shall meet criteria acceptable to the AHJ. No credit shall be taken for operator actions required to effect repairs to equipment to achieve FSSD of the reactor. Personnel necessary to achieve and maintain the plant in FSSD following a fire shall be provided from the normal on-site staff, exclusive of the fire brigade.	COL	COL Item 9.5(1) No operator manual actions in the fire-affected area are required to achieve safe shutdown. Refer to Appendix C, NRC RG position 8.1.

Table 9.5.1-2 (26 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
7.5 Manual Actions	The operator training program shall include performance-based simulator training on FSSD procedures. Walk-through of operator actions necessary to achieve FSSD of the reactor shall be performed to verify that the actions are feasible and shall be integrated into the operator training program. Post fire shutdown and recovery plans shall be included in the station emergency preparedness plan. Drills and operator requalification training shall ensure that operations personnel are familiar with and can accomplish the necessary actions.	COL	COL Item 9.5(1) No operator manual actions in the fire-affected area are required to achieve safe shutdown. Refer to Appendix C, NRC RG position 8.1.
7.5.3.1 Operator Access	Access routes to areas containing equipment necessary for safe shutdown of the reactor shall be protected from the effects of smoke and fire. Two separate access routes shall be provided from the MCR to the remote shutdown location. Emergency lighting shall be provided for the access routes and the remote shutdown location (see Chapter 8, Section 8.6).	Conform	
7.5.3.2 Equipment Operation	Operator safety shall not be threatened by fire conditions while FSSD of the reactor is being implemented. Operation of equipment required to effect FSSD of the reactor shall not require any extraordinary actions by the operator. Operators (e.g., handwheels of valves that require manual manipulation for FSSD) shall be readily accessible. If the handwheel is located more than 5 ft above the floor, it shall be provided with either a chain operator or a permanent platform. The platform shall be of sufficient size to allow the operator to safely perform the manual action.	N/A	

Table 9.5.1-2 (27 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
7.6.1	Alternative shutdown capability provided for a specific fire area shall include the following: a. Achieving and maintaining subcritical reactivity conditions in the reactor b. Maintaining the reactor coolant inventory c. Achieving safe shutdown d. Maintaining safe shutdown following the fire event	Conform	The only alternative shutdown capability of the APR1400 is RSR.
7.6.2	During the post fire shutdown, the reactor coolant system process variables shall be maintained within those values predicted for a loss of normal ac power, and the fission product boundary integrity shall not be affected.	Conform	
7.6.3	Performance goals for reactor shutdown functions shall be the same as those required by 7.3.1.8.	Conform/COL	
7.6.4	The safe shutdown circuits for each fire area shall meet the following criteria: a. They shall be known to be isolated from associated circuits in the fire area so the hot shorts, shorts to ground, open circuits, or short circuits will not prevent the operation of the safe shutdown equipment. b. Isolation of associated circuits from the safe shutdown equipment shall be such that a postulated fire involving the associated circuits will not prevent safe shutdown or damage the safe shutdown components.	Conform/COL	The COLA is to update the final SSA including PSSA circuits analysis. COL Item 9.5(4)

Table 9.5.1-2 (28 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8. General Plant Design 8.1 Plant Arrangement. 8.1.1 Building Separation	In multiunit plants, each unit shall be separated from adjacent units by either an open space of at least 50 f or at least a 3-hour-rated fire barrier Buildings or portions thereof containing nuclear safety-related systems shall be separated from buildings or portions thereof not related to nuclear safety by barriers having a designated fire resistance rating of 3 hours. Buildings containing nuclear safety-related systems shall be permitted to be separated from buildings not related to nuclear safety by an open space of at least 50 ft.	Conform	See 8.1.1.2; the APR1400 uses 3-hour separation for power block buildings.
8.1.2 Fire Areas	Advanced light water reactor electric generating plants shall be subdivided into separate fire areas to minimize the risk of fire spread and the resultant consequential damage from fire gases, smoke, heat, radioactive contamination, and fire-fighting activities. In addition to 8.1.2.1, the subdivision into fire areas shall allow adequate access for manual fire suppression activities.	Conform	Refer to Appendix 9.5A for the APR1400 fire area descriptions.

Table 9.5.1-2 (29 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.1.2 Fire Areas	A listed fire barrier having a fire resistance rating of at least 3 hours and with listed 3-hour-rated penetration seals shall be provided as follows: a. To separate all contiguous buildings or portions thereof serving different purposes, such as reactor containment, auxiliary, turbine, radwaste, control, service, administration, and other occupancy areas as dictated by reactor design b. To separate safety-related standby emergency diesel generators and combustion turbines from each other and the rest of the plant c. To separate the turbine generator lube oil conditioning system and lube oil storage from the TB and adjacent areas d. To separate diesel fire pumps and associated equipment from other pumps in the same pump house e. To separate all areas with heavy concentrations of cables, such as cable spreading rooms, cable tunnels, cable penetration areas, and cable shafts or chases, including those within the reactor containment, from adjacent areas f. To separate auxiliary boiler rooms from adjacent areas g. Wherever so determined by the fire hazards analysis To prevent vertical spread of fire, stairways, elevator shafts, trash chutes, and other vertical shafts and plenums shall be enclosed with barriers having a fire resistance rating of at least 2 hours. Openings in the barriers specified in 8.1.2.4 shall be protected with listed automatic or self-closing fire doors having a fire protection rating of at least 1½ hours.	Conform	Refer to Appendix 9.5A for the APR1400 fire area descriptions.

Table 9.5.1-2 (30 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.1.3 Openings in Fire Barriers	All openings in fire barriers shall be provided with fire door assemblies, fire dampers, penetration seals (fire stops), or other approved means having a fire protection rating consistent with the designated fire resistance rating of the barrier, unless the criterion of 8.1.3.2 is met. Assemblies used to meet the requirements of 8.1.3.1 that are not listed or approved due to nuclear safety or security requirements shall be demonstrated to be equivalent. Fire door assemblies, fire dampers, and fire shutters used in 2-hour-rated fire barriers shall be listed as not less than 1½ hour rated and shall meet the requirements of NFPA 80, Standard for Fire Doors and Fire Windows, for fire door requirements and NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, for fire damper requirements, unless otherwise permitted by 8.1.3.4. Where approved full-scale fire tests indicate that opening protection is not necessary, the opening protection specified in 8.1.3.3 shall not be required. Windows in fire barriers, such as for a control room or computer room, shall be provided with a listed or approved fire shutter or automatic wall curtain. Cable openings, piping openings, and building joints shall be provided with fire-rated penetration seals that meet the requirements of ASTM E 814, Fire Tests of Through-Penetration Fire Stops, or UL 1479, Standard for Safety Fire Tests of Through-Penetration Firestops. All conduits shall be sealed at the barrier with a fire-rated seal, if accessible. As an alternative to 8.1.3.4.3, internally sealing with a fire-rated seal at the first break in the conduit on both sides of the barrier shall be acceptable. For the configuration specified in 8.1.3.4.3.1, the fire rating of the internal conduit seal shall be equivalent to the rating of the fire barrier being penetrated.	Conform	No unprotected openings are provided in the fire-rated barriers of the APR1400 design.

Table 9.5.1-2 (31 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.1.3 Openings in Fire Barriers	Where approved full-scale fire tests indicate that internal conduit seals are not necessary, internal conduit seals shall not be required. All fire-rated assemblies shall be tested with a positive pressure in the furnace. Normally closed fire doors in fire barriers shall be identified with a sign indicating "Fire Door - Keep Closed." Design features that provide for monitoring and control of fire doors to ensure fire door operability and fire barrier integrity shall be provided, unless otherwise permitted by 8.1.3.6. Administrative procedures shall be permitted to be used instead of the design features required by 8.1.3.5.	Conform	No unprotected openings are provided in the fire-rated barriers of the APR1400 design.
8.2 Life Safety	NFPA 101, Life Safety Code, shall be the standard for life safety from fire in the design and operation of the Advanced Light Water Reactor, except where modified by this standard.	Conform	
8.2.2	The majority of the areas involved in the transfer of nuclear energy to electrical energy shall be considered as special-purpose industrial occupancies and special-structure windowless buildings, as defined in NFPA 101, Life Safety Code.	Conform	
8.2.3	In determining the exits for an Advanced Light Water Reactor plant, the actual number of personnel and occupancy hazards during maintenance, refueling, and testing shall determine the exit requirements and occupant load based on NFPA 101, Life Safety Code.	Conform	
8.2.4	Cafeterias, lunchrooms, conference rooms, and assembly rooms having an occupant load greater than 50 shall conform to the new assembly occupancy requirements in NFPA 101, Life Safety Code.	COL	These facilities are not part of the APR1400 basic buildings. COL Item 9.5(2)
8.2.5	General office areas, office buildings, and training facilities shall conform to the business occupancy requirements in NFPA 101, Life Safety Code.	COL	These facilities are not part of the APR1400 basic buildings. COL Item 9.5(2)
8.2.6	Warehouses and storage areas shall conform to the storage occupancy requirements in NFPA 101, Life Safety Code.	COL	These facilities are not part of the APR1400 basic buildings. COL Item 9.5(2)

Table 9.5.1-2 (32 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.3 Building and Construction Materials 8.3.1	Construction materials for the Advanced Light Water Reactor plant shall be classified by at least one of the following test methods appropriate to the end-use configuration of the material: a. NFPA 220, Standard on Types of Building Construction b. ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 °C c. NFPA 251, Standard Methods of Tests of Fire Resistance of Building Construction and Materials(ASTM E 119, Standard Test Methods for Fire Tests of Building Construction and Materials) d. NFPA 253, Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source e. NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials (ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials) f. NFPA 256, Standard Methods of Fire Tests of Roof Coverings g. NFPA 259, Standard Test Method for Potential Heat of Building Materials	Conform	
8.3.2	All walls, floors, and structural components, except interior finish materials, shall be of noncombustible construction. Interior wall or ceiling finish classification shall be in accordance with NFPA 101, Life Safety Code, requirements for Class A material. Interior floor finish classification shall be in accordance with NFPA 101, Life Safety Code, requirements for Class I interior floor finish.	Conform	
8.3.3	Thermal insulation materials, radiation shielding materials, ventilation duct materials, soundproofing materials, and suspended ceilings, including light diffusers and their supports, shall be noncombustible or limited combustible.	Conform	

Table 9.5.1-2 (33 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.3.4	Wiring above suspended ceilings shall be listed for plenum use, routed in armored cable, routed in metallic conduits, or routed in cable trays with solid metal top and bottom covers.	Conform	
8.3.5	Roof coverings shall be Class A as determined by tests described in NFPA 256, Standard Methods of Fire Tests of Roof Coverings.	Conform	
8.3.6	Metal roof deck construction shall be Class I as listed by Factory Mutual or fire acceptable as listed by Underwriters Laboratories Inc.	Conform	
8.3.7	Bulk flammable gas storage, either compressed or cryogenic, shall not be permitted inside structures housing safety-related systems. Storage of flammable gas, such as hydrogen, shall be located outdoors or in separate detached buildings, so that a fire or explosion will not adversely affect any safety-related systems or equipment. Outdoor high-pressure flammable gas storage containers shall be located so that the long axis is not pointing at the building walls.	Conform	
8.3.8	The following requirements shall apply to bulk storage of flammable and combustible liquids: a. Storage shall not be permitted inside structures housing safety-related systems. b. As a minimum, the storage and use shall comply with the requirements of NFPA 30, Flammable and Combustible Liquids Code.	Conform	

Table 9.5.1-2 (34 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.4 Ventilation	The design, installation, and operation of ventilation systems necessary for normal and emergency operation of the plant shall be in accordance with NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.	Conform	
8.4.2	Automatic damper closure or shutdown of ventilation systems shall be consistent with nuclear safety and the safety of on-site personnel.	Conform	
8.4.3	Smoke removal shall be provided for nuclear safety–related areas of the plant, and the following criteria also shall apply: a. Equipment shall be suitable for removing smoke without damage to equipment. b. The release to the environment of smoke containing radioactive materials shall be monitored in accordance with emergency plans. c. For those plants provided with complete automatic sprinkler protection, fixed ventilation systems for the removal of smoke shall not be required. Smoke and heat removal systems shall be provided for other fire areas based on the fire hazards analysis, unless otherwise permitted by 8.4.3.2. For those plants provided with complete automatic sprinkler protection, fixed ventilation systems for the removal of smoke shall not be required. Smoke from nonnuclear areas shall be discharged directly outside to an area that will not adversely affect nuclear safety–related areas. Any ventilation system designed to exhaust potentially radioactive smoke or heat shall be evaluated to ensure that inadvertent operation or single failures will not violate the radiologically controlled areas of the plant.	Conform	

Table 9.5.1-2 (35 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.4.4	To facilitate manual firefighting, smoke control shall be provided in high-density cable-use areas, switchgear rooms, diesel fuel oil storage areas, T/Bs, and other areas where potential exists for heavy smoke and heat conditions as determined by the fire hazards analysis.	Conform/COL	
8.4.5	The power supply and controls for mechanical ventilation systems used for smoke removal shall be routed outside the fire area served by the system or protected from fire damage.	Conform	
8.4.6	The fresh air supply intakes to plant areas shall be located remote from the exhaust air outlets and smoke vents of other fire areas.	Conform	
8.4.7	Where natural-convection ventilation is used, a minimum ratio of vent area to floor area shall be at least 1 to 200, except in oil hazard areas, where at least a 1-to-100 ratio shall be provided.	Conform	
8.4.8.1	Combustible ducts, including fire-retardant types, shall not be used for ventilation systems.	Conform	
8.4.8.2	Fire dampers shall be installed in accordance with NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems. Consideration shall be given to the velocity in the duct.	Conform	
8.4.8.3	Listed fire dampers having a rating of 1½ hours shall be installed where ventilation ducts penetrate fire barriers having a required fire resistance rating of 2 hours.	Conform	
8.4.8.4	Approved fire dampers having a fire protection rating of 3 hours shall be installed where ventilation ducts penetrate required 3-hour fire barriers.	Conform	

Table 9.5.1-2 (36 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.4.8.5	Fire dampers shall be equipped for automatic closure by thermal release elements, and one of the following criteria shall be met: a. The fire damper shall be mounted directly into the separating wall. b. The duct shall be protected between the wall and the damper according to the fire resistance of the separating wall structure.	Conform	
8.4.8.6	Fire dampers shall be designed and installed so that the air velocity in the ducts assists in closing fire dampers and does not preclude proper damper closure.	Conform	
8.4.8.7	Ventilation ducts containing fire dampers shall be provided with access ports for ease of inspection and for replacement of the thermal element.	Conform	
8.4.9 Filter	Air entry filters shall have approved noncombustible filter media that produce a minimum amount of smoke (UL Class 1) when subjected to heat. To decrease the fire hazard of air entry and oil-bath-type filters, only approved fire-resistive adhesives and oils meeting all of the following criteria shall be used: a. They shall be in accordance with ASTM D 92, Standard Test Method for Flash and Fire Points by Cleveland Open Cup. b. Their flash points shall be equal to or greater than 240 °C (464 °F). c. They shall not produce appreciable smoke. High-efficiency particulate air (HEPA) filters shall meet the requirements of UL 586, Standard for Test Performance of High-Efficiency Particulate Air Filter Units. Fixed water spray systems shall be provided for charcoal adsorber beds containing more than 45.4 kg (100 lb) of charcoal. Fire suppression systems shall be installed to protect filters that collect combustible material.	COL	

Table 9.5.1-2 (37 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.5 Drainage 8.5.1	Drainage shall be provided in all areas of the plant for the removal of all liquids directly to safe areas or for containment in the area without adverse flooding of equipment and without endangering other areas.	Conform	
8.5.2	Drainage and the prevention of equipment water damage shall be accomplished by one or more of the following: a. Floor drains b. Floor trenches c. Open doorways or other wall openings d. Curbs for containing or directing drainage e. Equipment pedestals f. Pits, sumps, and sump pumps	Conform	
8.5.3	Drainage and any associated drainage facilities for a given area shall be sized to accommodate the volume of liquid produced by all of the following: a. The spill of the largest single container of any flammable or combustible liquids in the area b. Where automatic suppression is provided throughout, the credible volume of discharge (as determined by the fire hazards analysis) for the suppression system operating for a period of 30 minutes c. Where automatic suppression is not provided throughout, the contents of piping systems and containers that are subject to failure in a fire d. Where the installation is outside, the volume of credible environmental factors such as rain and snow e. Where automatic suppression is not provided throughout, the volume based on a manual fire-fighting flow rate of 1,892.5 L/min (500 gal/min) for a duration of 30 minutes, unless the fire hazards analysis demonstrates a different flow rate and duration	Conform	

Table 9.5.1-2 (38 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.5.4	Floor drainage from areas containing flammable or combustible liquids shall be trapped to prevent the spread of burning liquids beyond the fire area.	Conform	
8.5.5	Where gaseous fire suppression systems are installed, floor drains shall be provided with adequate seals, or the fire suppression system shall be sized to compensate for the loss of fire suppression agent through the drains.	Conform	
8.5.6	Drainage facilities shall be provided for outdoor oil-insulated transformers, or the ground shall be sloped such that oil spills flow away from buildings, structures, and adjacent transformers. Unless drainage from oil spills is accommodated by sloping the ground around transformers away from structures or adjacent equipment, consideration shall be given to providing curbed areas or pits around transformers. If a layer of uniformly graded stone is provided in the bottom of the curbed area or pit as a means of minimizing ground fires, the following shall be assessed: a. The sizing of the pit shall allow for the volume of the stone. b. The design shall address the possible accumulation of sediment or fines in the stone.	COL	COL Item 9.5(2)
8.5.7	For facilities consisting of more than one generating unit, a curb or trench drain shall be provided on solid floors where the potential exists for an oil spill, such that oil released from the incident on one unit will not expose an adjacent unit.	COL	COL Item 9.5(2)
8.5.8	Water drainage from areas that might contain radioactivity shall be collected, sampled, and analyzed before discharge to the environment.	Conform/COL	

Table 9.5.1-2 (39 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.5.9	Water released during fire suppression operations in areas containing radioactivity shall be drained to a location that is acceptable for the containment of radioactive materials.	Conform/COL	
8.6 Emergency Lighting 8.6.1	Emergency lighting units shall provide lighting levels as required in 8.6.2.	Conform	
8.6.2	The lighting units shall be sized to provide a duration of operation that will illuminate the egress and access routes to areas containing safe shutdown equipment and the equipment operation until all required operator actions are completed or until normal or emergency plant lighting can be reestablished.	Conform	
8.6.3	The illumination of means of egress shall be in accordance with NFPA 101, Life Safety Code, and shall include emergency lighting and marking of the means of egress.	Conform	
8.6.4	The floor of the means of egress and the safe shutdown operations shall be illuminated to values of not less than 1 foot candle measured at the floor and at safe shutdown equipment at all points, including the following: a. Angles b. Intersections of corridors c. Passageways d. Stairways e. Landings of stairways f. Exit doors g. Safe shutdown equipment h. Access and egress routes to safe shutdown equipment	Conform	

Table 9.5.1-2 (40 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.6.5	The required illumination shall be so arranged that the failure of any single lighting unit, such as the burning out of a single light bulb, will not leave any area in darkness.	Conform	
8.6.6	Suitable battery-powered hand lights shall be provided for emergency use by the fire brigade and other operations personnel required to achieve safe plant shutdown.	COL	COL Item 9.5(1)
8.7 Lightning Protection	The plant shall be provided with a lightning protection system in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems.	Conform	
8.8 Electrical Cabling 8.8.1	As a minimum, combustible cable insulation and jacketing material shall meet the fire and flame test requirements of IEEE 1202, Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies..	Conform	
8.8.2	Meeting the requirements of IEEE 383, Standard for Type Test of Class IE Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations, shall not eliminate the need for protection as specified in this standard and the fire hazards analysis.	N/A	
8.8.3	Fiber optic cable insulation and jacketing material shall meet the fire and flame test requirements of IEEE 383, Standard for Type Test of Class IE Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations.	N/A	
8.8.4	Group cabling shall be routed away from exposure hazards or protected as specified in this standard. Group cabling shall not be routed near sources of ignition. Group cabling shall not be routed near flammable and combustible liquid hazards.	Conform	

Table 9.5.1-2 (41 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.8.5	Cable raceways shall be used only for cables.	Conform	
8.8.6	Only metal shall be used for cable trays.	Conform	
8.8.7	Only metallic tubing shall be used for conduit, unless otherwise permitted by 8.8.7.1.	Conform	
8.8.7.1	Nonmetallic conduit shall be permitted to be used with concrete encasement or for direct burial runs.	Conform	
8.8.7.2	Thin-wall metallic tubing shall not be used.	Conform	
8.8.7.3	Flexible metallic tubing shall be used only in lengths less than 5 ft to connect components to equipment.	Conform	
8.8.7.4	Other raceways shall be made of noncombustible materials.	Conform	
8.9 Exposure Protection	Buildings shall be protected from exposure fires by any one of the following: a. Listed 3-hour fire barrier with automatic or self-closing fire doors having a fire protection rating of 3 hours and listed penetration protection of a 3-hour rating b. Spatial separation of at least 50 ft. c. Exterior exposure protection	Conform	
8.10 Electrical Systems for the Plant	The electrical design and installation of electrical generating, control, transmission, distribution, and metering of electrical energy shall be provided in accordance with NFPA 70, National Electrical Code, or ANSI/IEEE C2, National Electrical Safety Code, as applicable.	Conform	

Table 9.5.1-2 (42 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
8.11 Communications	The plant-approved voice/alarm communications system in accordance with NFPA 72, National Fire Alarm Code, shall be available on a priority basis for fire announcements, directing the plant fire brigade, and fire evacuation announcements. A portable radio communications system shall be provided for use by the fire brigade and other operations personnel required to achieve safe shutdown. The radio communications system shall not interfere with the communications capabilities of the plant security force. The impact of fire damage on the communications systems shall be considered when fixed repeaters are installed to permit the use of portable radios. Repeaters shall be located such that a fire-induced failure of the repeater will not also cause failure of the other communications systems relied on for safe shutdown. Plant control equipment shall be designed so that the control equipment is not susceptible to radio frequency interferences from portable radios. Preoperational tests and periodic testing shall demonstrate that the frequencies used for portable radio communications will not affect actuation of protective relays or other electrical components.	COL	COL Item 9.5(1)

Table 9.5.1-2 (43 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9 General Fire Protection Systems and Equipment 9.1 General	A fire hazards analysis shall be conducted to determine the fire protection requirements for the facility. All fire protection systems, equipment, and installations shall be dedicated to fire protection purposes unless permitted by the following: a. The requirement of 9.1.2 shall not apply to fire protection systems, equipment, and installations where in accordance with 9.4.10. b. Fire protection systems shall be permitted to be used to provide redundant backup to nuclear safety-related systems provided that both the following criteria are met: 1) The fire protection systems shall meet the design basis requirements of the nuclear safety–related systems. 2) Fire protection systems used in 9.1.2 a) shall be designed to handle both functions. All fire protection equipment shall be listed or approved for its intended service.	Conform	Refer to Appendix 9.5A.

Table 9.5.1-2 (44 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.2 Water Supply 9.2.1	The fire water supply shall be calculated on the basis of the largest expected flow rate for a period of 2 hours but shall not be less than 300,000 gal (1,135,500 L), and the following criteria also shall apply: a. The flow rate shall be based on 1892.5 L/min (500 gpm) for manual hose streams plus the largest design demand of any sprinkler or fixed water spray system as determined in accordance with this standard, with NFPA 13, Standard for the Installation of Sprinkler Systems, or with NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection. b. The fire water supply shall be capable of delivering the design demand specified in 9.2.1 1) with the hydraulically least demanding portion of the fire main loop out of service.	Conform	Refer to NRC RG 1.189, Position 3.2 guidance.
9.2.2	Two 100-percent [minimum of 1,135,500 L (300,000 gal) each] system capacity tanks shall be installed, and the following shall apply: a. The tanks shall be interconnected such that fire pumps can take suction from either or both. b. A failure in one tank or its piping shall not cause both tanks to drain. c. The tanks shall be designed in accordance with NFPA 22, Standard for Water Tanks for Private Fire Protection. d. Refill times for filling the water tanks shall not apply.	Conform	Refer to NRC RG 1.189, Position 3.2 guidance. Refill time is maximum 8 hours per NRC RG 1.189, Position 3.2.
9.2.3	The tanks shall not be supplied by an untreated, raw water source	Conform	Refer to NRC RG 1.189, Position 3.2 guidance. COL Item 9.5(2)

Table 9.5.1-2 (45 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.2.4. Fire Pumps 9.2.4.1	Fire pumps shall meet the requirements of NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, and shall be automatic starting.	Conform	Refer to NRC RG 1.189, Position 3.2 guidance.
9.2.4.2	Fire pumps shall be provided to ensure that 100 % of the flow rate capacity will be available assuming failure of the largest pump.	Conform	Refer to NRC RG 1.189, Position 3.2 guidance.
9.2.4.3	Individual fire pump connections to the yard fire main loop shall be separated with sectionalizing valves between connections, and the following criteria also shall be met: a. Each pump and its driver and controls shall be located in a room separated from the remaining fire pumps by a fire wall with a minimum rating of 3 hours. b. The fuel for the diesel fire pump(s) shall be separated so that it does not provide a fire source exposing nuclear safety-related equipment.	Conform	Refer to NRC RG 1.189, Position 3.2 guidance.
9.2.4.4	A method of automatic pressure maintenance of the fire protection system shall be provided independent of the fire pumps.	COL	The COLA provides a fire water supply system meeting NRC RG 1.189, Rev. 2, Position 3.2 guidance. COL Item 9.5(2)
9.2.4.5	Supervisory signals and visible indicators required by NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, shall be received in the control room.	COL	The COLA provides a fire water supply system meeting NRC RG 1.189, Rev. 2, Position 3.2 guidance. COL Item 9.5(2)

Table 9.5.1-2 (46 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.3 Valve Supervision	All fire protection water supply and system control valves shall be under a periodic inspection program and shall be supervised by one of the following methods: a. Electrical supervision with audible and visual signals in the MCR or another constantly attended location and monthly valve inspections b. Locking valves in their normal position and monthly valve inspections with keys made available only to authorized personnel c. Sealing valves in their normal positions and weekly valve inspections with this option utilized only where valves are located within fenced areas or under the direct control of the property owner	Conform /COL	COL Item 9.5(1)
9.4 Yard Mains, Hydrants, and Building Standpipes 9.4.1	The underground yard fire main loop shall be installed to furnish anticipated water requirements, and the following criteria also shall be met: a. The type of pipe and water treatment shall be design considerations, with tuberculation as one of the parameters. b. Means for inspecting and flushing the systems shall be provided.	Conform	
9.4.2	Approved visually indicating sectional control valves such as post indicator valves shall be provided to isolate portions of the main for maintenance or repair without simultaneously shutting off the supply to both primary and backup fire suppression systems.	Conform	
9.4.3	Valves shall be installed to allow isolation of outside hydrants from the fire main for maintenance or repair without interrupting the water supply to automatic or manual fire suppression systems.	Conform	

Table 9.5.1-2 (47 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.4.4	Sectional control valves shall allow maintaining independence of the individual loop around each unit, and the following also shall apply: a. For such installations, common water supplies shall also be permitted to be utilized. b. For multiple-reactor sites with widely separated plants [approaching 1.6 km (1 mi) or more], separate yard fire main loops shall be used.	N/A	
9.4.5	Outside manual hose installation shall provide an effective hose stream to any on-site location, and the following also shall apply: a. Hydrants with individual hose gate valves shall be installed approximately every 250 ft apart on the yard main system. b. A hose house equipped with hose and combination nozzle and other auxiliary equipment specified in NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances shall be provided at intervals of not more than 1,000 ft along the yard main system. c. Mobile means of providing hose and associated equipment, such as hose carts or trucks, shall be permitted in lieu of hose houses, and where provided, such mobile equipment shall be equivalent to that supplied by three hose houses.	Conform/COL	
9.4.6	One of the following criteria shall be met: a. Threads compatible with those used by local fire departments shall be provided on all hydrants, hose couplings, and standpipe risers. b. The fire departments shall be provided with adapters that allow interconnection between plant equipment and the fire department equipment.	COL	The COLA provides a fire water supply system meeting NRC RG 1.189, Rev. 2, Position 3.2 guidance. COL Item 9.5(2)

Table 9.5.1-2 (48 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.4.7	Sprinkler systems and manual hose station standpipes shall have connections to the plant underground water main so that a single active failure or a crack in a moderate-energy line can be isolated so as not to impair both the primary and the backup fire suppression systems unless otherwise permitted by the following: a. Alternatively, headers fed from each end shall be permitted inside buildings to supply both sprinkler and standpipe systems, provided 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 where such headers are part of the seismically analyzed hose standpipe system. b. Where provided, such headers shall be considered an extension of the yard main system. c. Each sprinkler and standpipe system shall be equipped with an outside screw and yoke (OS and Y) gate valve or other approved shutoff valve.	Conform	
9.4.8	For all power block buildings, Class 3 standpipe and hose systems shall be installed in accordance with NFPA 14, Standard for the Installation of Standpipe and Hose Systems.	Conform	
9.4.9	For all other buildings on site, the requirements for standpipe and hose systems shall be appropriate for the hazard being protected.	Conform/COL	COL Item 9.5(2)

Table 9.5.1-2 (49 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.4.10	The proper type of hose nozzle to be supplied to each area shall be based on the fire hazards analysis, and the following criteria also shall apply: a. The usual combination spray/straight-stream nozzle shall not be used in areas where the straight stream can cause unacceptable damage. b. Approved, electrically safe fixed fog nozzles shall be provided at locations where high-voltage shock hazards exist. c. All hose nozzles shall have shutoff capability.	COL	COL Item 9.5(2)
9.4.11 Seismic Fire Suppression Capabilities 9.4.11.1	Provisions shall be made to supply water at least to standpipes and hose stations for manual fire suppression in all areas containing nuclear safety–related systems and components for safe shutdown in the event of a SSE.	Conform	
9.4.11.2	The piping system serving these hose stations shall be analyzed for safe shutdown and earthquake loading and shall be provided with supports that ensure pressure boundary integrity.	Conform	
9.4.11.3	The piping and valves for the portion of hose standpipe system affected by the functional requirement of 9.4.11.2 shall, as a minimum, satisfy the requirements of ASME B31.1, Power Piping.	Conform	
9.4.11.4	The system shall be designed to flow a minimum of one Class III standpipe station in accordance with NFPA 14, Standard for the Installation of Standpipe and Hose Systems.	Conform	
9.4.11.5	Where the seismic required hose stations are cross-connected to essential seismic Category I water systems, the fire flow shall not degrade the essential water system requirements.	Conform	Independent seismic Category I water tank shall be supplied.

Table 9.5.1-2 (50 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.5 Portable Fire Extinguishers	Portable and wheeled fire extinguishers shall be installed, inspected, maintained, and tested in accordance with NFPA 10, Standard for Portable Fire Extinguishers, unless otherwise permitted by 9.5.2. Where placement of extinguishers would result in required activities that are contrary to personnel radiological exposure concerns or nuclear safety–related concerns, fire extinguishers shall be permitted to be inspected at intervals greater than those specified in NFPA 10, Standard for Portable Fire Extinguishers, or consideration shall be given to locating the extinguishers outside high-radiation areas.	Conform /COL	COL Item 9.5(1) COL Item 9.5(3)
9.6 Fire Suppression Systems. 9.6.1	Automatic suppression systems shall be provided in all areas of the plant as required by the fire hazards analysis.	Conform	Refer to Appendix 9.5A.
9.6.2	Except as modified in this chapter, the following NFPA standards shall be used: a. NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam b. NFPA 12, Standard on Carbon Dioxide Extinguishing Systems c. NFPA 13, Standard for the Installation of Sprinkler Systems d. NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection e. NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems f. NFPA 17, Standard for Dry Chemical Extinguishing Systems g. NFPA 214, Standard on Water-Cooling Towers h. NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems	Conform/ COL	The COLA is to use this guidance. COL Item 9.5(2)

Table 9.5.1-2 (51 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.6.3	The extinguishing systems chosen shall be based on the design parameters required as a result of the fire hazards analysis.	Conform	Refer to Appendix 9.5A; conform except where NRC RG 1.189 recommends protection not dictated by FHA.
9.6.4	Selection of extinguishing agent shall be based on all of the following: a. Type or class of hazard b. Effect of agent discharge on critical equipment such as thermal shock, continued operability, water damage, over pressurization, or cleanup c. Health hazards	Conform	
9.6.5	Each fire suppression system shall be equipped with approved alarming devices and annunciate in a constantly attended area.	Conform	
9.7 Fire Alarm Systems 9.7.1	Fire signaling systems shall be provided in all areas of the plant as required by the fire hazards analysis.	Conform	
9.7.2	The requirements of this chapter shall constitute the minimum acceptable protective signaling system functions when used in conjunction with NFPA 72, National Fire Alarm Code.	Conform	
9.7.3	The signaling system's initiating device and signaling line circuits shall provide emergency operation for fire detection, fire alarm, and water flow alarm during a single break or a single ground fault.	Conform	
9.7.4	The fire signaling equipment used for fixed fire suppression systems shall give audible and visual alarm and system trouble annunciation in the plant control room for the power block buildings, and the following shall apply: a. Local alarms shall be provided. b. Other fire alarm signals from other buildings shall be permitted to annunciate at the control room or other locations that are constantly attended.	Conform	

Table 9.5.1-2 (52 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.7.5	Audible signaling appliances shall meet the following criteria: a. They shall produce a distinctive sound, used for no other purpose. b. They shall be located and installed so that the alarm can be heard above ambient noise levels.	Conform	
9.7.6	Plant control room or plant security personnel shall be trained in the operation of all fire signaling systems used in the plant, including the ability to identify any alarm zone or fire protection system that is operating.	COL	COL Item 9.5(1)
9.7.7	Fire signaling equipment and actuation equipment for the release of fixed fire suppression systems shall be connected to power supply sources in accordance with the requirements of NFPA 72, National Fire Alarm Code, and shall be routed outside the area to be protected.	Conform	
9.7.8	Manual fire alarm boxes shall be installed as required by the fire hazards analysis, and the following criteria also shall be met: a. Where manual release devices are installed for the purpose of releasing an extinguishing agent in a fixed fire suppression system, the manual releases shall be marked for that purpose. b. The manual release device circuits shall be routed outside the area protected by the fixed extinguishing system.	Conform	
9.7.9	All signals shall be permanently recorded in accordance with NFPA 72, National Fire Alarm Code.	Conform	

Table 9.5.1-2 (53 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
9.8 Fire Detectors	Automatic fire detectors shall be selected and installed in accordance with all of the following: a. NFPA 72, National Fire Alarm Code b. Design parameters required as a result of the fire hazards analysis of the plant area c. Additional requirements of this standard	Conform	
10 Identification of and Protection Against Hazards 10.1 General	The identification and selection of fire protection systems shall be based on the fire hazards analysis. This chapter identifies fire and explosion hazards in advanced light water reactor plants and specifies the protection criteria that shall be used unless the fire hazards analysis indicates otherwise.	Conform and Information	
10.2 Containments 10.2.1 Normal Operation	Fire protection for the primary and secondary containment areas shall be provided for hazards identified by the fire hazards analysis.	Conform	
10.2.1.1	Operation of the fire protection systems shall not compromise the integrity of the containment or other safety-related systems.	Conform	
10.2.1.2	Fire protection systems in the containment areas shall function in conjunction with total containment requirements such as ventilation and control of containment liquid and gaseous release.	Conform	
10.2.1.3	Inside primary containment, fire detection systems shall be provided for each fire hazard identified in the fire hazards analysis.	Conform	
10.2.1.4	The type of detection used and the location of the detectors shall be the most suitable for the particular type of fire hazard identified by the fire hazards analysis.	Conform	

Table 9.5.1-2 (54 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.2.1.5	A general area fire detection capability shall be provided in the primary containment as a backup for the hazard detection described in 10.2.1.4 by the installation of smoke or heat detectors compatible with the radiation environment in accordance with NFPA 72, National Fire Alarm Code.	Conform	
10.2.1.6	Standpipe and hose stations shall be installed inside containment. Standpipe and hose stations inside containment shall be permitted to be connected to a high-quality water supply of the required quantity and pressure other than the fire main loop if plant-specific features prevent extending the fire main supply inside containment.	Conform	
10.2.1.7	For inerted primary containment, standpipe and hose stations shall be permitted to be placed outside the primary containment, with hose no longer than 100 ft, to reach any location inside the primary containment with a 30 ft effective hose stream.	N/A	The APR 1400 containment is not inerted.
10.2.1.8	Reactor coolant pumps with an external lubrication system shall be provided with an oil collection system.	Conform	
10.2.1.9	The oil collection system shall be so designed, engineered, and installed that failure of the oil collection system will not lead to a fire during normal operations or off-normal conditions such as accident conditions or earthquakes.	Conform	

Table 9.5.1-2 (55 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.2.1.10	The oil collection systems shall be capable of collecting oil from all potential pressurized and unpressurized leakage sites in the reactor coolant pump oil systems, and the following criteria also shall apply: a. Leakage shall be collected and drained to a vented closed container that can hold the entire oil system inventory. b. Leakage points to be protected shall include the following, where such features exist on the reactor coolant pumps: 1) Lift pump and piping 2) Overflow lines 3) Oil cooler 4) Oil fill 5) Drain lines and plugs 6) Flanged connections on oil lines 7) Oil reservoirs c. The drain line shall be large enough to accommodate the largest potential oil leak.	Conform	
10.2.2 Refueling and Maintenance	Management procedures and controls necessary to ensure fire protection for fire hazards introduced during maintenance and refueling shall be provided. Backup fire suppression shall be provided so that total reliance is not placed on a single fire suppression system. Self-contained breathing apparatus meeting the following criteria shall be provided near the containment entrance for fire-fighting and damage control personnel: a. The units shall be independent of any breathing apparatus or air supply systems provided for general plant activities. b. The units shall be marked as emergency equipment.	COL	COL Item 9.5(1) COL Item 9.5(3)

Table 9.5.1-2 (56 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.3 Control Room Complex 10.3.1	The control room complex (including kitchen, office spaces, etc.) shall be protected against disabling fire damage and shall be separated from other areas of the plant by floors, walls, ceilings, and roofs having a minimum fire resistance rating of 3 hours.	Conform	
10.3.2	Peripheral rooms in the control room complex shall have an automatic water-based suppression system, where required by the fire hazards analysis, and shall be separated from the control room by noncombustible construction with a minimum fire resistance rating of 1 hour.	Conform	
10.3.3	Ventilation system openings between the control room and the peripheral rooms shall have automatic smoke dampers installed that close on operation of the fire detection and fire suppression systems.	Conform	
10.3.4	Manual fire-fighting capability shall be provided for both of the following: a. Fires originating within a cabinet, console, or connecting cables b. Exposure fires involving combustibles in the general room area	Conform	
10.3.5	Portable Class A and Class C fire extinguishers shall be located in the control room, and a fire hose station shall be installed outside the control room.	COL	
10.3.6	Nozzles that are compatible with the hazards and the equipment in the control room shall be provided for the fire hose stations.	COL	COL Item 9.5(2)
10.3.7	The choice of nozzles shall satisfy fire-fighting requirements and electrical safety requirements and shall minimize physical damage to electrical equipment from hose stream impingement.	COL	COL Item 9.5(2)

Table 9.5.1-2 (57 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.3.8	Smoke detectors shall be provided in the control room complex, the electrical cabinets, and the consoles.	Conform	
10.3.9	If redundant safe shutdown equipment is located in the same control room cabinet or console, the cabinet or console shall be provided with internal separation (noncombustible barriers) to limit the damage to one safety division.	N/A	The APR1400 provides separation of safety trains and remote shutdown console.
10.3.10	Breathing apparatus for the control room operators shall be available.	COL	COL Item 9.5(3)
10.3.11	The outside air intakes for the control room ventilation system shall be provided with smoke detection capability to alarm in the control room and enable manual isolation of the control room ventilation system, thus preventing smoke from entering the control room.	Conform	
10.3.12	Venting of smoke produced by a fire in the control room by means of the normal ventilation system shall be permitted to be acceptable if provision is made for isolation of the recirculation portion of the normal ventilation system.	Conform	
10.3.13	Manually operated venting of the control room shall be available to the operators.	Conform	
10.3.14	All cables that enter the control room shall terminate in the control room, and the following criteria also shall apply: a. No cabling shall be routed through the control room from one area to another. b. Cables in spaces under floor and in above-ceiling spaces shall meet the separation criteria necessary for fire protection.	Conform	

Table 9.5.1-2 (58 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.3.15	Air-handling functions shall be ducted separately from cable runs in such spaces (under floor and above ceiling, such spaces shall not be used as air plenums for ventilation of the control room).	Conform	
10.3.16	Fully enclosed electrical raceways located in such under floor and ceiling spaces, if over 0.09 m^2 (1 ft) in cross-sectional area, shall have automatic fire suppression inside.	Conform	
10.3.17	Area automatic fire suppression shall be provided for underfloor and ceiling spaces if used for cable runs unless all cable is run in 101.6 mm (4 in) or smaller steel conduit or cables are in fully enclosed raceways internally protected by automatic fire suppression.	Conform	
10.4 Cable Concentrations 10.4.1 Cable Spreading Room 10.4.1.1	The cable spreading room shall have an automatic fixed water-based suppression system, and the following criteria also shall be met: a. The location of sprinklers or spray nozzles shall protect cable tray arrangements to ensure water coverage for areas that could present exposure fire hazards to the cable raceways. b. Automatic sprinkler systems shall be designed for a density of 12.2 L/min m^2 (0.30 gpm/ft^2) over the most remote 232.2 m^2 (2,500 ft^2).	Conform	
10.4.1.2	Suppression systems shall be zoned to limit the area of protection to that which the drainage system can handle with any two adjacent systems actuated.	Conform	
10.4.1.3	Deluge and water spray systems shall be hydraulically designed with each zone calculated with the largest adjacent zone flowing.	Conform	

Table 9.5.1-2 (59 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.4.1.4	Cable spreading rooms shall be provided with all of the following: (1) At least two remote and separate entrances for access by the fire brigade personnel (2) Aisle separation between tray stacks at least 0.9 m (3 ft) wide and 24 m (8 ft) high (3) Hose stations and portable fire extinguishers installed outside the room (4)*Area smoke detection	COL	
10.4.2 Cable Tunnels	Cable tunnels shall be provided with smoke detection.	COL	COL Item 9.5(2)
	Cable tunnels shall be provided with automatic fixed suppression systems.		
	Automatic sprinkler systems shall be 2 designed for a density of 0.30 gpm/ft for the most remote 100 linear ft of cable tunnel up 2 to the most remote 2,500 ft.		
	The location of sprinklers or spray nozzles shall protect cable tray arrangements and possible transient combustibles to ensure water coverage for areas that could present exposure fire hazards to the cable raceways.		
	Deluge sprinkler systems or deluge spray systems shall meet the following criteria: (1) They shall be zoned to limit the area of protection to that which the drainage system can handle with any two adjacent systems actuated. (2) They shall be hydraulically designed with each zone calculated with the largest adjacent zone flowing.		
	Cables shall be designed to allow wetting of undamaged cables with water supplied by the fire suppression system without electrical faulting.		

Table 9.5.1-2 (60 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.4.2 Cable Tunnels	Cable tunnels over 50 ft long shall be provided with all of the following: (1) At least two remote and separate entrances for access by the fire brigade personnel (2) An aisle separation between tray stacks at least 3 ft wide and 8 ft high (3) Hose stations and portable fire extinguishers installed outside the tunnel	COL	COL Item 9.5(2)
10.4.3	Cable tray fire breaks shall be installed every 20 ft for vertical cable trays that rise over 30 ft, and the following criteria also shall be met: (1) Access to cable shafts shall be provided every 40 ft with the topmost access within 20 ft of the cable shaft ceiling. (2) Automatic sprinkler protection and smoke detection shall be provided at the ceiling of the vertical shaft.	Conform	
10.5 Plant Computer and Communications Rooms	Computer and communications rooms shall meet the applicable requirements of NFPA 75, Standard for the Protection of Information Technology Equipment.	Conform	

Table 9.5.1-2 (61 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.6 Switchgear Rooms and Relay Rooms 10.6.1 10.6.2	Smoke detection shall be provided and shall alarm in both the control room and locally, and the following criteria also shall apply: (1) Cables entering the safety-related switchgear rooms shall terminate in the switchgear room. (2) The safety-related switchgear rooms shall not be used for other purposes. (3) Fire hose stations and portable fire extinguishers shall be readily available outside the area. Equipment shall be located to facilitate firefighting, and the following criteria also shall be met: (1) Drains shall be provided to prevent water accumulation from damaging safety-related equipment. (2) Remote manually actuated ventilation shall be provided for smoke removal when manual fire suppression is needed.	Conform	Refer to Appendix 9.5A.
10.7 Battery Rooms 10.7.1 10.7.2	Battery rooms shall be provided with ventilation to limit the concentration of hydrogen to 2 % by volume, and loss of ventilation shall alarm in the control room. Safety-related battery rooms shall be protected against fires and explosions, and the following criteria also shall apply: (1) Battery rooms shall be separated from other areas of the plant by fire barriers having a 1-hour minimum rating. (2) Direct current switchgear and inverters shall not be located in the battery rooms. (3) Fire detection shall be provided. (4) Fire hose stations and portable fire extinguishers shall be available outside the room.	Conform	

Table 9.5.1-2 (62 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.8 Turbine Building	The T/B shall be separated from adjacent structures containing safety-related equipment by fire-resistive barriers having a minimum 3-hour rating, and the following criteria also shall apply: (1) The fire barriers shall be designed so that the barrier will remain in place even in the event of complete collapse of the turbine structure. (2) Openings and penetrations shall be minimized in the fire barrier and shall not be located where turbine oil systems or generator hydrogen cooling systems create a direct fire exposure hazard to the fire barrier. (3) Smoke and heat removal systems shall be provided in accordance with 8.4.3. (4) For those plants provided with complete automatic sprinkler protection at the roof level, smoke and heat removal systems shall not be required.	Conform	
10.8.2 Beneath Turbine Generator Operating Floor 10.8.2.1	All areas beneath the turbine generator operating floor shall be protected by an automatic sprinkler or foam-water sprinkler system meeting the following criteria: (1) The sprinkler system beneath the turbine generator shall be designed around obstructions from structural members and piping. (2) The sprinkler system shall be designed to a minimum density of 12.2 L/min.m^2 (0.30 gpm/ft^2) over a minimum application of 464.5 m (5,000 ft).	Conform	
10.8.2.2	Foam-water sprinkler systems installed in place of automatic sprinklers described in 10.8.2.1 shall be designed in accordance with NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems, and the design densities specified in 10.8.2.1.	Conform	

Table 9.5.1-2 (63 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.8.2.3	Electrical equipment in the area covered by a water or foam system shall be of the enclosed type or otherwise protected to minimize water damage in the event of system operation.	Conform	
10.8.3.1	Automatic fixed suppression systems shall be provided for all turbine generator and exciter bearings.	Conform	
10.8.3.2	If closed-head water spray systems utilizing directional nozzles in accordance with NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection, are provided, bearing protection shall be provided for a minimum density of 12.2 L/min.m^2 (0.30 gpm/ft^2) over the protected area.	Conform	
10.8.3.3	Accidental water discharge on bearing points and hot turbine parts shall be considered. If necessary, these areas shall be permitted to be protected by shields and encasing insulation with metal covers.	Conform	
10.8.4	Lubricating oil lines above the turbine operating floor shall be protected with an automatic sprinkler system to a minimum density of 12.2 L/min.m^2 (0.30 gpm/ft^2) that covers those areas subject to oil accumulation, including the area within the turbine lagging (skirt).	Conform	
10.8.5	Lubricating oil reservoirs and handling equipment shall be protected in accordance with 10.8.2.1.	Conform	
10.8.6	If the lubricating oil reservoir specified in 10.8.5 is elevated, sprinkler protection shall be extended to protect the area beneath the reservoir.	Conform	

Table 9.5.1-2 (64 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.8.7	The following shall apply to protection associated with shaft-driven ventilation systems: (1) Where shaft-driven ventilation systems are not used, the area inside a directly connected exciter housing shall be protected with an automatic fire suppression system. (2) Where shaft-driven ventilation systems are used, an automatic preaction sprinkler system providing a density of 12.2 L/min.m^2 (0.30 gpm/ft^2) over the entire area shall be provided.	Conform	
10.8.8	Clean- or dirty-oil storage areas shall be protected based on the fire risk evaluation, and the designer shall include, as a minimum, the installation of fixed automatic fire protection systems and the ventilation and drainage requirements in Chapter 8.	Conform	Fire hazard evaluation for oil storage areas is described in Appendix 9.5A.
10.8.9 Hydrogen Systems 10.8.9.1 General. 10.8.9.1.1	Bulk hydrogen systems supplying one or more generators shall have automatic valves located at the supply and operable by “dead man”–type controls at the generator fill point(s) or operable from the control room.	Conform	
10.8.9.1.2	As an alternative to the requirement of 10.8.9.1.1, vented guard piping shall be permitted to be used inside the building to protect runs of hydrogen piping.	Conform	
10.8.9.1.3	A flanged spool piece or equivalent arrangement shall be provided to facilitate the separation of hydrogen supply when the generator is open for maintenance.	Conform	
10.8.9.1.4	Control room alarms shall be provided to indicate abnormal gas pressure, temperature, and percentage of hydrogen in the generator.	Conform	

Table 9.5.1-2 (65 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.8.9.1.5	The generator hydrogen dump valve and hydrogen-detraining equipment shall meet the following criteria: (1) They shall be arranged to vent directly to a safe outside location. (2) The dump valve shall be remotely operable from the control room or from an area accessible during a machine fire.	Conform	
10.8.9.1.6	An excess-flow check valve shall be provided for the bulk supply hydrogen piping.	Conform	
10.8.9.2 Hydrogen Seal Oil Pumps. 10.8.9.2.1	Redundant hydrogen seal oil pumps with separate power supplies shall be provided for reliability of seal oil supply.	Conform	
10.8.9.2.2	Where feasible, electrical circuits to redundant pumps shall be run in buried conduit or provided with fire-retardant coating if exposed in the area of the turbine generator, to minimize the possibility of loss of both pumps as a result of a turbine generator fire.	Conform	
10.8.9.2.3	Hydrogen seal oil units shall be protected as follows: (1) In accordance with 10.8.2 (2) By an automatic, open-head water spray system providing a density of 12.2 L/min.m^2 (0.30 gpm/ft^2) over the hydrogen seal area	Conform	
10.8.9.2.4	Curbing or drainage or both shall be provided for the hydrogen seal oil unit in accordance with Chapter 8, Section 8.5.	Conform	

Table 9.5.1-2 (66 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.8.9.3 Hydrogen in Safety-Related Areas 10.8.9.3.1	Hydrogen lines in safety-related areas shall meet one of the following criteria: (1) They shall be designed to seismic Class I requirements or sleeved such that the outer pipe is directly vented to the outside. (2) They shall be equipped with excess-flow valves so that, in case of a line break, the hydrogen concentration in the affected areas will not exceed 2 %.	Conform	
10.8.9.3.2	Hydrogen lines or sensing lines containing hydrogen shall not be piped into or through the control room.	Conform	
10.8.10 Hydraulic Control Systems	The hydraulic control system shall use a listed fire-resistant fluid.	Conform	
10.8.11* Lubricating Oil Systems. 10.8.11.1	Turbine lubricating oil reservoirs shall be provided with vapor extractors, which shall be vented to an outside location.	Conform	
10.8.11.2	Curbing or drainage or both shall be provided for the turbine lubricating oil reservoir in accordance with Chapter 8, Section 8.5.	Conform	
10.8.11.3	All oil pipe serving the turbine generator shall be designed and installed to minimize the possibility of an oil fire in the event of severe turbine vibration.	Conform	

Table 9.5.1-2 (67 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.8.11.4	Piping design and installation shall include all of the following measures: (1) Welded construction (2)* Guard pipe construction with the pressure feed line located inside the return line or in a separate shield pipe drained to the oil reservoir (3) Routing oil piping clear of or below steam piping or metal parts (4) Insulating with impervious lagging for steam piping or hot metal parts under or near oil piping or turbine bearing points	Conform	
10.8.11.5	Cable for operation of the lubricating oil pumps shall be protected from fire exposure, and the following criteria also shall apply: (1) Where feasible, electrical circuits to redundant pumps shall be run in buried conduit. (2) Protection shall be permitted to consist of separation of cables for ac and dc oil pumps or 1-hour fire-resistive coating (derating of cable shall be considered).	Conform	
10.9 Standby Emergency Diesel Generators and Combustion Turbines 10.9.1	The installation and operation of standby emergency diesel generators and combustion turbines shall be in accordance with NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, unless otherwise permitted by 10.9.2.	Conform	
10.9.2	The requirement of 10.9.1 shall not apply to automatic shutdown and remote shutdown features, which shall be governed by nuclear-safety requirements.	Conform	

Table 9.5.1-2 (68 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.9.3	Standby emergency diesel generators and combustion turbines located within main plant structures shall be protected as follows: (1) They shall be protected by automatic sprinkler, water spray, or foam-water sprinkler systems. (2) The sprinkler and water spray protection systems shall be designed for a 10.19 L/min.m^2 (0.25 gpm/ft^2) density over the entire area.	Conform	
10.9.4	Fire detection shall be provided to alarm and annunciate in the control room and to alarm locally, and the following criteria also shall be met: (1) Fire hose stations and portable fire extinguishers shall be located outside the area. (2) Drainage for fire-fighting water and means for local manual venting of smoke shall be provided.	Conform	
10.9.5	A day tank shall be permitted in standby emergency diesel generator and combustion turbine rooms if the day tank is located in a diked enclosure that has sufficient capacity to hold 110 % of the contents of the day tank or is drained to a safe location.	Conform	
10.10 Diesel Fuel Storage and Transfer Areas 10.10.1	Diesel fuel oil storage tanks shall not be located inside buildings containing other nuclear safety–related equipment, and the following criteria also shall apply: (1) If aboveground tanks are used, they shall be located at least 50 ft from any building, or if within 50 ft, they shall be separated from the building by a fire barrier having a minimum 3-hour rating. (2) Potential oil spills shall be confined or directed away from buildings containing safety-related equipment.	Conform	

Table 9.5.1-2 (69 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.10.2	Aboveground tanks shall be provided with automatic fire suppression systems.	Conform	
10.11 Nuclear Safety–Related Pump Rooms	Nuclear safety–related pump rooms shall be protected by fire detection systems, and the following criteria also shall apply: (1) Automatic fire suppression systems shall be provided unless the fire hazards analysis determines that fire suppression is not required. (2) Fire hose stations and fire extinguishers shall be readily accessible.	Conform	Refer to Appendix 9.5A.
10.12 New-Fuel Area 10.12.1 10.12.2	Fire extinguishers shall be located within the new-fuel area, and the following criteria also shall be met: (1) Fire hose stations shall be located as determined by the fire hazards analysis to facilitate access and use for fire-fighting operations. (2) Fire detection systems shall be provided. (3) Combustible material shall be limited to the minimum necessary for operation in the new-fuel area.	Conform	Refer to Appendix 9.5A.
	The storage configuration of new fuel shall always be maintained as to preclude criticality for any water density that could occur during fire water application.		
10.13 Spent-Fuel Pool Area 10.13.1 10.13.2	Protection for the spent-fuel pool area shall be provided by fire hose stations and fire extinguishers.	Conform	
	Fire detection shall be provided in the area.	Conform	

Table 9.5.1-2 (70 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.14 Radwaste and Decontamination Areas 10.14.1 10.14.2	Fire barriers, fire detection, and automatic fire suppression shall be provided as determined by the fire hazards analysis. Manual ventilation control to assist in smoke removal shall be provided if necessary for manual firefighting.	Conform	Refer to Appendix 9.5A.
10.15 Safety-Related Water Tanks 10.15.1 10.15.2	Storage tanks that supply water for fire-safe shutdown shall be protected from the effects of an exposure fire. Combustible materials shall not be stored next to these tanks.	Conform	
10.16 Record Storage Areas 10.16.1 10.16.2	Record storage areas shall be located and protected in accordance with NFPA 232, Standard for the Protection of Records. Record storage areas shall not be located in safety-related areas and shall be separated from safety-related areas by fire barriers having a minimum 3-hour rating.	COL	COL Item 9.5(2)
10.17 Cooling Towers 10.17.1 10.17.2 10.17.3	Cooling towers shall be of noncombustible or limited-combustible construction. Cooling towers shall be located such that a fire in the cooling tower will not adversely affect safety-related systems or equipment. The following criteria also shall be met: (1) Cooling towers shall be of noncombustible construction when the basin is used as the ultimate heat sink. (2) If cooling towers are of combustible construction, the following criteria shall be met: (a) They shall be protected by automatic sprinklers or water spray systems in accordance with NFPA 214, Standard on Water-Cooling Towers. (b) They shall be located so that they do not affect safety-related systems or equipment in the event of a fire.	COL	COL Item 9.5(2)

Table 9.5.1-2 (71 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.18 Acetylene–Oxygen Fuel Gases	Gas cylinder storage locations or the fire protection systems that serve those safety-related areas shall not be in areas that contain or expose safety-related equipment.	COL	COL Item 9.5(2)
10.19 Storage Areas for Ion Exchange Resins	Unused ion exchange resins shall not be stored in areas that contain or expose safety-related systems or equipment.	Conform	
10.20 Storage Areas for Hazardous Chemicals	Hazardous chemicals shall not be stored in areas that contain or expose safety-related systems or equipment.	Conform	
10.21 Warehouses	Automatic sprinkler protection shall be provided for warehouses that contain high-value equipment or combustible materials.	Conform	COL Item 9.5(2)
10.22 Fire Pump Room/House 10.22.1 10.22.2	Rooms housing diesel-driven fire pumps shall be protected by automatic sprinkler, water spray, or foam-water sprinkler systems. If sprinkler and water spray systems are provided for fire pump houses, they shall be designed for a minimum density of 0.25 10.19 L/min.m^2 (22 gpm/ft^2) over the entire fire area.	Conform	COL Item 9.5(2)

Table 9.5.1-2 (72 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.23 Transformers 10.23.1 10.23.2 10.23.3 10.23.4	Buildings shall be protected from exposure fires involving oil-filled transformers by one of the following means: (1) Locating the transformer casing, conservator tank, and cooling radiators at least 50 ft from buildings (2) Providing a minimum 2-hour fire barrier between transformers as required in Figure 10.23.1 (a) and Figure 10.23.1 (b) and exposed buildings (3) Complying with Table 10.23.1 [See Figure 10.23.1(a) and Figure 10.23.1(b).]	Conform	COL Item 9.5(2)
	A minimum 1-hour fire barrier or a distance of 30 ft shall be provided between adjacent transformers.		
	Means shall be provided to contain oil spills.		
	Oil-filled main, station service, and startup transformers shall be protected with automatic water spray systems in accordance with NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection, or foam-water spray systems in accordance with NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.		
	Transformers installed inside fire areas containing safety-related systems or equipment shall be of the dry type or insulated and cooled with noncombustible liquid, unless otherwise specified in 10.23.4.		
	Transformers filled with combustible fluid that are located indoors shall be enclosed in a transformer vault.		

Table 9.5.1-2 (73 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.24 Auxiliary Boilers 10.24.1 10.24.2 10.24.3	Auxiliary boilers, their fuel-burning systems, combustion product removal systems, and related control equipment shall be installed and operated in accordance with NFPA 85, Boiler and Combustion Systems Hazards Code.	Conform	COL Item 9.5(2)
	Oil-fired boilers or boilers using oil ignition within the main plant shall be protected with automatic sprinkler, water spray, or foam-water sprinkler systems covering the boiler area.		
	Sprinkler and water spray systems shall be designed for a minimum density of 10.19 L/min.m^2 (0.25 gpm/ft^2) over the entire area.		
10.25 Offices, Shops, and Storage Areas	Automatic sprinklers shall be provided for storage rooms, offices, and shops containing combustible materials that present an exposure to surrounding areas that are critical to plant operation and shall be so located and protected that a fire or the effects of a fire, including smoke, will not adversely affect any safety-related systems or equipment.	Conform	COL Item 9.5(2)
10.26 Simulators 10.26.1	Simulators shall be provided with a fixed automatic suppression system.	COL	COL Item 9.5(2)
10.26.2	Simulators and supporting equipment shall be separated from other areas by a fire barrier with a minimum 1-hour rating.	COL	COL Item 9.5(2)

Table 9.5.1-2 (74 of 74)

Paragraph	Standard Requirement	Conformance	Remarks
10.27 Technical Support and Emergency Response Centers	Technical support centers shall be separated from all other areas by fire barriers or from all other buildings by at least 50 ft and be protected by an automatic fixed suppression system as required by the fire hazards analysis.	COL	COL Item 9.5(2)
10.28 Intake Structure	Intake structures shall be of noncombustible construction and shall be provided with automatic sprinkler protection.	COL	COL Item 9.5(2)
11. Fire Protection for the Construction Site	Consideration of fire protection shall include safety to life and potential for delays in construction schedules and plant startup, as well as protection of property.	COL	COL Item 9.5(1) The COLA is to conform to these guidelines.

Table 9.5.3-1

Plant Lighting Failure Modes and Effects Analyses

Failure Modes/Cause	Effects on system	Analyses
Loss of offsite power	None	Partial loss of lighting in nuclear power plant EDGs restore power to the Class 1E power supply system, which restores emergency lighting system fixtures. MCR and RSR lighting is provided by emergency dc lighting during EDG start sequence. Emergency DC lighting provides illumination in stairways, corridors, and room exits. AAC DG restores power to emergency lighting.
Loss of voltage from one non-Class 1E normal power supply lighting distribution panel	None	Partial loss of lighting in areas served Normal lighting powered from separate lighting distribution panel or area emergency lighting maintains sufficient lighting in affected areas. Emergency DC lighting provides illumination in stairways, corridors, and room exits.
Loss of voltage from one Class 1E normal power supply lighting distribution panel	None	Partial loss of lighting in areas served Normal lighting maintains sufficient lighting in affected areas. Redundant emergency lighting division and battery pack emergency lighting maintains sufficient lighting in the MCR and RSR.

Table 9.5.4-1 (1 of 2)

Emergency Diesel Engine Fuel Oil System Component Data

Fuel Oil Storage Tank	
Quantity	4
Type	Horizontal, Cylinder
Fuel Consumption Rate at continuous rated Load	31.5 L/min (8.32 gpm)
Capacity (usable volume)	363,360 L (96,000 gal)
Operating Pressure/Temperature	Atmosphere/Ambient
Material of Construction	Coated Carbon Steel (does not contain Cu or Zn)
Interior Coating	N/A
Design Pressure/Temperature	ATM/ 65 °C (150 °F)
Design Code	ASME Section III, Class 3
Seismic Category	I
Fuel Oil Transfer Pumps	
Quantity	8
Type	Horizontal, centrifugal
Capacity (each pump)	64.3 L/min (17 gpm)
Total Differential Head	21.3 m (70 ft)
Net Positive Suction Head	Flooded Suction
Material	-
Casing	Stainless Steel
Impeller	Bronze
Pump Shaft	Stainless Steel
Design Code	ASME Section III, Class 3
Driver	Electrical Motor
Horse Power	3 HP @ 1800 RPM
Power Supply	460 V, 60 Hz, 3-Phase, Class 1E safety motor control center
Seismic Category	I

Table 9.5.4-1 (2 of 2)

Fuel Oil Day Tanks	
Quantity	4
Type	Horizontal, Cylinder
Fuel Consumption Rate at continuous	31.5 L/min (8.32 gpm)
Capacity (usable volume)	2,078 L (549 gal)
Operating Pressure/Temperature	Atmosphere/Ambient
Design Pressure/Temperature	4.6 kg/cm^2 G (65 psig) / 65 °C (150 °F)
Material of Construction	Coated Carbon Steel (does not contain Cu or Zn)
Interior Coating	N/A
Design Code	ASME Section III, Class 3
Seismic Category	I
Piping, Fittings, and valves	
Design Pressure	3.5 kg/cm^{2}G (50 psig)
Design Temperature	65 °C (150 °F)
Material	Carbon Steel
Design Code (Safety Related Portion)	ASME Section III, Class 3
Seismic Category	I
Non-safety related portions	ASME B31.1
Flame Arrestors (Storage and Day Tanks)	Manufacturer’s Standards

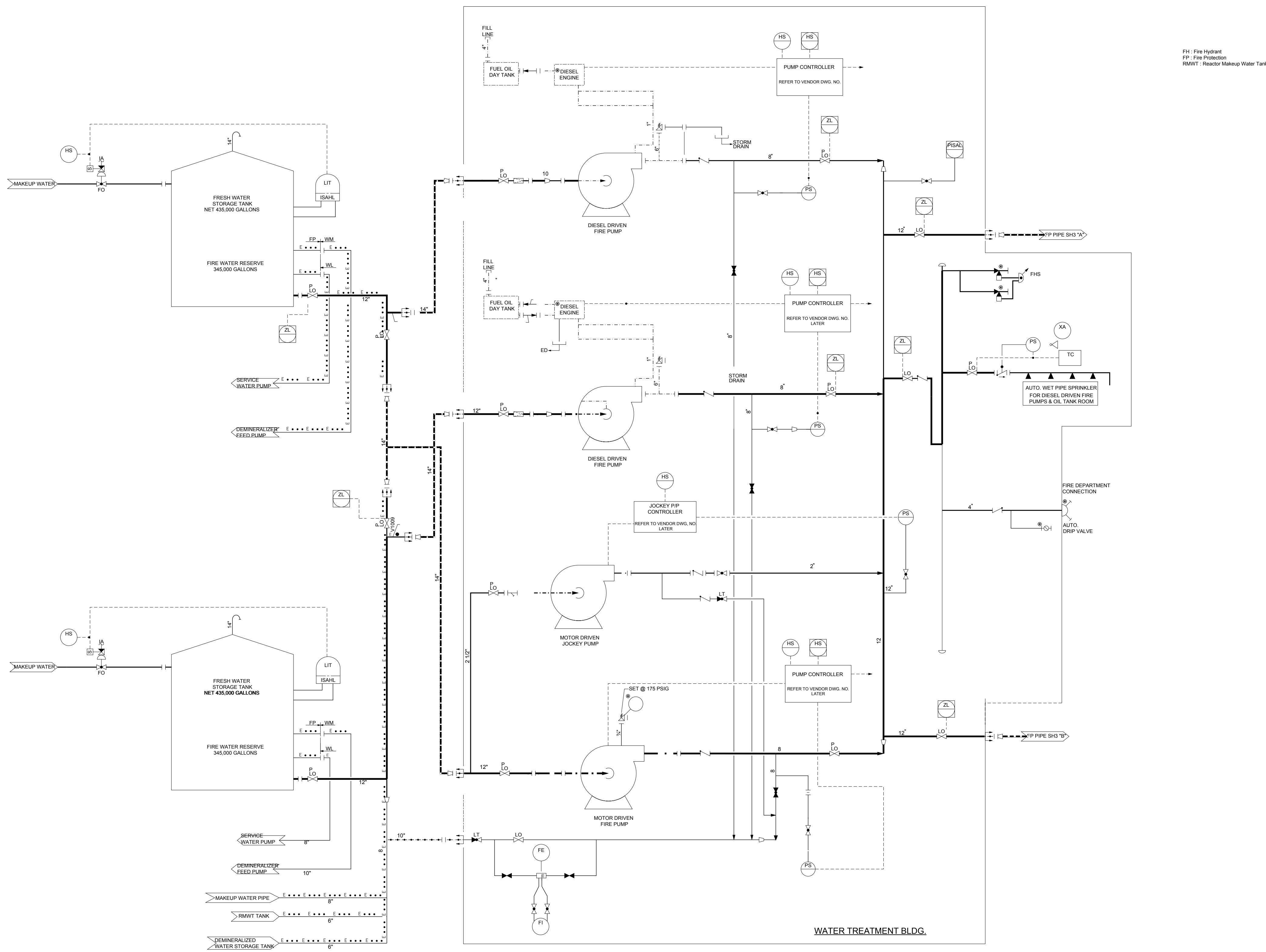


Figure 9.5.1-1 Fire Protection System Flow Diagram (1 of 9)

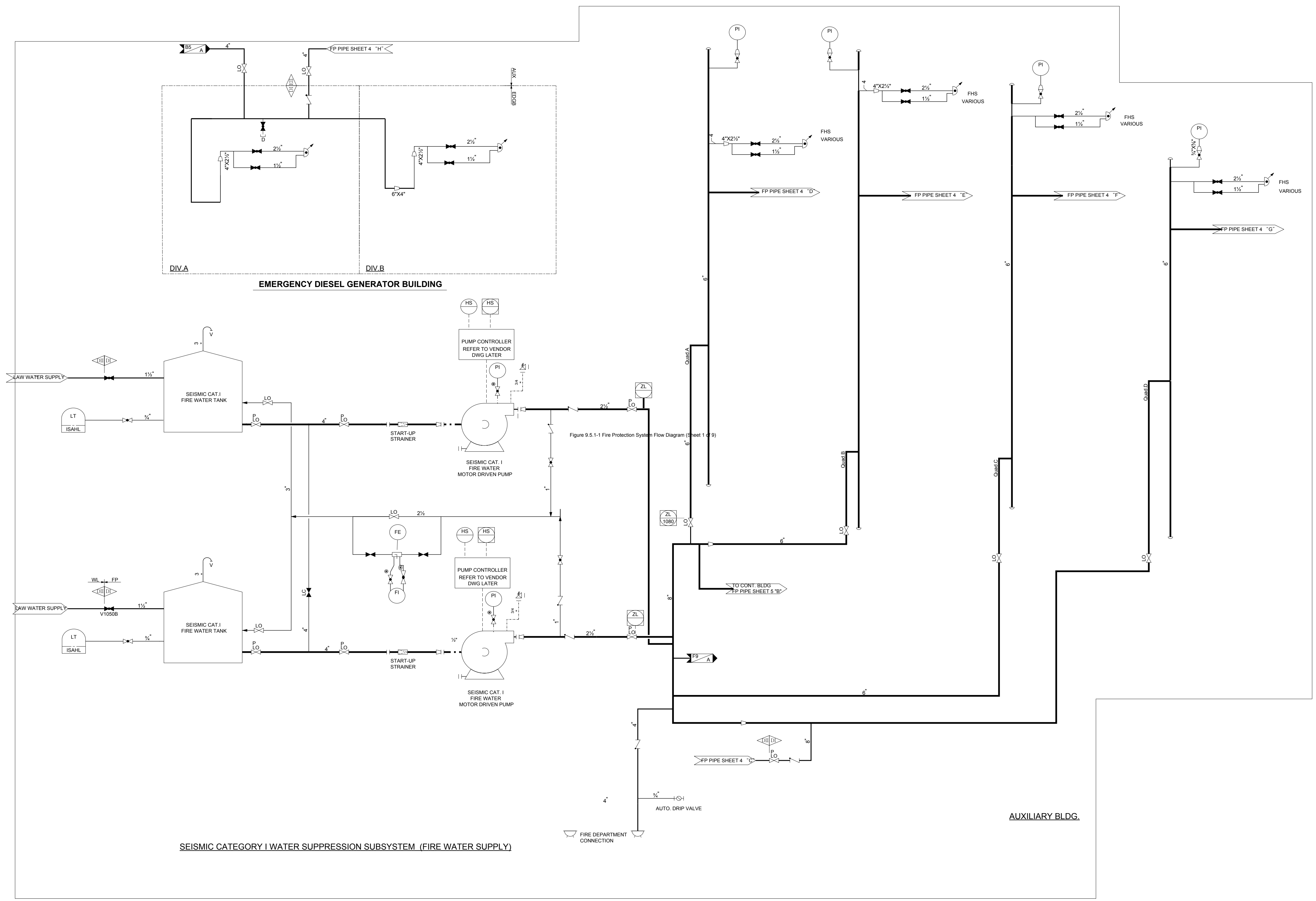


Figure 9.5.1-1 Fire Protection System Flow Diagram (2 of 9)

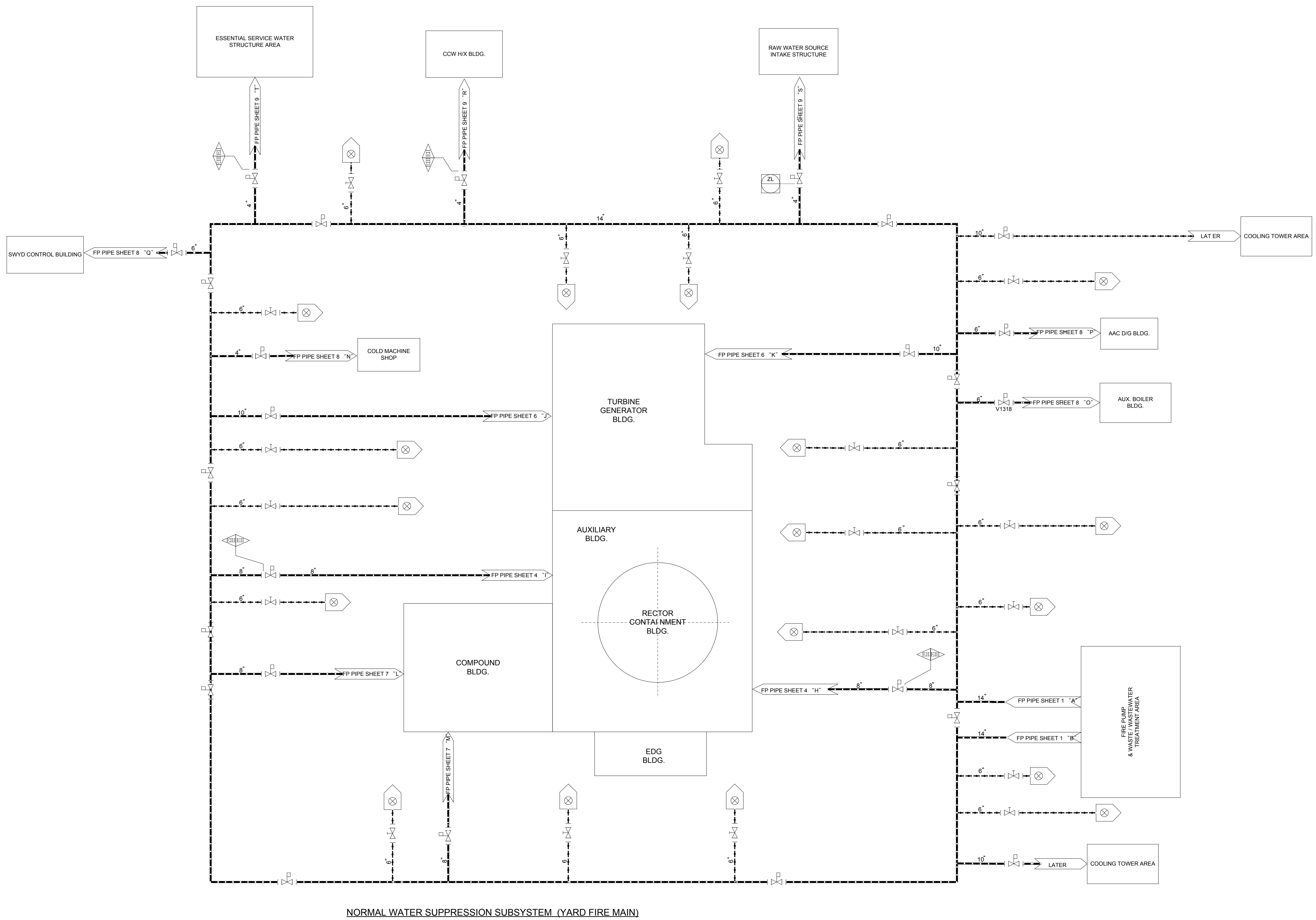


Figure 9.5.1-1 Fire Protection System Flow Diagram (3 of 9)

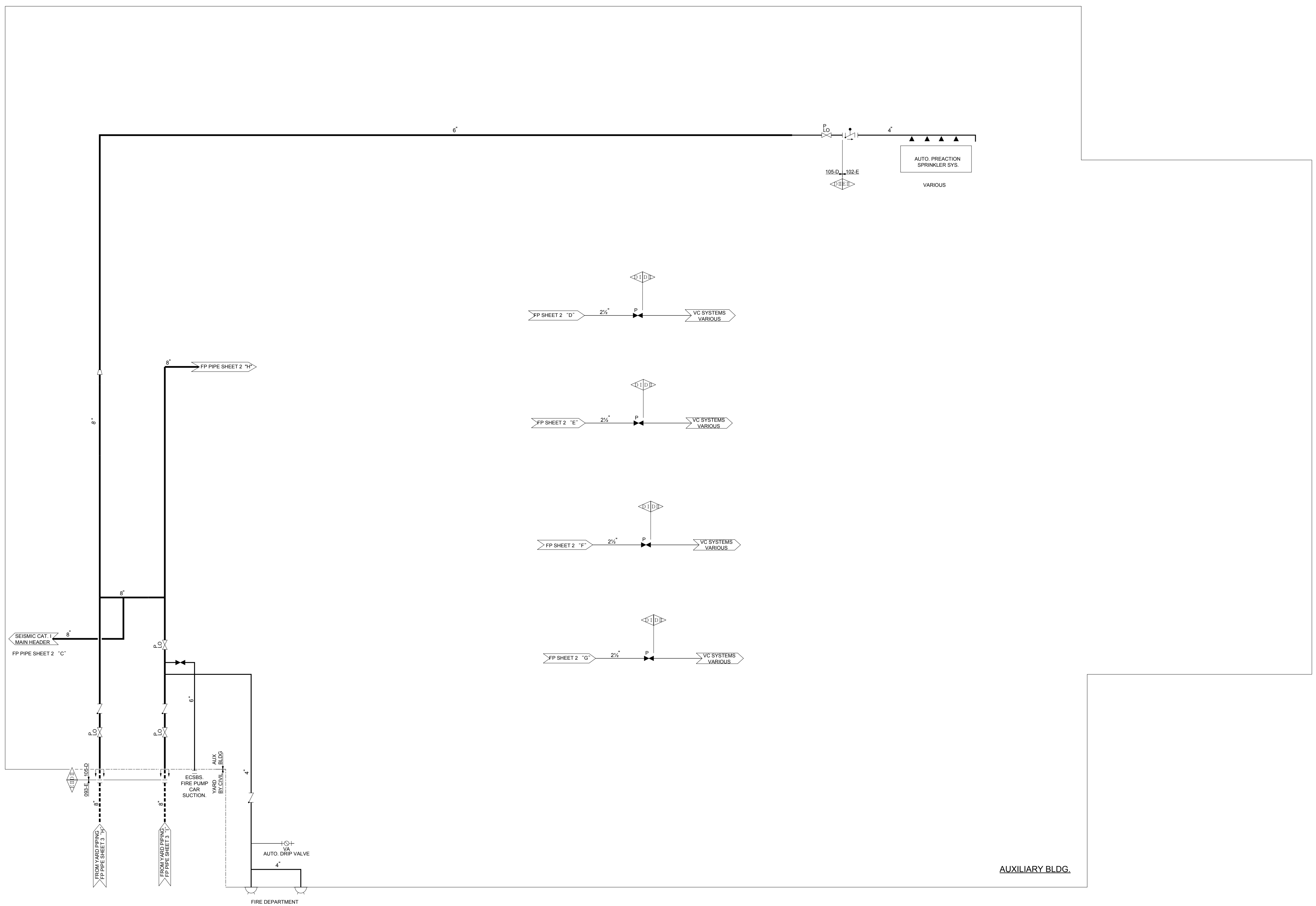


Figure 9.5.1-1 Fire Protection System Flow Diagram (4 of 9)

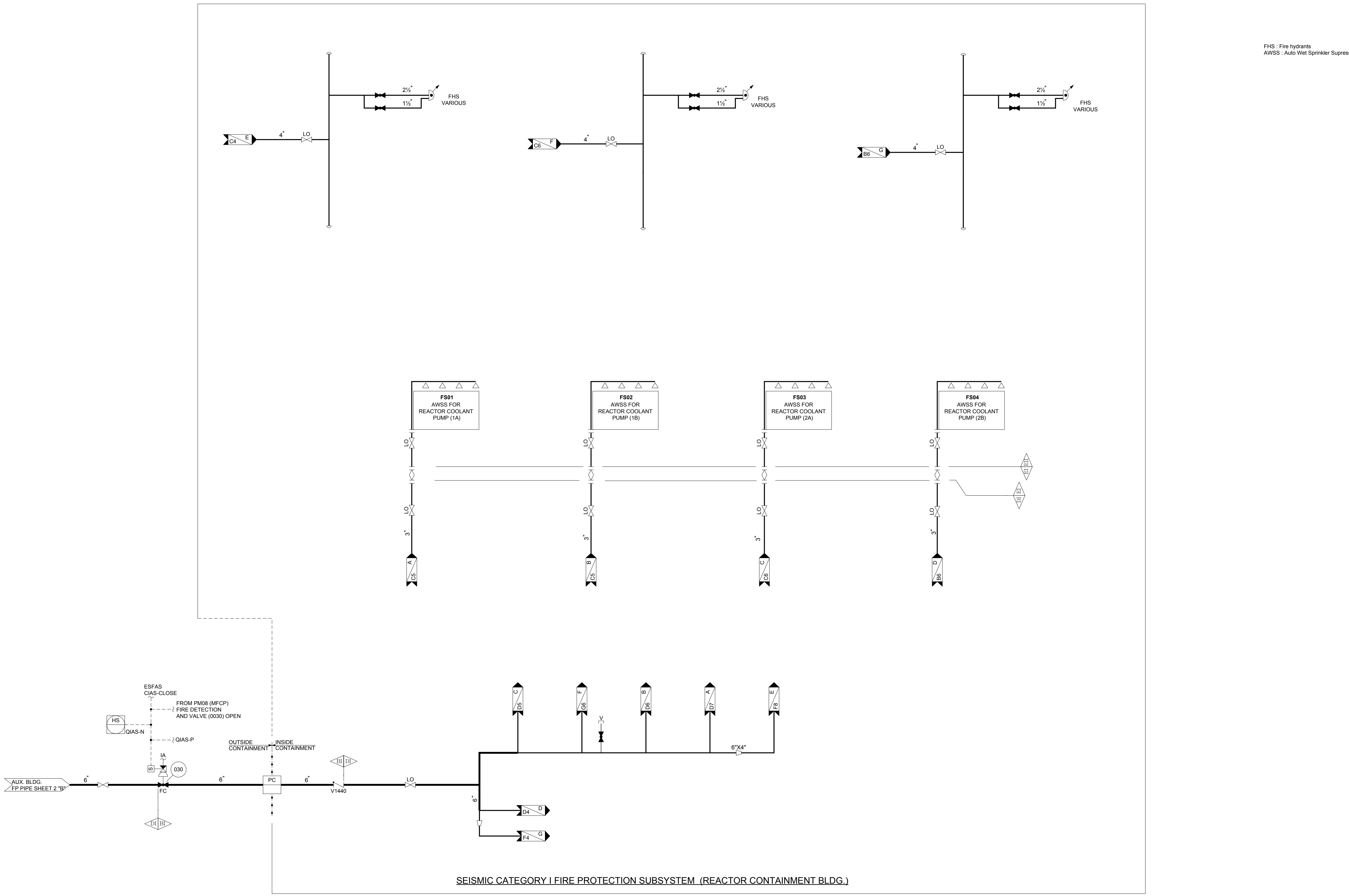


Figure 9.5.1-1 Fire Protection System Flow Diagram (5 of 9)

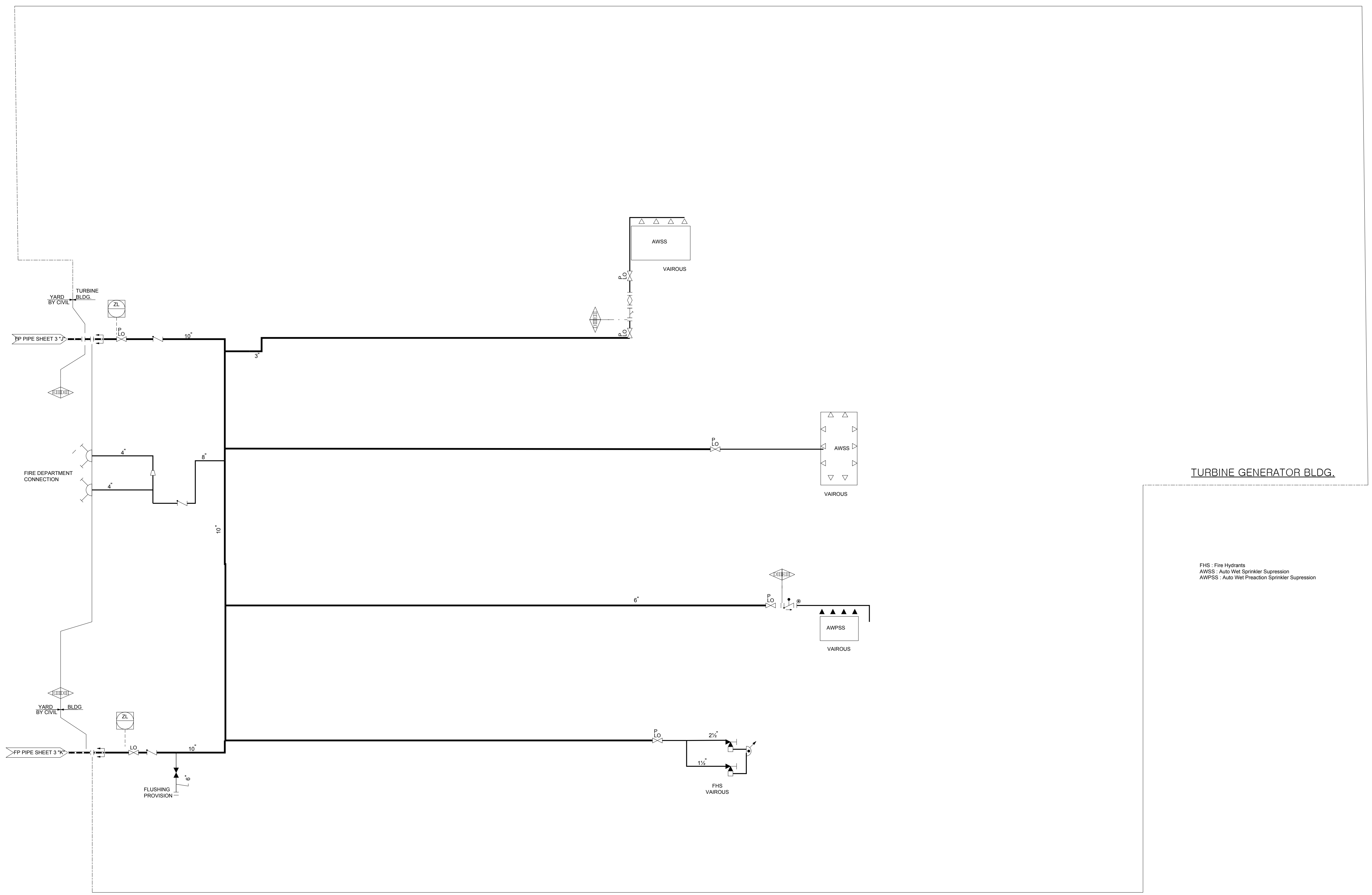


Figure 9.5.1-1 Fire Protection System Flow Diagram (6 of 9)

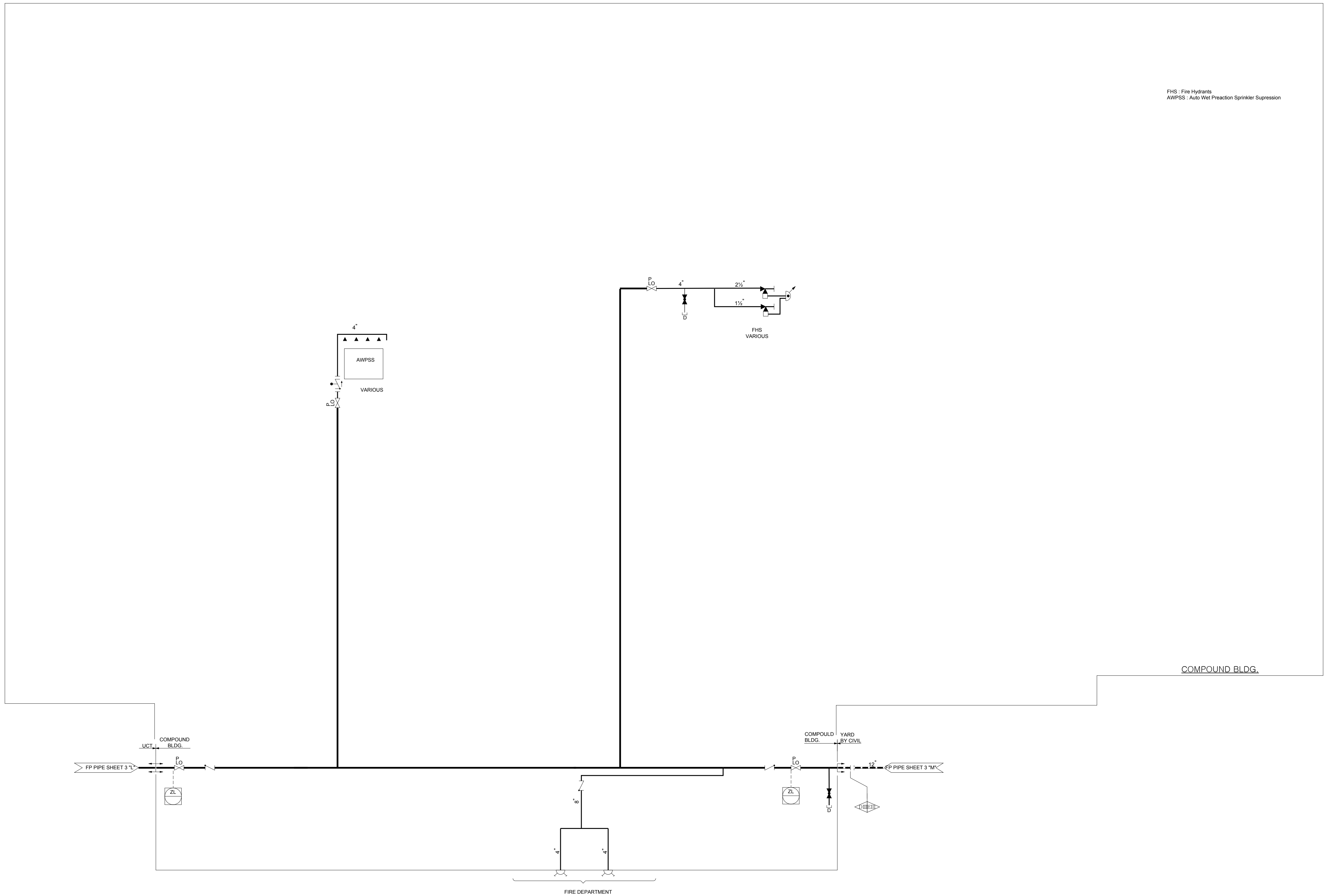


Figure 9.5.1-1 Fire Protection System Flow Diagram (7 of 9)

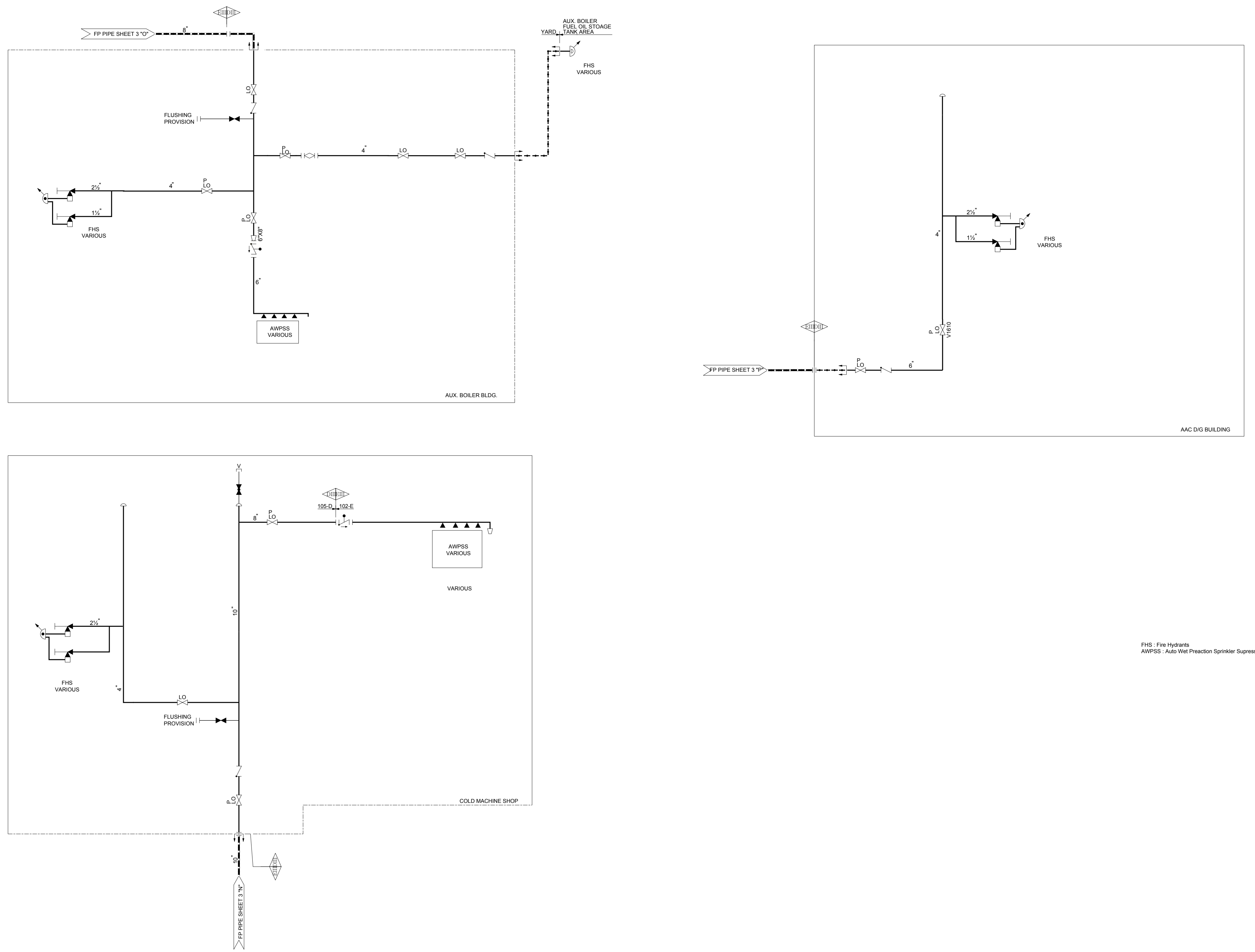


Figure 9.5.1-1 Fire Protection System Flow Diagram (8 of 9)

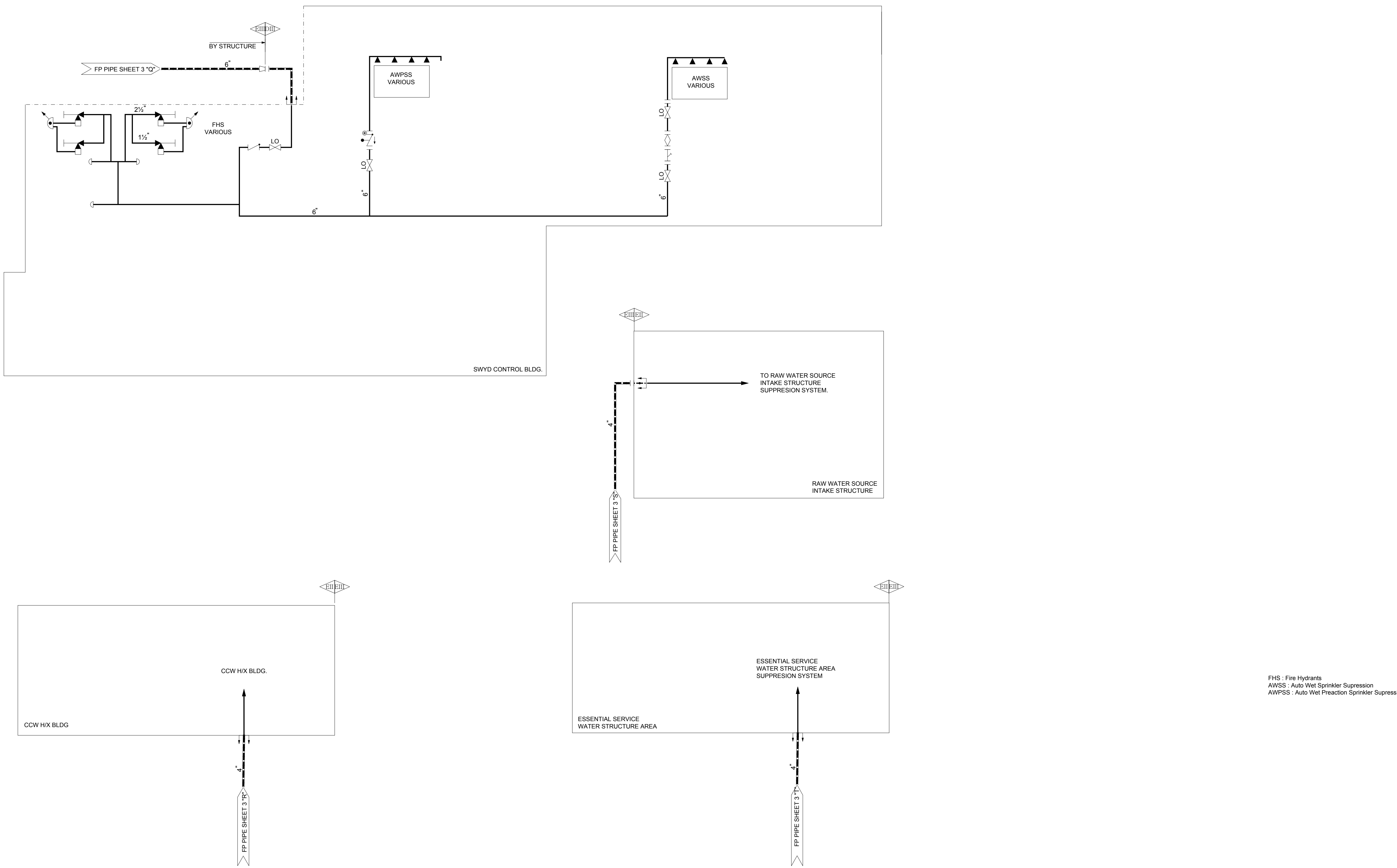


Figure 9.5.1-1 Fire Protection System Flow Diagram (9 of 9)

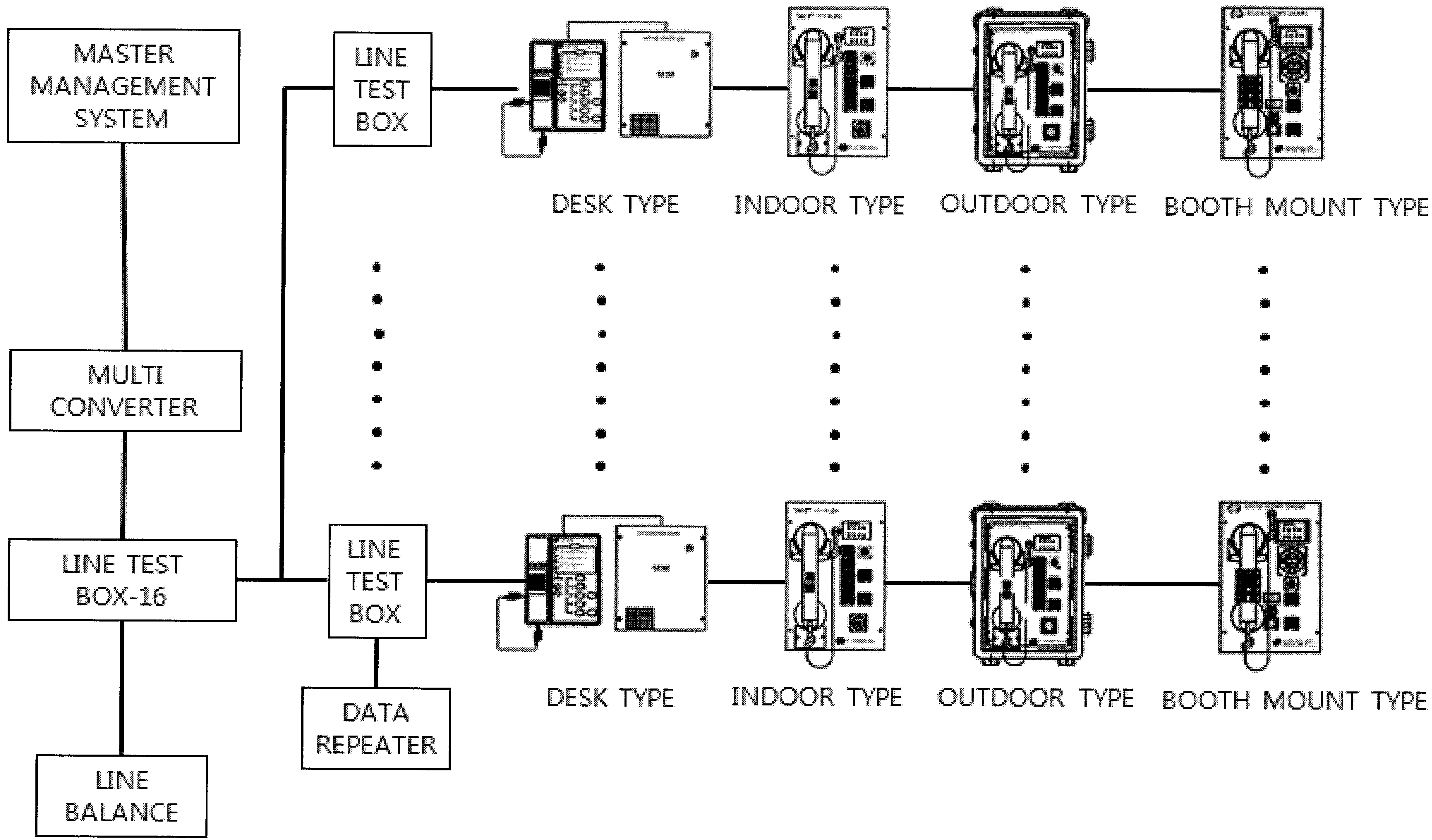


Figure 9.5.2-1 Paging Phone System Diagram

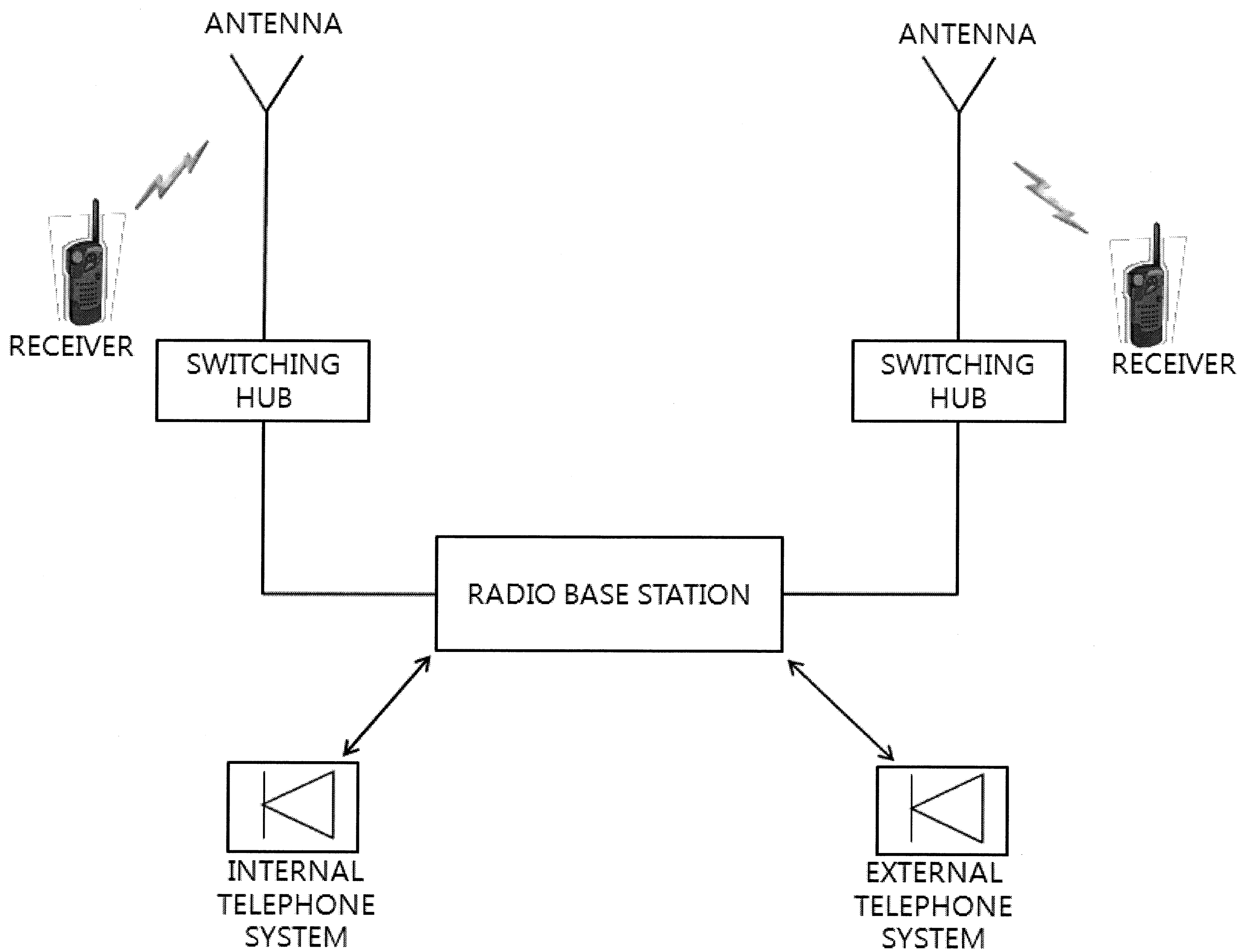


Figure 9.5.2-2 Wireless Communication System Diagram

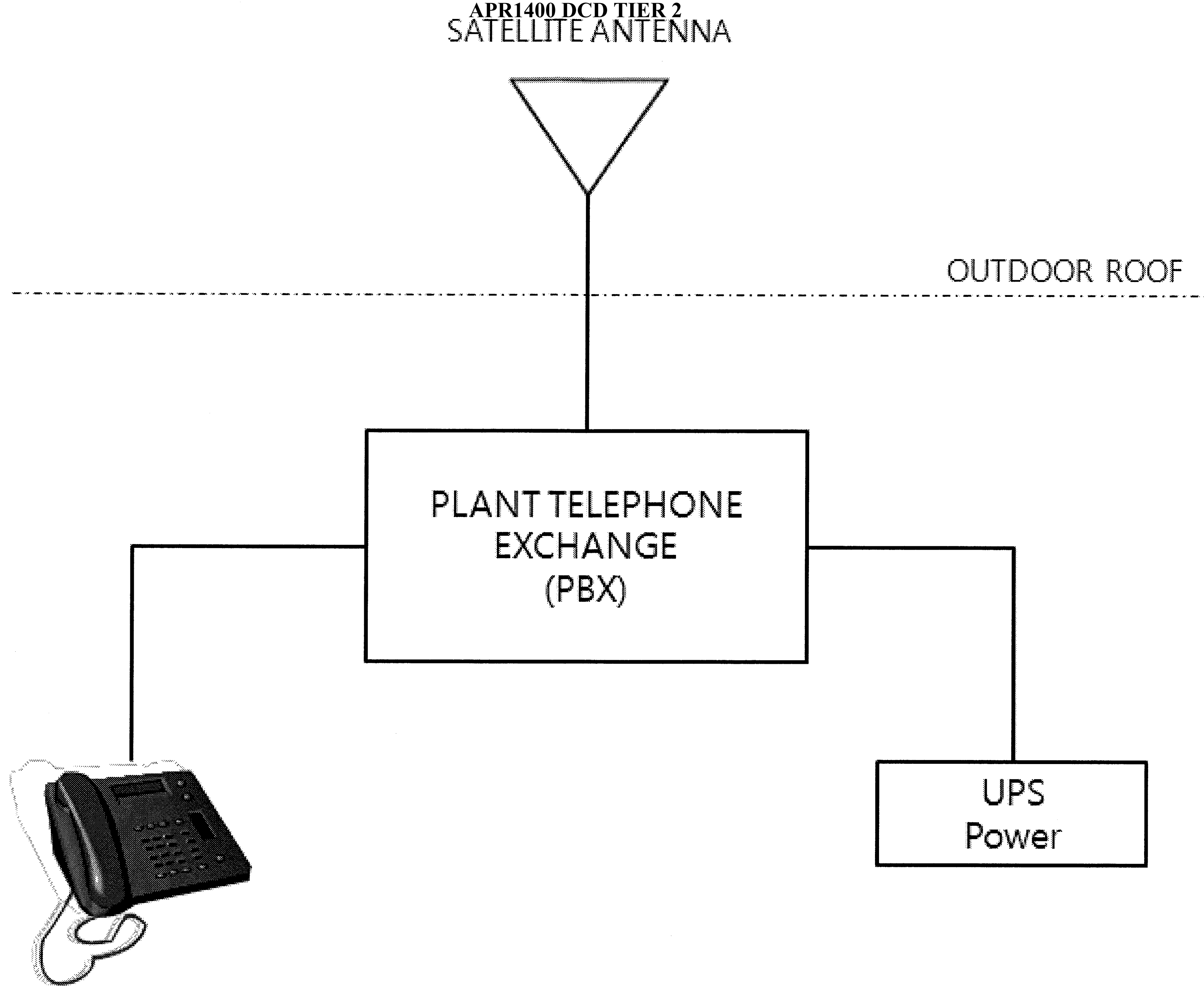
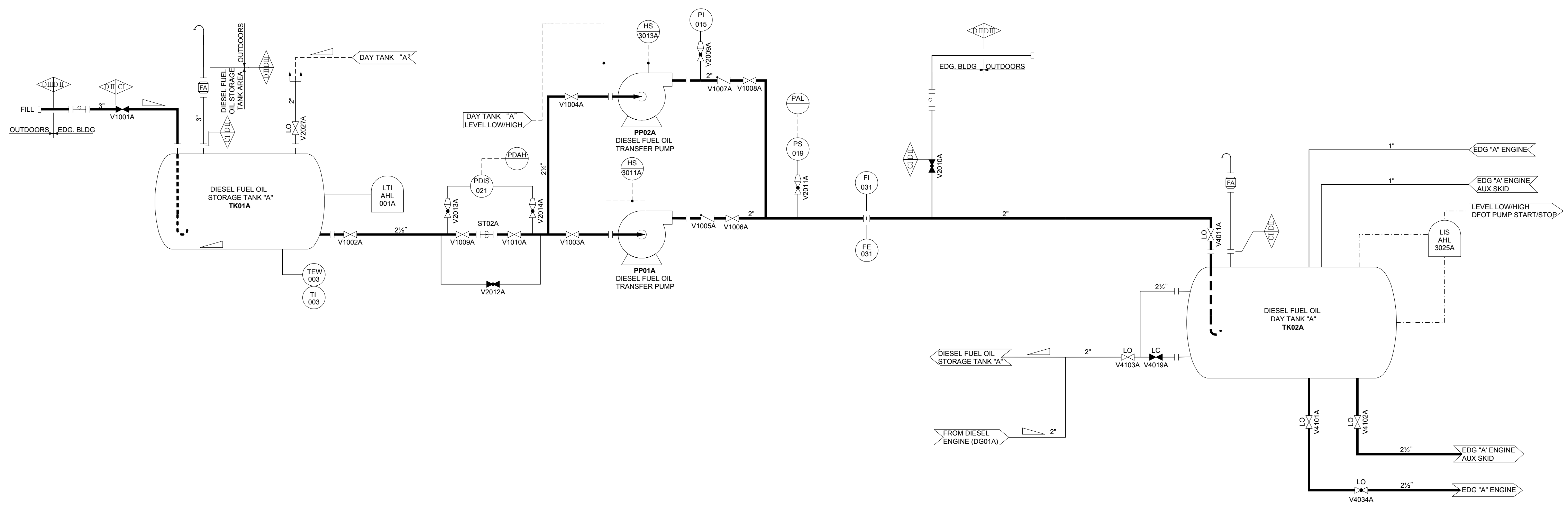


Figure 9.5.2-3   Satellite Telephone System Diagram

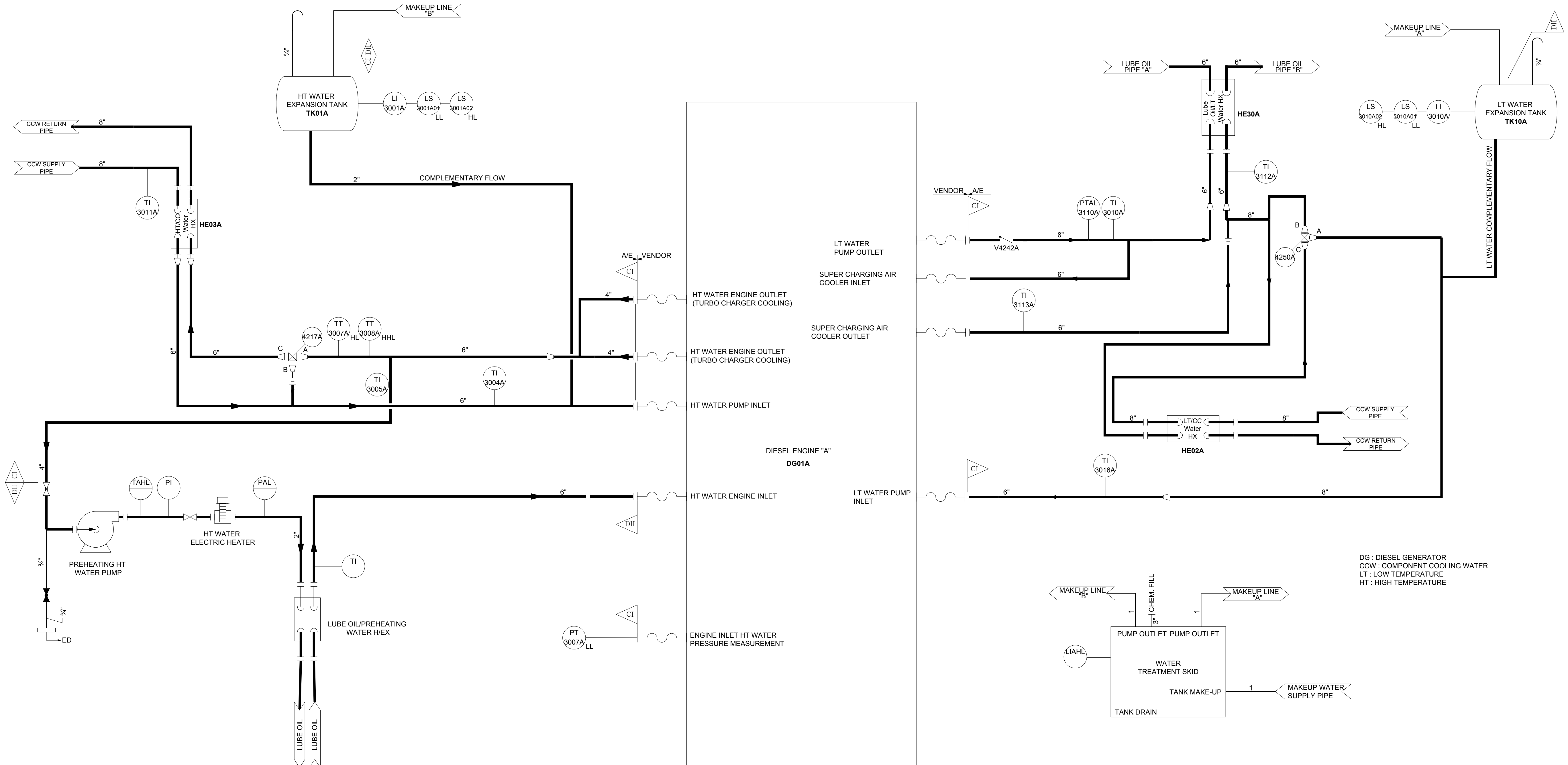
DFOT PUMP : DIESEL FUEL OIL TRANSFER PUMP

EDG : EMERGENCY DIESEL GENERATOR



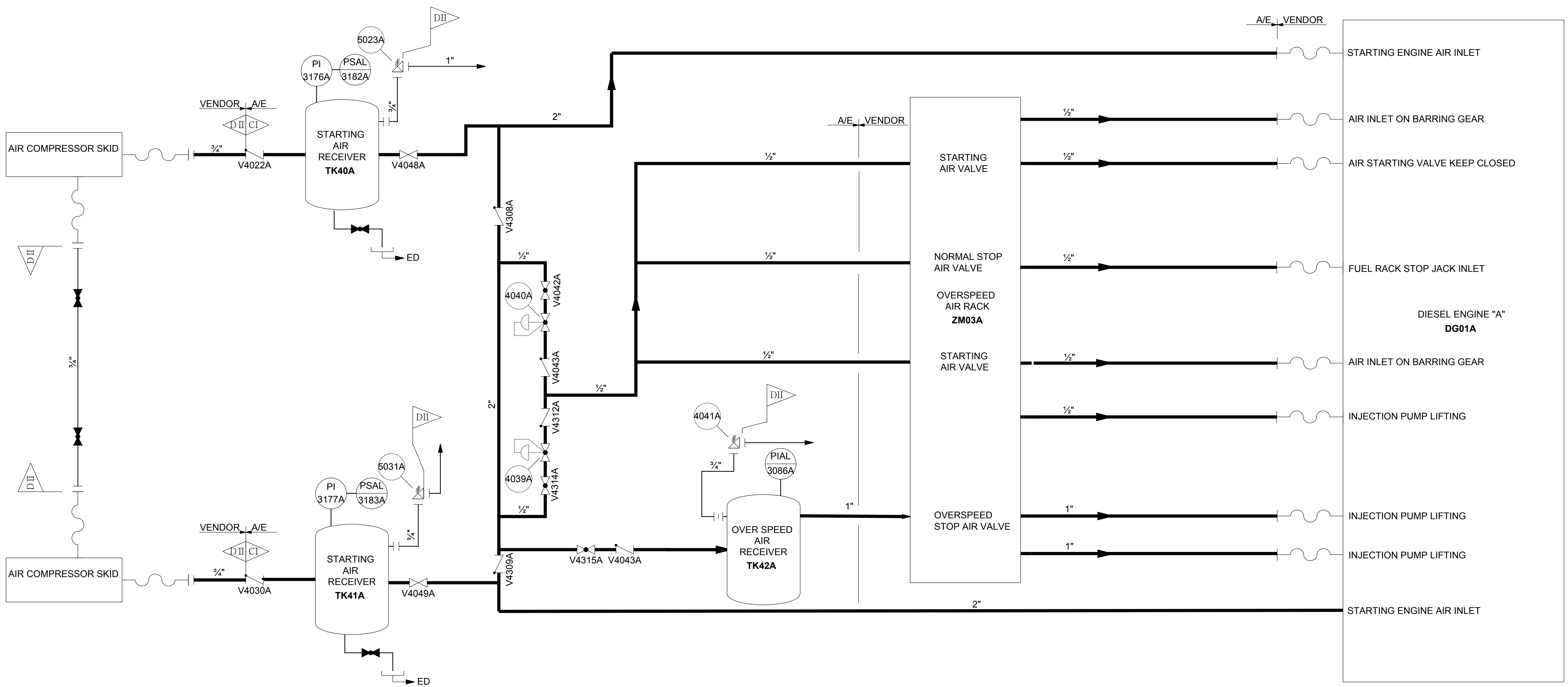
In APR1400 DC, there are four trains, A, B, C and D.
Train A is indicated as being representative of train B, C and D.

Figure 9.5.4-1 Diesel Fuel Oil Transfer System Flow Diagram



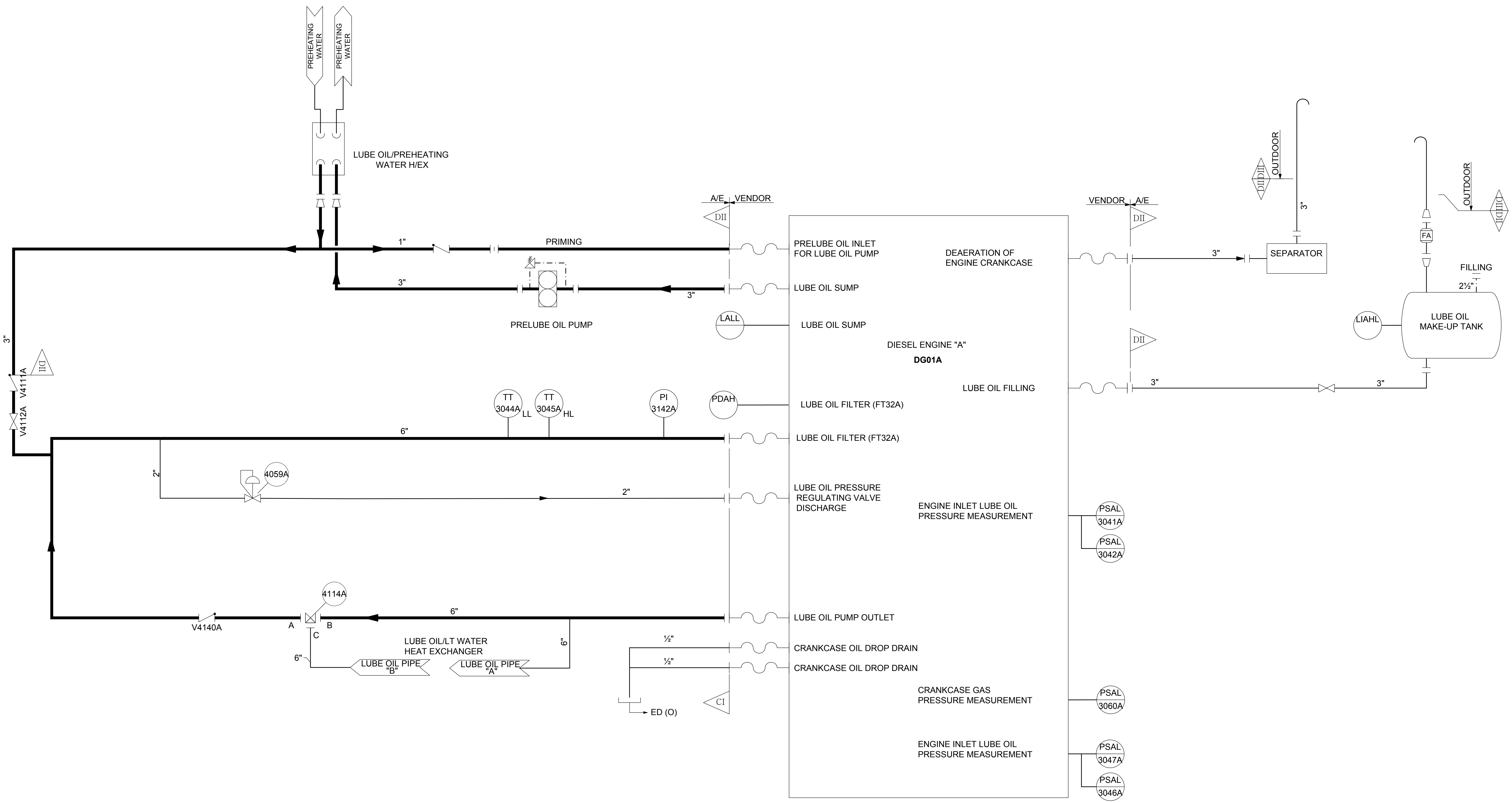
TRAIN A IS INDICATED AS REPRESENTATIVE OF TRAIN B, C, AND D.

Figure 9.5.5-1 Emergency Diesel Engine Cooling Water System Flow Diagram



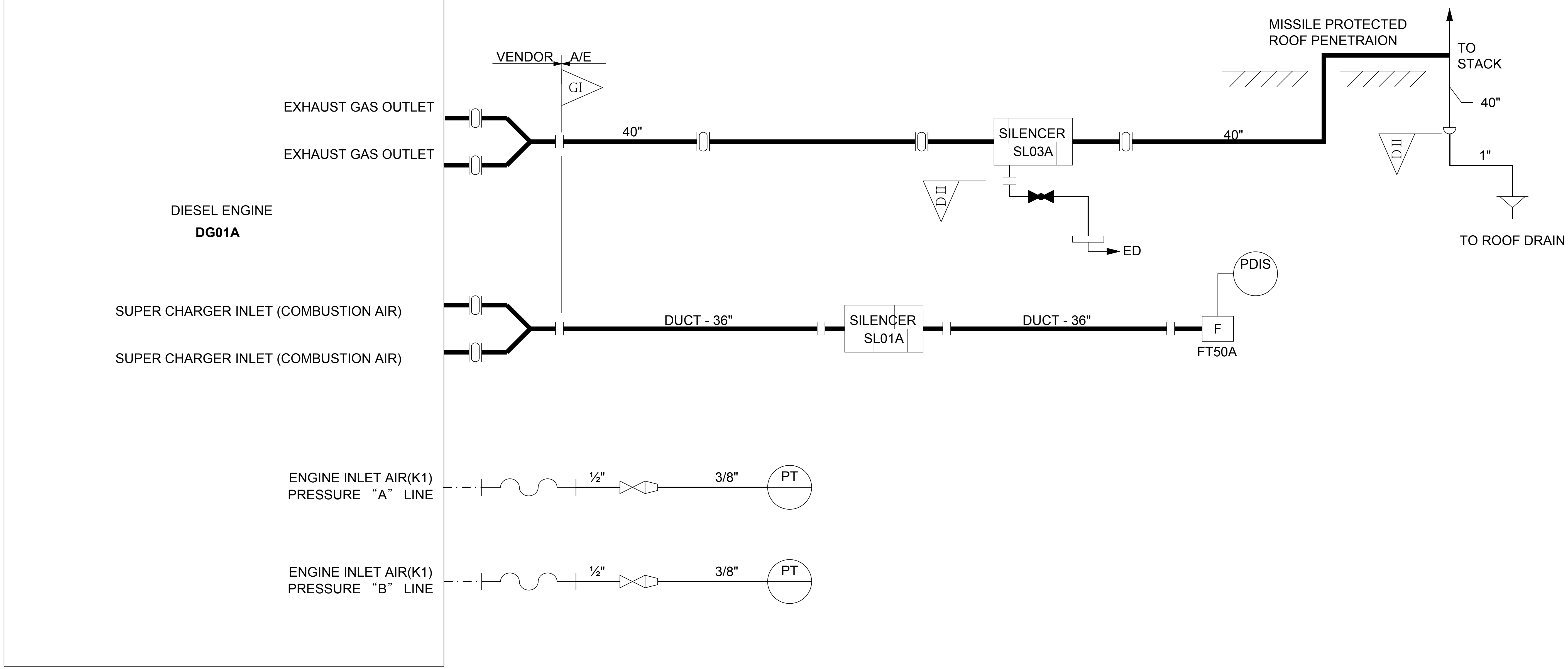
TRAIN A IS INDICATED AS REPRESENTATIVE OF TRAIN B, C, AND D.

Figure 9.5.6-1 Emergency Diesel Engine Starting Air System Flow Diagram



TRAIN A IS INDICATED AS REPRESENTATIVE OF TRAIN B, C, AND D.

Figure 9.5.7-1 Emergency Diesel Engine Lube Oil System Flow Diagram



TRAIN A IS INDICATED AS REPRESENTATIVE OF TRAIN B, C, AND D.

Figure 9.5.8-1 Emergency Diesel Engine Air Intake and Exhaust System Flow Diagram

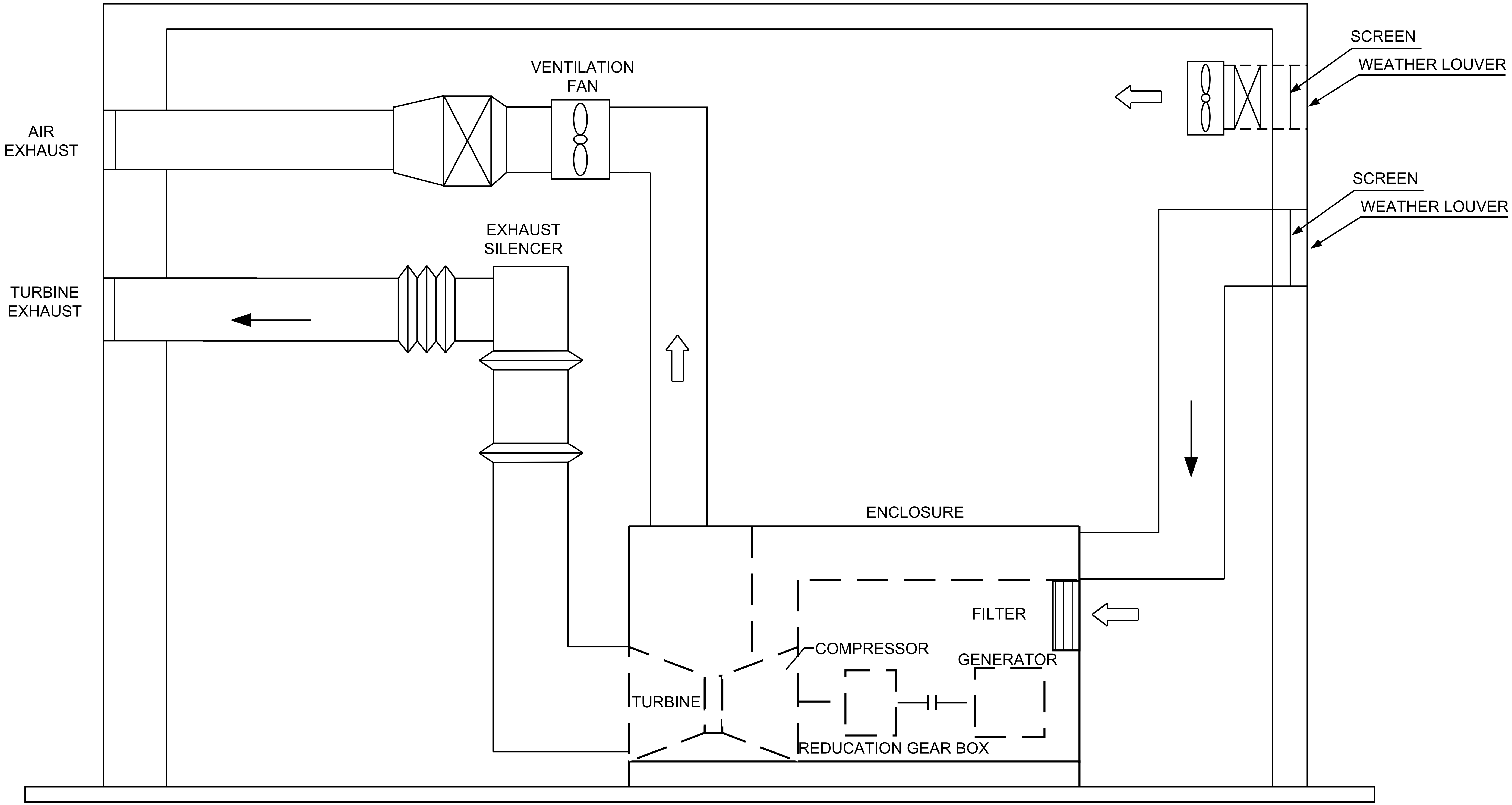


Figure 9.5.9-1 Gas Turbine Generator Facility Flow Diagram (1 of 2)

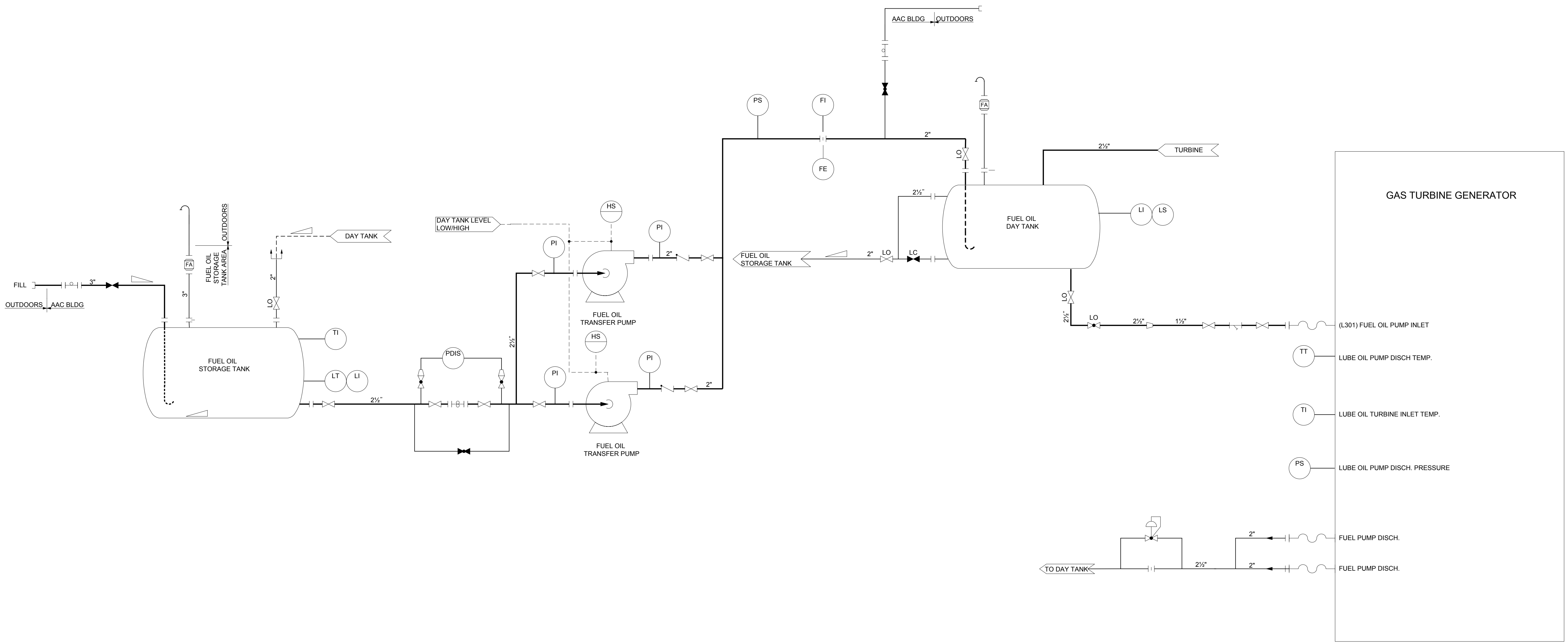


Figure 9.5.9-1 Gas Turbine Generator Facility Flow Diagram (2 of 2)

APPENDIX 9.5A

FIRE HAZARD ANALYSIS

APPENDIX 9.5A – FIRE HAZARD ANALYSIS

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APPENDIX 9.5A – FIRE HAZARD ANALYSIS

9.5A.1 Introduction

This fire hazard analysis (FHA) evaluates the potential for the occurrence of fire within the plant and demonstrates that the plant maintains the capability to perform safe shutdown functions and minimize the release of radioactive material to environment in the event of a fire.

The purpose of the fire hazard analysis is as follows:

a. Evaluate the potential in situ and transient fire hazards.

b. Determine the effects of a fire in any location in the plant and the capability to safely shut down the reactor and minimize and control the release of radioactivity to the environment.

c. Specify the appropriate measures for fire prevention, fire detection, fire suppression, and fire containment for each area containing structures, systems, and components (SSCs) important to safety in accordance with NRC guidelines and regulations.

The fire hazard analysis is performed for each fire area/zone using the methodology described in Subsection 9.5A.2. The methodology follows the guidance of NRC Regulatory Guide (RG) 1.189 (Reference 1). The results of the analysis are provided in Subsection 9.5A.3.

9.5A.2 Analysis Methodology

The fire hazard analysis methodology uses a systematic approach, which includes the followings:

a. Safety-related equipment and components that could be used for the safe shutdown of the plant are identified by fire area and/or fire zone using all available current information.

b. Combustible materials, which include in-situ and potential transient fire and explosion hazards, type of fire hazard, quantity, and the combustible loading that the material imposes on the area/zone, are reviewed.

c. The design basis fire for each fire area/zone, which assumes no fire suppression system actuation, is estimated based on the combustible loading and floor area.

d. The fire detection and suppression provided for the area/zone are reviewed.

e. The effects of the design basis fire on the capability to safely shut down the plant and the potential for release of radioactive are evaluated. Design basis fires and worst-case fires are not postulated to be concurrent with non-fire-related failures in safety systems, other plant accidents, or the most severe natural phenomena.

f. The potentially disabling effects of an inadvertent actuation of suppression systems on the safe shutdown capability are evaluated.

g. The effects of manual fighting activities are evaluated.

The arrangement of the equipment and combustible materials in the area, location of doors, provisions of the ventilation system, and wall penetrations are considered.

9.5A.2.1 Descriptions of Fire Area/Zone

Fire areas, consistent with the definition in NRC Regulatory Guide (RG) 1.189 (Reference 1), are the portions of a building or plant that are separated from other areas by 3-hour-rated fire barriers (i.e., walls, floors, and ceilings) that contain the effects of a fire to within a single fire area. Fire areas minimize the adverse effects of a fire on redundant SSCs important to safety. Fire-rated barriers include components such as reinforced concrete walls, floors, beams, joists, and columns. All penetrations in fire-rated barriers are protected with 3-hour-rated components such as penetration seals, fire doors, and fire dampers.

Fire zones are subdivisions of a fire area that are typically based on fire protection systems and structural features in the fire zone that provide an appropriate level of protection for the associated hazards. Fire zones are not necessarily isolated by complete fire barriers or

fire-rated construction, but fire zone boundaries are capable of substantially confining the impact of a fire that occurs in the fire zone. A fire area may be divided into fire zones when it is not practicable or desirable to divide a fire area into multiple fire areas because of the plant design and layout (e.g., inside containment, structures containing a single safety train of equipment). Barriers that define fire zones may have open hatches, ladder ways, doorways, or unsealed penetrations. “Fire zone” is a term that is used in fire risk analysis and on maps of fire areas showing areas that are defined by the potential for fire damage.

The fire area/zone numbering system is similar to the room numbering system, but fire area numbers may not correspond exactly to room numbers because many rooms are not bounded by rated barriers or exterior walls and do not qualify as fire areas. Therefore, many fire areas comprise several rooms and may extend through one or more plant elevations. The numbering of such fire areas is based on the following:

a. A fire area that comprises more than one room and extends through one or more plant elevations is designated as F000-XXX. The “000” indicates more than one elevation. An example is F000-CNB, the designation for the containment building fire area. “CNB” is a unique suffix that means “containment building.”

b. The number of fire areas that comprises several rooms on one elevation consists of the elevation and a unique suffix (e.g., F157-ACPX, the fire area number for the computer room area).

The fire areas/zones in the APR1400 design are described in the fire hazard analysis (Section 9.5A.3). The results of each fire area analysis include the following:

a. Description of the area boundary

   The rooms in the fire area/zone are described. The boundaries of the fire area/zone are described including the fire-rated walls, floors, and ceilings.

b. Summary of penetrations

   The fire-rated HVAC dampers, electrical and piping penetration seals, and openings through the fire area rated boundaries are described.

c. Major equipment

The major safety-related equipment and non-safety-related equipment with high combustible loading within each fire zone are identified. Equipment and components that are available for a safe shutdown in the event of a fire and that are in the fire zone are marked with an "S."

The equipment in each fire zone that contains radioactive materials is marked with an "R" to help identify equipment that has the potential for a significant release of radioactive products. Smoke detectors and radiation monitors that contain radioactive materials are found throughout the plant and are not included.

9.5A.2.2 Combustibles and Load Quantity

The combustible loading in a fire area/zone is quantified and evaluated to determine an equivalent fire severity in units of time. The calculation of fire loads in a given area or zone considers the effect of the potential heat release spread over the total floor area of the fire area or fire zone. Although the calculation does not account for combustible concentrations, it provides a method of quantifying the effects of a potential fire rather than a maximum concentration in a limited area, the fire area, or the fire zone.

The analysis method that is used to determine fire severity is as follows:

a. Determine the in-situ combustible load for each type of combustible material present in the fire area.

   Cables routed in conduit throughout the area are not included.

   Combustibles in the various areas of the plant are composed primarily of electrical insulation, lubricating oil, charcoal filters, and miscellaneous paper products. The actual in-situ quantities are not known at this time but are conservatively estimated.

b. Determine the transient combustible load for each type of combustible material present in the fire area.

Transient fire loadings are unidentified combustibles, generally given as being equivalent in kJ (Btu) content to the fire load, that are dependent on the type and quantity of the in-situ load in the fire area or zone. Transient fire loadings are determined as follows:

1) In each area or zone that contains fluid components such as pumps, a transient combustible load of one or more 280 L (55 gal) drums of lubricating oil is considered.

2) Where cable is the predominant combustible, an average of 91.44 m (300 ft) of replacement cable (approximately 506,427 kJ [480,000 Btu]) is considered. In areas with a large amount of cable insulation (i.e., more than 914.4 m [3,000 ft]), however, approximately 10 percent of the total heat release due to the permanent cable insulation is considered.

3) Where the predominant combustibles are consumable items, the replacement of the combustibles (minimum 422,022 kJ [400,000 Btu]) is considered in calculating the total transient combustible load.

c. Derive the total heat load, in Btu, from the heat of combustion assuming complete combustion.

The total heat load includes both in-situ and postulated transient combustible loads.

d. Calculate the floor surface area of the fire area.

The floor area is the gross bounded area of the fire area less the following:

1) Horizontal cross-sectional area of interior concrete walls of thickness greater than or equal to 0.61 m (2 ft)

2) Area of floor openings (e.g., uncovered hatches and openings covered by grating)

3) Horizontal cross-sectional area of open stairwells or elevator shafts

e. Calculate the fire load from the total heat load divided by the floor area, in kJ/m^2 (Btu/ft^2).

f. Calculate an equivalent fire severity in units of time.

Performance fire tests of materials and construction are rated for severity by the standard time-temperature curve developed from the ASTM E-119 fire test (Reference 2). The curve is based on test data from a fuel-surface controlled fire with a wood combustible loading and represents the maximum severity of this type of fire. Fire severity is determined by the quantity of material burned and the rate of burning. Most fire testing has been done on compartment configurations with roofs, doors, and windows, and has involved a fuel of cellulosic materials such as wood and paper having caloric values of 16,282 to 18,608 kJ/kg (7,000 to 8,000 Btu/lb). By analyzing the data, the relationship between the combustible loading that produces an exposure equivalent and the standard time-temperature curve for a specific duration can be approximated. By using these principles and the information in Table 9.5A-1, the severity and duration of a fire, in terms of material available to burn, can be evaluated.

9.5A.2.3 Fire Protection Adequacy

The adequacy of the fire protection features for a postulated fire in each fire area is evaluated. The evaluation involves the followings:

a. Compliance with regulatory guidance or requirements

b. Compliance with National Fire Protection Association (NFPA) codes

c. Review of how the fire is detected and suppressed

d. Verification of a fire barrier to confine a fire and limit fire damage

e. Verification that the ventilation system (HVAC) in the fire area properly limits the spread of fire and removes or controls smoke

f. Verification that a fire in a non-safety-related area does not threaten safety-related areas

The fire protection features in each area are described in Table 9.5A-2 according to the following criteria:

a. Detection systems

The type of fire detection system provided within the fire area is provided. The smoke detectors in HVAC ducts are not considered because detectors outside ducts are adequate to detect fires in the fire area. Fire detection systems annunciate in the main control room, the remote shutdown room, and on local control panels. Fire detectors in all fire areas or zones that provide early warning and actuate fire suppression systems are selected based on the combustible materials present, NFPA 72 guidelines (Reference 3), and manufacturer recommendations.

b. Suppression systems

The fire suppression systems for extinguishing fires in various fire suppression zones in the APR1400 are listed. Fire suppression zones are designated to indicate portions of fire areas that are protected either fully or partially by an automatic or manual suppression system. In some cases, a suppression zone is equivalent to a fire area.

c. Hose station

The manual hose stations available to extinguish a fire area/zone are listed. If a hose station to be used is not located within a fire area, the acceptability of its physical location relative to the fire area is confirmed.

d. Portable fire extinguishers

All of the portable fire extinguishers located within or near a fire area are noted. The type of portable fire extinguisher depends on the type of combustible hazards in the fire area.

e. Smoke removal provisions

A description of the smoke venting method provided for smoke removal from a fire area/zone during a fire is provided.

f. Provisions for access and egress

The presence of access and egress routes within all fire areas/zones needed for firefighting and personnel egress is indicated.

9.5A.2.4 Fire Protection Integrity

For fire areas containing safety-related SSCs, the potential for a credible inadvertent actuation of automatic fire suppression systems is evaluated. Inadvertent actuation effects of the fire suppression system initiated by events such as operator testing error, maintenance activities, and earthquakes are evaluated.

Safe shutdown and safety-related equipment cannot be rendered inoperable by an inadvertent operation of the fire suppression system installed in a fire area.

A properly installed clean agent system, if inadvertently discharged, does not cause damage to safety-related equipment. Therefore, in most cases, fire suppression systems installed in fire areas containing safety-related equipment except the reactor coolant pumps (RCPs) are preaction sprinkler systems or automatic clean agent suppression systems.

The preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed-type sprinkler heads. Even if the preaction valve is opened by a spurious fire detection signal, the water is retained within the piping if there is no actual fire that could melt the fusible sprinkler heads.

9.5A.2.5 Fire Safe Shutdown Analysis

This subsection describes the methodology for evaluating the potential impact of a fire on the capability to achieve a safe shutdown of the plant in each fire area. This evaluation is based on the criteria and assumptions described in Subsection 9.5A.2.5.1.

As indicated in Subsection 9.5A.1, the fire safe shutdown analysis is based on the requirements of NRC RG 1.189. The APR1400 meets the enhanced fire protection criteria designated in NRC RG 1.189, Regulatory Position 8.2. The fire safe shutdown analysis confirms that safe shutdown can be achieved by assuming that all equipment in any fire area is rendered inoperable by fire, and that re-entry into the fire area for repairs and operator actions is not possible.

The control room is excluded from this approach because of its physical configuration. The APR1400 design includes an independent alternative shutdown capability that is physically and electrically independent of the control room.

Fire protection for redundant shutdown systems in the reactor containment building provides reasonable assurance that one shutdown division is free of fire damage. Additionally, an assessment is performed to provide reasonable assurance that smoke, hot gases, or the fire suppressant do not migrate into other fire areas to the extent that they could adversely affect safe-shutdown capabilities, including operator actions.

The safe shutdown analysis includes identification of the following:

a. Cables that need to be protected (i.e., fire wrap)

b. Equipment that needs to be manually operated

c. Equipment that needs an 8-hour battery pack for lighting access routes for local manual action

For the purpose of this analysis, hot standby and cold shutdown are defined as follows:

a. Hot standby – A plant condition in which the reactor is subcritical with a shutdown margin which is addressed in subsection 16.B, and the primary coolant system cold leg temperature is greater than or equal to 176 °C (350 °F).

b. Cold shutdown – A plant condition in which the reactor is subcritical with a shutdown margin which is addressed in subsection 16.B, and the primary coolant system cold leg temperature is less than or equal to 99 °C (210 °F).

A safe shutdown condition is achieved by meeting the following requirements:

a. Maintain the RCS pressure boundary integrity

b. Provide reasonable assurance that the reactivity control function maintains cold shutdown reactivity conditions

c. Provide reasonable assurance that reactor coolant makeup is available to maintain the reactor coolant level within the level indication of the pressurizer

d. Maintain decay heat removal function

e. Provide direct reading of process variables necessary to perform and control the above functions

f. Maintain support functions for equipment required for safe shutdown

9.5A.2.5.1 Criteria and Assumptions

The fire safe shutdown analysis is based on the criteria and assumptions described below.

Design Basis Fire

A design basis fire is postulated for each fire area/zone. Design basis fires are fires that develop in a local area and have the following characteristics: no manual, automatic, or other firefighting action has been initiated; the fire has passed flashover (i.e., the temperature at which auto-ignition of other combustibles in the area occurs); and the fire has reached a peak burning rate.

A design basis fire is the most severe fire that would cause the most damage in a fire area or zone. The design basis fire concept dictates the design of protective measures. The design basis fire is not considered a credible event for most areas.

Fire initiation and the failure of existing automatic protection systems are assumed, as suggested in NRC RG 1.189. Flashover conditions are not assumed unless it is apparent that the arrangement of combustibles in the fire area or zone makes flashover a possibility. Thus, the analysis is conservative. In addition, in the fire hazard analysis, a fire is not considered to occur simultaneously with non-fire-rated failures in safety systems, plant accidents, events, or the most severe natural phenomena. However, a loss of offsite power (LOOP) is assumed to be concurrent with the postulated fire only when the safe shutdown evaluation indicates that the fire could result in a LOOP, as required by the regulatory guidance.

In the design basis fire evaluation of each fire area or zone, the following aspects are considered:

a. Potential effect on safe shutdown and safety-related equipment if all equipment within each fire area is lost

b. Potential for release of radioactive materials in the event of a fire within each area

Manual Operation

Manual operations or repair operations in a fire-affected area are assumed to be impossible.

For a fire in the main control room, evacuation of the main control room is assumed to occur. However, credit is taken for a reactor trip and verification of the control element assembly (CEA) insertion prior to evacuation. Control element assembly insertion is sufficient to provide reasonable assurance of subcriticality to maintain hot standby. If a manual scram from the control room is not possible prior to exiting, this action can be performed at the remote shutdown room. For fires outside the main control room, the operators are assumed to remain in the main control room and to use the instruments and controls in the main control room to the greatest possible extent, in accordance with station procedures.

No other manual actions are required for safe reactor shutdown, which can be accomplished from either the main control room or the remote shutdown room.

High-Low Pressure Interface

All interfaces of the reactor coolant system with other plant fluid systems that use electrically actuated valves for isolation of the reactor coolant pressure boundary are reviewed. An evaluation is performed for each interface to determine if a single fire could result in an uncontrolled loss of reactor coolant due to the inadvertent actuation of a valve(s). Spurious opening of valves is considered to occur as a result of shorts within a single cable (wire-to-wire shorts), shorts between separate cables (cable-to-cable hot shorts), or open circuits (if applicable). Where redundant valves in series are used to prevent damage in the event of a single failure in redundant valve, appropriate fire separation and installation are provided to prevent a fire-induced failure from resulting in a violation of a high-low pressure interface.

Associated Circuits

Cables that are not needed for safe shutdown but have a common power source or common raceway with cables that are needed have coordinated short circuit protection so that an open, ground, or hot short of these cables does not affect the system with which the power source or raceway is shared.

Spurious actuation by an associated circuit, whose fire-induced failure could affect shutdown, is not a concern for the APR1400 because of the fire barriers that separate redundant divisions. However, where separation is not complete, spurious actuation by an associated circuit is addressed, consistent with the approach used in licensed U.S. plants as well as the APR1400 Design Certification (DC), as follows:

a. In non-safe-shutdown equipment powered from a source common to safe shutdown equipment, the associated circuit interrupting device time-over-current trip characteristic (for all circuit faults) interrupts the fault current prior to the initiation of a trip of any upstream interrupting devices. In all cases, the power source supplies the necessary fault current for a sufficient time to provide reasonable assurance of proper coordination. The interrupting device design is factory tested to verify overcurrent protection as designed in accordance with the applicable standards. The low and medium voltage switchgear (480 V and greater) circuit breaker protective relays are tested periodically to demonstrate that the coordination scheme remains within the specified limits. The molded case

circuit breakers are manually exercised periodically and inspected to provide reasonable assurance of ease of operation. In addition, a sample of the breakers is tested periodically to determine that breaker drift is within the allowed limits according to the design criteria. Where fuses are being used as interrupting devices, administrative controls provide reasonable assurance that correct replacement fuses are used. Therefore, a common source with the redundant shutdown equipment is always protected.

b. Most associated cables that share a common raceway (and all safe shutdown cables) in the APR1400 DC meet the IEEE 383(Reference 4) flame test, which demonstrates that a cable does not propagate fire even if its outer covering and insulation have been destroyed in the area of flame impingement.

c. Most associated cables that share a common enclosure (e.g., control panel, MCC, terminal box), as noted above, (and all safe shutdown cables) in the APR1400 DC meet the IEEE 383 flame test. As a result, any fire in an enclosure containing safe shutdown circuits does not propagate to an enclosure containing redundant safe shutdown circuits.

Spurious Operation

Fire-caused damage is assumed to be capable of resulting in the following types of circuit faults: hot shorts, open circuits, and shorts to ground. Spurious operation of components caused by these circuit faults is evaluated, and components are assumed to be energized or de-energized by one or more of these circuit faults.

The potential for spurious actuation of equipment as a result of fire damage to electrical circuits is considered for each fire area. As described in Subsection 9.5A.2.5.2.d, multiple spurious operations resulting from the fire were assessed, and it was concluded that spurious actuations do not occur, or the consequences are such that safe shutdown can still be achieved. The spurious actuation of equipment does not prevent safe shutdown.

The list of PWR MSO scenarios in Table G-2 of NEI 00-01, Rev. 3, formed the basis for this evaluation. Each scenario was reviewed to determine whether it was applicable to the APR1400. During the review of the generic MSO scenarios in NEI 00-01, Rev. 3, the

APR1400 design was also reviewed for possible MSOs not found on the generic list and specific to the APR1400 design.

Each fire area was evaluated to determine whether a fire could result in an MSO. If the evaluation showed that an MSO in the area was possible, one of the following approaches was used to resolve the concern:

a. Consequences of the MSO were determined to have no effect on safe shutdown

b. More in-depth analysis showed that there was no MSO concern

c. The design or procedure was changed to remove the MSO concern

The APR 1400 safe shutdown analysis is based on crediting the design separation of the electrical distribution system and the design separation of the credited shutdown flow path trains. The separation design criteria are assumed to be valid and constitute the baseline for the MSO review. All cable routing is based on the current level of design documentation that is available.

Plant Personnel

The plant operating staff in the main control room is sufficient to achieve safe plant shutdown. No manual actions other than normal main control room actions or tripping the MCR/RSR transfer switches upon MCR evacuation are required to achieve safe shutdown. The personnel assigned to the plant fire brigade do not reduce the minimum control room staffing or the number of operators for safe-shutdown actions.

Equipment Environment

Equipment that is dedicated to a safe plant shutdown is maintained in a normal operating environment by being properly isolated from fire effects by 3-hour-rated fire barriers that also confine the fire effects to the area of fire occurrence. Equipment in a fire-involved compartment is not relied on for achieving safe plant shutdown.

Emergency Communication

Fixed emergency communications independent of the normal plant communication system are installed at predetermined stations. In addition, a portable radio communications system is installed for use by the fire brigade and other operations personnel required to achieve safe plant shutdown. This system does not interfere with the communications capabilities of the plant security force. Fixed repeaters are installed to permit the use of portable radio communication units throughout the plant. The fire repeaters are protected from exposure fire damage.

Emergency Lighting

Emergency lighting is provided in selected areas for safe-shutdown of the plant, restoring the plant to normal operation, firefighting and safe movement of people to the access and egress routes during plant off-normal condition and loss of normal power supply.

Emergency lighting system is composed of emergency alternation current (ac) and emergency direct current (dc) lighting system.

Emergency ac lighting is provided in areas where emergency operations are required to be performed to safely-shutdown the reactor, maintain the plant in safe-shutdown condition during the design basis events. The emergency ac lighting provides more than 10 foot-candles of illumination at the safety panel, workstations in the control room and the remote shutdown room areas.

Emergency dc lighting system from 8-hour self-contained battery lighting fixtures is provided in areas needed for operation of safe-shutdown equipment and for access and egress routed thereto during loss of normal or emergency ac lighting power. The 8-hour self-contained battery lighting fixtures located in the Class 1E equipment areas are qualified for seismic Category I requirements. The receptacles for charging these 8-hour self-contained battery lighting fixtures in the MCR are also fed from the emergency ac lighting panels powered from the Class 1E motor control centers. The receptacles for charging the 8-hour self-contained battery lighting fixtures located in all other areas are connected to the lighting and receptacle circuits fed from the normal or emergency ac lighting panels. The 8-hour self-contained battery lighting fixtures provide minimum illumination at the end of 8 hours of at least 0.1 foot-candles at the floor level along travel paths.

Shutdown/Refueling Operations

During shutdown operations, particularly during maintenance or refueling outages, fire conditions can change significantly as a result of work activities. Redundant systems important to safety may not be available. Fire protection during shutdown or refueling conditions minimizes 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 release of radioactive materials, under the unusual conditions that may be present during these operations.

Self-contained breathing apparatuses are provided near the containment entrances for firefighting and damage control personnel to support fire safety during shutdown/refueling operations. These apparatuses are independent of any breathing apparatuses or air supply systems provided for general plant activities and are clearly marked as emergency equipment. A fire water standpipe system installed within the containment can be pressurized during outages. Fire extinguisher stations are established within containment. Fire hose and fire extinguishers are staged near the containment entrances to facilitate redistribution to the containment locations during refueling outages.

9.5A.2.5.2 Analysis Methodology

The analysis was conducted in the following manner:

a. Systems and components that could be used to meet safe shutdown conditions are identified. Instrumentation that the operators could use to verify the plant and equipment status is also identified. Systems and components required to support the operation of the primary systems required for safe shutdown are included.

b. The next step is to perform a preliminary safe shutdown analysis and establish plant guidelines for routing safe shutdown cables. According to the fundamental fire protection criterion established for the APR1400, redundant trains of safe shutdown equipment are separated by 3-hour-rated structural barriers. Therefore, safe shutdown equipment is located using this criterion during the development of the general arrangement and fire barrier drawings. The electrical cabling design follows the same design criterion. Redundant equipment and cables that cannot be separated by 3-hour-rated structural barriers because of overriding

considerations (e.g., inside containment) are evaluated against special separation criteria similar to the criteria that been accepted by the NRC on operating U.S. plants. The preliminary safe shutdown analysis identified safe shutdown equipment and cabling that are subject to special separation criteria. The results of the preliminary analysis were then used as input to the plant design process.

c. Once the plant design process has reached a suitable completion, the last step consists of the confirmatory safe shutdown analysis to verify that the established safe shutdown design criteria have been satisfactorily implemented. The confirmatory analysis is considered complete when the final safe shutdown cable routing design has been verified. Finally, for fire areas that contain components or cables from both trains of safe shutdown equipment, for example where special separation criteria has been invoked, justification for the existing design is provided.

d. Additionally, a multiple spurious operation (MSO) analysis is conducted to review the APR1400 design against the requirements of NRC RG 1.189, Revision 2, and NEI 00-01, Revision 3 (Reference 5). The NEI 00-01 Table F-1 MSO Checklist provides the process for identifying the MSOs using the guidance in NEI 00-01, Appendix G, for pressurized water reactor (PWR) generic MSO scenario determination.

9.5A.3 Fire Hazard Analysis Result

The fire hazard analysis is conducted for the following primary plant structures and associated fire areas, which are shown on Figures 9.5A-1 through 9.5A-24.

a. Containment building

b. Auxiliary building

c. EDG building

d. Turbine Generator Building

e. Compound Building

Table 9.5A-2 identifies the type and quantity of combustible materials in each fire zone and provides a summary of the fire hazard analysis.

9.5A.3.1 Containment Building

The containment building consists of one fire area: F000-CNB. For the purpose of the fire hazard analysis, the containment internal area is divided into 10 fire zones, as follows:

a. Z069-C01 ICI Cavity

b. Z100-C02A SG Cavity 1

c. Z100-C02B SG Cavity 2

d. Z100-C03 Reactor Drain Tank Room

e. Z100-C04 Letdown Heat Exchanger Room

f. Z128-C01 Regenerative Heat Exchanger Room

g. Z136-C02 Pressurizer Cavity

h. Z156-C01 Containment Upper Area

i. Z000-CAN Containment Annulus Area

j. Z000-CRP Refueling Pool Area

Fire Protection Adequacy Evaluation

It is considered highly unlikely that a fire in this zone would spread to another area because this area consists of several subcompartments that are made of concrete. Therefore, redundant divisions of equipment are generally well separated.

If the radioactive material contained in the equipment located inside the containment building is released by damage from a fire, the material would remain inside the

containment. In addition, the products of combustion would be exhausted through the containment purge system in this building.

The electrical penetration assemblies (EPAs) through the containment boundary are not sealed with a 3-hour-rated fire barrier seal. EPAs are fitted with stainless steel header plates that are designed to maintain the integrity of the containment building and form a continuous barrier to flames and hot gases. Stainless steel header plates are consistent with the approach at existing plants.

The personnel air lock is located on the 3-hour-rated barrier of the containment wall. The personnel air is designed to maintain the integrity of the containment boundary.

Reactor containment fan coolers, the control element drive mechanism (CEDM) cooling fans, and reactor cavity cooling fans can be used, if available, to disperse smoke before it is vented to the outside. The containment purge system can be used to remove smoke and supply outside air.

Fire Protection Integrity

Automatic water spray systems for the RCPs are installed in this area. Spurious operation of water spray systems may affect the availability of the RCPs, but the capability to shut down the reactor would not be impaired by the loss of any or all of the RCPs because these pumps are not needed for the safe shutdown of the reactor.

Safe Shutdown Analysis

The containment building is analyzed as a single area for safe shutdown purposes, consistent with the definition of a fire area in NRC RG 1.189. Redundant trains of equipment and associated cables needed for safe shutdown are located within the containment building and are generally separated from or protected by fire wrap and/or embedded in concrete. In the event of a fire in the containment building, at least one train of equipment (train B or D) is available for safe shutdown.

The following redundant equipment and cables associated with the following hot standby instrumentation are located in the containment building fire area:

a. Wide range RC hot leg temperature (four channels: 431-J-TE-132A, 132B, 133A, 133B)

b. Wide range RC cold leg temperature (four channels: 431-J-TE-142A, 142B, 143A, 143B)

c. Ex-core neutron monitoring (two channels: 731-J-NE-001A, 001B)

d. Wide range steam generator level (two channels per SG: 541-J-LT-1113A, 1113B, 1123A, 1123B)

e. Steam generator pressure (two channels per SG: 521-J-PT-1013A, 1013B, 1023A, 1023B)

f. Pressurizer wide range level (two channels: 431-J-LT-110A, 110B)

g. Pressurizer pressure (two channels: 431-J-PT-102A, 102B)

To provide reasonable assurance that a fire will not damage redundant trains of instrumentation, the following criteria are applied: (1) maintenance of separation by a 3-hour-rated fire barrier, (2) maintenance of a separation of at least 6.1 m (20 ft) between redundant trains of cabling with no intervening combustibles or fire hazard and installation of fire detectors and an automatic fire suppression system, and (3) protection of one train of cabling in a 1-hour-rated enclosure and installation of fire detectors and an automatic fire suppression system.

For inside the containment, the following criteria are applied: (1) installation of fire detectors and an automatic fire suppression system in the fire area and (2) separation of cables and equipment and associated non-safety circuits of redundant trains by a noncombustible radiant energy shield having a minimum fire rating of 30 minutes, as demonstrated by testing or analysis.

Thus, safe shutdown can be accomplished in the event of a fire in this area.

9.5A.3.2 Auxiliary Building (Division I)

Division I of the auxiliary building is divided into 112 fire areas for the fire hazard analysis.

9.5A.3.2.1 F050-A01C: CS Pump and Miniflow Heat Exchanger Room A

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z050-A01C CS Pump and Miniflow Heat Exchanger Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed by 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor is a basement that is not required to be rated, according to NRC RG 1.189.

The combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour fire-rated barriers provide adequate separation from adjacent fire areas, and a fire would be contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14 (Reference 6). Based on the expected fire hazards in this fire area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that could occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by an AB controlled area HVAC system. Any HVAC ductwork that passes into the area has automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After a fire, smoke is removed from the fire area by an exhaust air cleaning unit (ACU).

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the effect of the inadvertent actuation of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas by 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C) and is not needed for safe shutdown. Therefore, a complete loss of Division I (Quadrant C) equipment from a fire in this area would not affect plant safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.2.2 F050-A02C: Safety Injection Pump Room C

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone:

Z050-A02C Safety Injection Pump Room C

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor is a basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas by 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) is acceptable because the redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

The charcoal filters in the auxiliary building exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated. Therefore, significant release is not expected.

9.5A.3.2.3 F050-A03A: Safety Injection Pump Room A

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z050-A03A Safety Injection Pump Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC

ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by an AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas by 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

The charcoal filters in the auxiliary building exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated. Therefore, significant release is not expected.

9.5A.3.2.4 F050-A04A: SC Pump and Mini-Flow Heat Exchanger Room A

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z050-A04A SC Pump and Mini Flow Heat Exchanger Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.2.5 F055-A01C: Containment Spray Heat Exchanger Room A

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A01C Containment Spray Heat Exchanger Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through the barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries on this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division I (Quadrant A) and is not needed for safe shutdown. Therefore, a complete loss of Division I (Quadrant A) equipment in the event of a fire in this area would not affect the plant safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.2.6 F055-A02A: Component Cooling Water Pump Room A

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A02A Component Cooling Water Pump Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and the south wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through the barriers is equipped with a fire damper. The floor and south wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.2.7 F055-A02C: Component Cooling Water Pump Room C

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A02C Component Cooling Water Pump Room C

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and the south wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through the barriers is equipped with a fire damper. The floor and south wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.2.8 Z055-A04C: Seismic CAT- I Fire Water Tank Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A04C Seismic CAT- I Fire Water Tank Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through the barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I. Therefore, a complete loss of Division I equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.2.9 F055-A10C: Tendon Gallery Entrance Area

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A10C Tendon Gallery Entrance Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through the barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.2.10 F055-A14C: Pipe Chase, and Valve Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A14C Pipe Chase and Valve Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries in this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.2.11 F055-A18A: Pipe Chase and Valve Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A18A Pipe Chase and Valve Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.2.12 F055-A21A: Pipe Chase and Valve Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A21A Pipe Chase and Valve Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.2.13 F055-A22A – Pipe Chase

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A22A Pipe Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.2.14 F055-A30A: SC Heat Exchanger Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A30A SC Heat Exchanger Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor and east wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division I (Quadrant A) and is not needed for safe shutdown. Therefore, a complete loss of Division I (Quadrant A) equipment in the event of a fire in this area would not affect the plant safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.2.15 F055-A42A: Charging Pump Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A42A Charging Pump Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is Division I. Therefore, a complete loss of Division I is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

The charcoal filters in the exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated. Therefore, significant release is not expected.

9.5A.3.2.16 F055-A19A: General Access Area A – 55 ft 0 in

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A19A General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

9.5A.3.2.17 F055-AGAC: General Access Area C – 55 ft 0 in

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A07C General Access Area

Z055-A03C Central Water Chiller Room

Z055-A08C Floor Drain Sump Pump Room

Z055-A57C Piping and Cable Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour -rated concrete walls except the floor and the south wall and has 3-hour-rated fire doors. Pe*n*etrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor and south wall of this area are basement that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and a heat detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

9.5A.3.2.18 F065-A01C: Diesel Fuel Oil Storage Tank Room C

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z065-A01C Diesel Fuel Oil Storage Tank Room C

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall below grade. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The exterior walls of this area are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by temperature and flame detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, manual extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The equipment in this fire area is Quadrant C. This area is separated from the adjacent fire areas by 3-hour-rated fire barriers and there is no penetration on the barrier common to Quadrant D DG fuel oil storage tank room. The fuel oil storage tank is separated by dikes, and there is no ignition source. The probability that a fire would occur in the fuel oil transfer pump room is low, but the effect of the fire would be negligible. An automatic preaction suppression system is installed for the DG fuel oil storage tank and fuel oil transfer pump. Three-hour-rated fire dampers are installed in the HVAC openings, in the 3-hour-rated fire barrier. Therefore, the safe shutdown of the plant is not affected because a fire does not spread to adjacent fire area and the redundant division of equipment, which is located in a separate fire area, is available.

9.5A.3.2.19 F068-A05A: HVAC Chase

Figure 9.5A-2 shows the location of this fire area, which comprises the following zone(s):

Z068-A05A HVAC Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated doors. HVAC ductwork that passes into a barrier is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is high, and the duration of fire is expected to be long. However, 3-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area by 3-hour-rated fire barriers, and equipment in this area is not needed for a safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.20 F078-A01C: PNS SWGR Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A01C PNS SWGR Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the

expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.21 F078-A02C: Class 1E Switchgear 01C Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A02C Class 1E Switchgear 01C Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an AB smoke removal fan.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The only combustible material in this area is the cable insulation material. The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Quadrant C. Therefore, a complete loss of Quadrant C equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.2.22 F078-A03C: Class 1E Load Center 01C Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A03C Class 1E Load Center 01C Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The only combustible material in this area is the cable insulation material. The design basis fire would occur if all cable insulation in this area burned. This fire area is separated

from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.2.23 F078-A04C: MISC. Electrical Equipment Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A04C MISC. Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment

located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.24 F078-A05C: Train C DC and IP Equipment Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A05C Train C DC and IP Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The only combustible material in this area is the cable insulation material. The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.2.25 F078-A06C: N1E Battery Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A06C N1E Battery Room Fire Protection Adequacy Evaluation

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector or temperature detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related equipment or structures that would be affected by the fire.

9.5A.3.2.26 F078-A07C: Train C Battery Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A07C Train C Battery Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector or temperature detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed

penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all combustible materials in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.2.27 F078-A09C: HVAC Chase

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A09C HVAC Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load is heavy but the duration of fire is expected to be within 3-hour. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.28 F078-A11C: Essential Chiller Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A11C Essential Chiller Room Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.29 F078-A12C: Essential Chiller Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A12C Essential Chiller Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.30 F078-A14C: Buttress Opening

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A14C Buttress Opening Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.31 F078-A16C: HVAC Chase

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone:

Z078-A16C HVAC Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.32 F078-A19A: General Access Area A – 78 ft 0 in

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone:

Z078-A19A General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.33 F078-A20A: Motor-Driven AFW Pump Room A

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A20A Motor-Driven AFW Pump Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.34 F078-A21A: Pipe Chase

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A21A Pipe Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

There is no safe shutdown equipment. Loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.2.35 F078-A23A: Buttress Opening

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A23A Buttress Opening

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area extinguished manually using portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated

boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

There is no safe shutdown equipment. Loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.2.36 F078-A25A: Class 1E Switchgear 01A Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A25A Class 1E Switchgear 01A Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire

that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.37 F078-A52C: 480V N1E MCC Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A52C 480V N1E MCC Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the south wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC

ductwork that passes through barriers is equipped with a fire damper. The south wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.38 F078-A53C: 480V N1E Loadcenter Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A53C 480V N1E Loadcenter Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the south wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The south wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.39 F078-A56A: Train A DC and IP Equipment Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A56A Train A DC and IP Equip. Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.40 F078-AAFC: Turbine AFW Driven Pump Room A

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A15C Turbine AFW Driven Pump Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I. Therefore, a complete loss of Division I equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.41 F078-AGAC: General Access Area C – 78 ft 0 in

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A10C	General Access Area
Z078-A29C	CCW Makeup Pump Room
Z078-A57C	Piping and Cable Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the south wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The south wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.42 F000-AHV: HELB Vent Area

Figures 9.5A-1 through 9.5A-6 show the location of this fire area, which comprises the following zone(s):

Z055-A46B Condensate Return Unit Room

Z068-A06A Gas Stripper Room

Z078-A40B Boric Acid Conc. Room

Z078-A42B HELB Area AHU Room

Z078-A43B HELB Area ACU Room

Z120-A14A SG Blowdown Regen. Hx. Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor

and east wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

There is no safe shutdown equipment. Loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.2.43 F000-ADGC: Diesel Generator Room C

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z000-ADGC Diesel Generator Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a heat detector and flame detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection

signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas by a 3-hour-rated fire barrier, and the equipment in this area is all Division I (Quadrant C). Therefore, safe shutdown of the plant is available using the Division II (Quadrant D) safe shutdown equipment in the event of the fire in this area.

9.5A.3.2.44 F100-A04C: Cable Access Area

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A04C Cable Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed

penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The only combustible material in this area is the cable insulation material. The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers. The ability to safely shut down the plant would not be affected by a fire in this area because cable trays and conduits of only one train are routed through this area and a redundant division separated by 3-hour-rated fire barriers is available.

9.5A.3.2.45 F100-A05C: Electrical Equipment Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A05C Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

There is no safe shutdown equipment. Loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.2.46 F100-A07C: Auxiliary Feed Water Tank Room A

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A07C Auxiliary Feed Water Tank Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

There is no ignition source. Fire load and the duration of fire from assumption of ordinary combustible are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I. Therefore, a complete loss of Division I equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.47 F100-A08C: Non 1E DC and IP Equipment Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A08C Non-1E DC and IP Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers

at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.48 F100-A10A: General Access Area A – 100 ft 0 in

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A10A General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.49 F100-A11A: Train A Battery Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A11A Train A Battery Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a temperature detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.50 F100-A13A, Mechanical Penetration Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A13A Mechanical Penetration Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.51 F100-A16C: Pipe Chase

Figure 9.5A-4 shows the location of this fire area, which comprises the following zones:

Z100-A16C Pipe Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable

9.5A.3.2.52 F100-A23A: AB Controlled Area (I) Supply ACU Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A23A AB Controlled Area (I) Supply AHU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I. Therefore, a complete loss of Division I equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.53 F100-A24A: SFP Cooling Heat Exchanger Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A24A SFP Cooling Heat Exchanger Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The east wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by fuel handling area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I. Therefore, a complete loss of Division I equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

Potential for release of radioactive materials is not significant because products of combustion are exhausted through HEPA filters in the fuel building HVAC system. In addition, the redundant spent fuel pool cooling pump is available to maintain cooling of the radioactive spent fuel pool.

9.5A.3.2.54 F100-A38A, Fuel Handling Area Normal Exhaust ACU Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A38A Fuel Handling Area Normal Exhaust ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by fuel handling area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This area is separated from the adjacent fire areas with 3-hour-rated fire barriers and has no safe shutdown equipment. Therefore, the capability to safely shut down the plant would not be affected by the design basis fire in this area.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.2.55 F100-AEEA: 480V Class 1E MCC Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A12A 480V Class 1E MCC 01A Room

Z100-A18A MUX N1 Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant A). Therefore, a complete loss of Division I (Quadrant A) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.56 F100-AGAC, General Access Area C – 100 ft 0 in

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A06C General Access Area

Z100-A09C Tendon Access Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.57 F120-A01C, Piping Cable Area

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A01C Piping Cable Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in

this area is Division I. Therefore, a complete loss of Division I equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.58 F120-A02C, Lube Oil Makeup Tank Room C

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A02C Lube Oil Makeup Tank Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

A fire in this area is detected by fire detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a fire hose and portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, manual water hoses, portable extinguishers, and an automatic fire detection system provides a defense in-depth approach of providing reasonable assurance of fire protection adequacy in this fire area and preventing the spread of a fire outside the fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally

closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.59 F120-A03C, Diesel Fuel Oil Day Tank Room C

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A03C Diesel Fuel Oil Day Tank Room C

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

A fire in this area is detected by fire detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a fire hose and portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, manual water hoses, portable extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this fire area is adequate and the spread of a fire outside this fire area is prevented.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I (Quadrant C). Therefore, a complete loss of Division I (Quadrant C) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.60 F120-A05C, Electrical Equipment Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A05C Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.61 F120-A08C, 480V N1E MCC Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A08C 480V N1E MCC Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.62 F120-A09C, Electrical Equipment Room C

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A09C Electrical Equipment Room C

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division I. Therefore, a complete loss of Division I equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, is available for safe shutdown.

9.5A.3.2.63 F120-A16A, Mechanical Penetration Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A16A Mechanical Penetration Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.64 F120-A21A, AB Controlled Area (I) ECCS Equipment Room Exhaust ACU Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A21A AB Controlled Area (I) ECCS Equip. Rm. Exhaust ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.2.65 F120-A24A, FH Area Emergency Exhaust ACU Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A24A FH Area Emergency Exhaust ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by fuel handling area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and the equipment in this area are all Division I. Therefore, a complete loss of Division I equipment is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.2.66 F120-A25A, HVAC Chase

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A25A HVAC Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the wall to the out-of-doors and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.67 F120-A32A, AB Controlled Area (I) ECCS Equipment Room Exhaust ACU Room 2

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A32A AB Controlled Area (I) ECCS Equip. Rm. Exhaust ACU Room 2

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load is heavy but the duration of fire is expected to be within 3-hour. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.2.68 F120-AGAA, General Access Area A – 120 ft 0 in

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A11A General Access Area

Z120-A18A LX Panel Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.69 F120-AGAC, General Access Area C – 120 ft 0 in

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A07C General Access Area

Z120-A10C Essential Chilled Water Make-up Pump Room

Z120-A18C Lx Panel Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.70 F137-A01C, Cable Spreading Area

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A01C Cable Spreading Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

These fire areas may contain cables from Channel A and C safety-related equipment. This is because cables serving the Train A area (e.g., electrical penetration area) at elevation 13 ft 6 in goes down to elevation 120 ft 0 in area, moves horizontally to the Quadrant C area, and moves vertically up to the MCR area, which is located at elevation 156 ft 6 in. Therefore, separation between channels is not maintained in these areas. However, fire damage to these cables is acceptable because the redundant division cables and equipment are available for safe shutdown. Regardless of the safe shutdown capability, reasonable assurance of maximization of cable separation in these areas is provided.

9.5A.3.2.71 F137-A02C, Electrical Equipment Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A02C Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour fire-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed

penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.72 F137-A03C, CEDM M/G SET Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A03C CEDM M/G Set Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers

at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.73 F137-A04C, CEDM Power Control Cabinet Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A04C CEDM Power Control Cabinet Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.74 F137-A09C, General Access Area C – 137 ft 6 in

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A09C General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.75 F137-A10C, 480V Class 1E MCC 03C Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A10C 480V Class 1E MCC 03C Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.76 F137-A11C, Electrical Penetration Room C

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A11C Electrical Penetration Room C

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.77 F137-A15A, 480V Class 1E MCC 04A Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A15A 480V Class 1E MCC 04A Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.78 F137-A20A, General Access Area A – 137 ft 6 in

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A20A General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.79 F137-A23A, 480V Class 1E MCC 03A Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A23A 480V Class 1E MCC 03A Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The east wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.80 F137-A25A, FH Area Emergency Exhaust ACU Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A25A FH Area Emergency Exhaust ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The east wall in this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by fuel handling area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and

openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.2.81 F137-A30C, Main Steam Enclosure

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A30C Main Steam Enclosure

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the south and west walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The various walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.82 F137-A31C, MS Valve Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A31C MS Valve Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the south wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The south wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

Equipment from Divisions I and II is located in this area. In the event of a fire in this area, both divisions of safe shutdown equipment may fail. To address this concern, one train of safe shutdown equipment is protected.

This room contains the two atmospheric dump valves (ADVs) and two atmospheric dump isolation valves for SG 1. Atmospheric dump valves 521-V-0102 are powered from BE/DE, and valve 521-V-0101 is powered from AE/CE. Atmospheric dump isolation valve 521-V-0105 is powered from AE1 and 521-V-0106 is powered from BE2. Thus, cables from both divisions are present and could be damaged by a fire. Although a symmetric cooldown of the plant is preferred (i.e., using both SGs), a fire in this area would not affect the capability to safely shut down the plant because an asymmetric cooldown could be performed using SG 2. Additionally, ADVs can be operated by using local manual actuators.

The SG 1 main steam isolation valves (MSIV) are located in this area. However, fire damage would not prevent safe shutdown because these valves are fail-closed valves and are powered from both Division I and Division II Class 1E power sources.

9.5A.3.2.83 F137-A35C, Reactor Trip Switchgear Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A35C Reactor Trip Switchgear Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.84 F137-A36C, Reactor Trip Switchgear Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A36C Reactor Trip Switchgear Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.85 F137-A37C, Reactor Trip Switchgear Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A37C Reactor Trip Switchgear Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.86 F137-A38C, Reactor Trip Switchgear Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A38C Reactor Trip Switchgear Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.87 F137-A41A, Remote Control Console Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A41A Remote Control Console Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose, or portable extinguishers in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

This fire area contains redundant divisions (all four channels) of instrumentations, controls, and cables needed for safe shutdown in the event of a fire in the MCR. In addition, other areas around the RCC room may contain cables from the redundant divisions of safe shutdown I&C components depending on the routing design of the cabling. However, unless the I&C components are transferred to the RCC room or remote shutdown panel (RSP) in the event of an MCR fire, all I&C components are set to the MCR mode during normal power operation. Therefore, fire damage to the control, instrumentation, and cables is acceptable because the I&C components in the MCR are available for safe shutdown.

9.5A.3.2.88 F137-AEPA, Electrical Penetration Room A

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A17A Penetration MUX A Room

Z137-A18A Electrical Penetration Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.89 F137-ANEA, Electrical Equipment Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A21A Electrical Equipment Room

Z137-A22A Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The east wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.90 F156-A14A, AB Controlled Area (I) Normal Exhaust ACU Room

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z156-A14A AB Controlled Area (I) Normal Exhaust ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The east wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and

openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.91 F156-A16A, SIS Filling Tank Room

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z156-A16A SIS Filling Tank Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north and east walls. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north and east walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.92 F157-ATOC, TSC Office

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-ATOC TSC Office

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has automatic clean agent system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

During normal operation, cold shutdown, and refueling, the MCR air-handling units and the MCR exhaust fan are actuated to perform ventilation and air conditioning inside the main control room envelope. In case of a fire generating smoke within the main control room, the smoke removal is accomplished by using control room area smoke removal fan.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, the clean agent suppression system does not affect the equipment, and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of the clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.93 F157-A16C, General Access Area C – 157 ft 0 in

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A16C General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and

regulatory guidance. Additional fire suppression capability is provided by a water hose or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, the clean agent suppression system does not affect the equipment, and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.94 F157-A18C, Clean Agent Room

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A18C Clean Agent Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.95 F157-A19C, I&C Equipment Room C

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A19C I&C Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by smoke detectors in accordance with NFPA 72. The fire area has automatic clean agent system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, the clean agent suppression system does not affect the equipment, and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of the clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.96 F157-A20C, I&C Equipment Room

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A20C I&C Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by smoke detectors in accordance with NFPA 72. The fire area has automatic clean agent system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, the clean agent suppression system does not affect the equipment and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.97 F157-A25C, I&C Equipment Room A

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A25C I&C Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by smoke detector in accordance with NFPA 72. The fire area has automatic clean agent system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, the clean agent suppression system does not affect the equipment, and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.98 F174-A01C, EDG Room Normal Exhaust Fan Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A01C EDG Room Normal Exhaust Fan Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries.

Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.99 F174-A05C, 480V N1E MCC Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A05C 480V N1E MCC Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.100 F174-A13C, 480V N1E MCC Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A13C 480V N1E MCC Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the

expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.2.101 F174-A14C, EDG Room Normal Supply AHU Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A14C EDG Room Normal Supply AHU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.102 F174-A23C, Control Room Area Supply AHUs Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A23C Control Room Area Supply AHUs Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

During normal operation, cold shutdown, and refueling, the MCR air-handling units and the MCR exhaust fan are actuated to perform ventilation and air conditioning inside the main control room envelope. In case of a fire generating smoke within the main control room, the smoke removal is accomplished by using control room area smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.103 F174-A24C, Control Room Area Supply AHU /ACU Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A24C Control Room Area Supply AHU /ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

During normal operation, cold shutdown, and refueling, the MCR air-handling units and the MCR exhaust fan are actuated to perform ventilation and air conditioning inside the main control room envelope. In case of a fire generating smoke within the main control room, the smoke removal is accomplished by using control room area smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time period within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.2.104 F174-A25C, HVAC Area

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A25C HVAC Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.105 F174-AGAC, General Access Area C – 174 ft 0 in

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A02C Essential Chilled Water Compression Tank Room

Z174-A03C CCW Surge Tank Room

Z174-A12C General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the south wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The south wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.2.106 F175-A01C, MSIV Room Supply AHU Room

Figure 9.5A-10 shows the location of this fire area. This area is comprised of the following zone(s):

Z175-A01C MSIV Room Supply AHU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete wall except exterior walls. Penetrations and openings are sealed for fire confinement. The walls of this area are exterior walls that are not required to be rated.

A fire in this area is detected by a smoke detector and extinguished manually using portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, evaluation of the inadvertent actuation effect of automatic suppression system is not required.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.2.107 F195-A02C, AB clean area Supply AHUs Room

Figure 9.5A-9 shows the location of this fire area, which comprises the following zone(s):

Z195-A02C AB clean area Supply AHUs Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the ceiling and the west wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The ceiling and west wall of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area has and is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.108 F195-A05C, 480V N1E Loadcenter Room

Figure 9.5A-9 shows the location of this fire area, which comprises the following zone(s):

Z195-A05C 480V N1E Loadcenter room

Fire Protection Adequacy Evaluation

The fire area is enclosed with non-rated concrete walls except the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. Most of the walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.109 F195-A09C, HVAC Exhaust Penthouse

Figure 9.5A-9 shows the location of this fire area, which comprises the following zone(s):

Z195-A09C HVAC Exhaust Penthouse

Fire Protection Adequacy Evaluation

The fire area is enclosed with non-rated concrete walls except the east wall and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper. Most of walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.110 F000-ACVL, CVCS Area – Lower Area

Figures 9.5A-1 through 9.5A-3 show the location of this fire area, which comprises the following zone(s):

Z055-ACVL CVCS Area – Lower Area El.55'-0"

Z068-ACVL CVCS Area – Lower Area El.68'-0"

Z078-ACVL CVCS Area – Lower Area El.78'-0"

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor and east wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.2.111 F000-ACVU, CVCS Area – Upper Area

Figures 9.5A-4 through 9.5A-7 show the location of this fire area, which comprises the following zone(s):

Z100-ACVU CVCS Area – Upper Area El.100'-0"

Z120-ACVU CVCS Area – Upper Area El.120'-0"

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the east wall and ceiling and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The east wall and ceiling of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The volume control tank (VCT) outlet isolation valves 451-V-501(AE) and 451-V-504(BE) are located in this area. At least one of these valves is closed to accomplish boration for cold shutdown, assuming the charging pumps take suction from the IRWST. In the event of the fire in this area, manual valves 451-V-316, 319, and 322 could be closed to isolate the VCT from the charging pump suction. These manual valves are located in the auxiliary building.

9.5A.3.2.112 Stairs, Elevator Hoistways, and Elevator Halls

Figures 9.5A-1 through 9.5A-9 show the location of these fire areas, which are as follows:

F049-A01C	Elevator Hoistway
F049-A02A	Elevator Hoistway
F055-A05C	Stair
F055-A20A	Stair
F055-A60A	Elevator Hall
F055-A61C	Elevator Hall

F078-A54A	Elevator Hall
F078-A55C	Elevator Hall
F100-A45A	Elevator Hall
F100-A46C	Elevator Hall
F120-A17A	Stair
F120-A33A	Elevator Hall
F120-A34C	Elevator Hall
F137-A16A	Elevator Hall
F137-A44C	Elevator Hall
F156-A13A	Elevator Hall
F157-A13C	Vestibule
F174-A18C	Elevator Hall
F195-A01C	Elevator Hall

The stairs and elevator hoistway with elevator halls are enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors.

There are no ignition sources in this area, and the fire load is expected to be light because of transient material.

A fire in this area is extinguished by fire hose and portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

9.5A.3.3 Auxiliary Building (Division II)

The auxiliary building (Division II) has been divided into 113 fire areas for the fire hazard analysis.

9.5A.3.3.1 F050-A01D, CS Pump and Mini Flow Heat Exchanger Room B

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z050-A01D CS Pump and Miniflow Heat Exchanger Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division II (Quadrant D) and is not needed for safe shutdown. Therefore, a complete loss of Division II (Quadrant D) equipment in the event of a fire in this area would not affect the plant safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.3.2 F050-A02D, Safety Injection Pump Room D

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z050-A02D Safety Injection Pump Room D

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division II (Quadrant D) and is not needed for safe shutdown. Therefore, a complete loss of Division II (Quadrant D) equipment in the event of a fire in this area would not affect the plant safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.3.3 F050-A03B, Safety Injection Pump Room B

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z050-A03B Safety Injection Pump Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC

ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division II (Quadrant B) and is not needed for safe shutdown. Therefore, a complete loss of Division II (Quadrant B) equipment in the event of a fire in this area would not affect the plant safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.3.4 F050-A04B, SC Pump and Mini Flow Heat Exchanger Room B

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z050-A04B SC Pump and Mini Flow Heat Exchanger Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division II (Quadrant B) and is not needed for safe shutdown. Therefore, a complete loss of Division II (Quadrant B) equipment in the event of a fire in this area would not affect the plant safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.3.5 F055-A01D, Containment Spray Heat Exchanger Room B

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A01D Containment Spray Heat Exchanger Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division II (Quadrant B) and is not needed for safe shutdown. Therefore, a complete loss of Division II (Quadrant B) equipment in the event of a fire in this area would not affect the plant safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.3.6 F055-A02B, Component Cooling Water Pump Room B

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A02B Component Cooling Water Pump Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor and north wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division II (Quadrant B) and is not needed for safe shutdown. Therefore, a complete loss of Division II (Quadrant B) equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.3.7 F055-A02D, Component Cooling Water Pump Room D

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A02D Component Cooling Water Pump Room D

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor and north wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division II (Quadrant D) and is not needed for safe shutdown. Therefore, a complete loss of Division II (Quadrant D) equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.3.8 F055-A04D, Seismic Category I Fire Water Tank Room B

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A04D Seismic CAT- I Fire Water Tank Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.3.9 F055-A14D, Pipe Chase and Valve Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A14D Pipe Chase and Valve Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.3.10 F055-A18B, Pipe Chase and Valve Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A18B Pipe Chase and Valve Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.3.11 F055-A21B, Pipe Chase and Valve Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A21B Pipe Chase and Valve Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.3.12 F055-A22B, Pipe Chase

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A22B Pipe Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment in this area is not needed for safe shutdown. Therefore, a complete loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.3.13 F055-A30B, Shutdown Cooling Heat Exchanger Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A30B SC Heat Exchanger Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor and east wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers, and the equipment in this area is Division II (Quadrant B) and is not needed for safe shutdown. Therefore, a complete loss of Division II (Quadrant B) equipment in the event of a fire in this area would not affect the plant safe shutdown.

Significant release is not expected because the charcoal filters in the AB exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.3.14 F055-A54B, Auxiliary Charging Pump Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A54B Auxiliary Charging Pump Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The Auxiliary Charging Pump (451-M-PP03) is designed to be powered from both divisions. Therefore, cabling and piping associated with Divisions I and II are routed in this area. However, a fire in this room would result in loss of only the auxiliary charging pump; at least one of the other two charging pumps (assuming one is down for maintenance) would be available to accomplish safe shutdown because two charging pumps and their associated cables are separated from this area by 3-hour-rated fire barriers.

9.5A.3.3.15 F055-A55B, Charging Pump Room

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A55B Charging Pump Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is Division II. Therefore, a complete loss of Division II is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

The charcoal filters in the exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated. Therefore, significant release is not expected.

9.5A.3.3.16 F055-A19B, General Access Area B – 55 ft 0 in

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A19B General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant B). Therefore, a complete loss of Division II (Quadrant B) is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

9.5A.3.3.17 F055-AGAD, General Access Area D – 55 ft 0 in

Figure 9.5A-1 shows the location of this fire area, which comprises the following zone(s):

Z055-A07D	General Access Area
Z055-A03D	Central Water Chiller Room
Z055-A08D	Floor Drain Sump Pump Room
Z055-A11D	Storage
Z055-A57D	Piping and Cable Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant D). Therefore, a complete loss of Division II (Quadrant D) is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

9.5A.3.3.18 F065-A01D, Diesel Fuel Oil Storage Tank Room D

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z065-A01D Diesel Fuel Oil Storage Tank Room D

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall below. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by temperature and flame detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, manual extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The equipment in this fire area is Quadrant D. This area is separated from the adjacent fire areas by 3-hour-rated fire barriers, and there is no penetration in the barrier common to

Quadrant C DG fuel oil storage tank room. The fuel oil storage tank is separated by dikes, and there is no ignition source. The probability that a fire would occur in the fuel oil transfer pump room is low, but the effect of the fire would be negligible. An automatic CO_2 suppression system is installed for the DG fuel oil storage tank and fuel oil transfer pump. Three-hour-rated fire dampers are installed in HVAC openings in the 3-hour-rated fire barrier. Therefore, the safe shutdown of the plant is not affected because a fire does not spread to adjacent fire area, and the redundant division of equipment, which is located in a separate fire area, is available.

9.5A.3.3.19 F078-A01D, PNS SWGR Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A01D PNS SWGR Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.20 F078-A02D, Class 1E Switchgear 01D Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A02D Class 1E Switchgear 01D Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The only combustible material in this area is the cable insulation material. The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Quadrant D. Therefore, a complete loss of Quadrant D equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.21 F078-A03D, Class 1E Load Center 01D Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A03D Class 1E Load Center 01D Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant D). Therefore, a complete loss of Division II (Quadrant D) is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

9.5A.3.3.22 F078-A04D, MISC. Electrical Equip Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A04D Miscellaneous Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from adjacent fire areas with 3-hour-rated fire barriers, and equipment in this area is Division II. Therefore, a complete loss of Division II is acceptable because a redundant division of equipment, which is located in a separate fire area, is available for safe shutdown.

9.5A.3.3.23 F078-A05D, Train D DC and IP Equipment Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A05D Train D DC and IP Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The only combustible material in this area is the cable insulation material. The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant D). Therefore, a complete loss of Division II (Quadrant D) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.24 F078-A06D, N1E Battery Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A06D N1E Battery Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector or temperature detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.25 F078-A07D, Train D Battery Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A07D Train D Battery Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector or temperature detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant D). Therefore, a complete loss of Division II (Quadrant D) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.26 F078-A09D, HVAC Chase

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A09D HVAC Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load is heavy but the duration of fire is expected to be within 3-hour. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.27 F078-A11D, Essential Chiller Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A11D Essential Chiller Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant B). Therefore, a complete loss of Division II (Quadrant B) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.28 F078-A12D, Essential Water Chiller Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A12D Essential Water Chiller Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2, hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area

boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant D). Therefore, a complete loss of Division II (Quadrant D) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.29 F078-A13D, Duct Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A13D Duct Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.30 F078-A16D, HVAC Chase

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A16D HVAC Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that

can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.31 F078-A20B, Motor-Driven AFW Pump Room B

Figure 9.5A-3 shows the location of this fire area. This area comprises the following zone(s):

Z078-A20B Motor-Driven AFW Pump Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant B). Therefore, a complete loss of Division II (Quadrant B) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.32 F078-A21B, Pipe Chase

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A21B Pipe Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.33 F078-A23B, Buttress Opening

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A23B Buttress Opening

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. There are no penetrations and openings except the door.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area extinguished manually using portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.34 F078-A47B, Electrical Equipment Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A47B Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except for the north and east walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north and east walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

There is no safe shutdown equipment. Loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.3.35 F078-A51B, Boric Acid Makeup Pump Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A51B Boric Acid Makeup Pump Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The east wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

This area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment in this area is not needed for safe shutdown.

9.5A.3.3.36 F078-A52D, 480V N1E MCC Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A52D 480V N1E MCC Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC

ductwork that passes through barriers is equipped with a fire damper. The north wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.37 F078-A53D, 480V N1E Loadcenter Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A53D 480V N1E Loadcenter Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC

ductwork that passes through barriers is equipped with a fire damper. The north wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.38 F078-A56B, Train B DC and IP Equipment Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A56B Train B DC and IP Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by electrical and I&C equipment areas HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant B). Therefore, a complete loss of Division II (Quadrant B) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.39 F078-AAFD, Turbine-Driven AFW Pump Room B

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A15D Turbine-Driven AFW Pump Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II. Therefore, a complete loss of Division II equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.40 F078-AEEB, Class 1E Switchgear 01B Room

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A25B Class 1E Switchgear 01B Room

Z078-A58B Swing Loadcenter Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

This area contains a B train of class 1E switchgear, load center and A and B train cables for swing load center for the auxiliary charging pump. Therefore, cabling from both divisions is located in this area. In the event of a fire in this area, at least one charging pump would be available to accomplish the safe shutdown because the A train charging pump and the associated cables are separated from this area by 3-hour-rated fire barriers.

9.5A.3.3.41 F078-AGAB, General Access Area B – 78 ft 0 in

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A19B General Access Area

Z078-A28B CCW Makeup Pump Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and

openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant B). Therefore, a complete loss of Division II (Quadrant B) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.42 F078-AGAD, General Access Area D – 78 ft 0 in

Figure 9.5A-3 shows the location of this fire area, which comprises the following zone(s):

Z078-A10D General Access Area

Z078-A57D Piping and Cable Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant D). Therefore, a complete loss of Division I (Quadrant D) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.43 F000-ADGD, Diesel Generator Room D

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z000-ADGD Diesel Generator Rom D

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a heat detector and flame detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas by 3-hour-rated fire barrier. And the equipment in this area is all Division II (Quadrant D). Therefore, safe shutdown of the plant is available using the Division I (Quadrant C) safe shutdown equipment in the event of the fire in this area.

There is an EDG combustion air intake penetration without fire damper in the 3-hour-rated south wall to outside area. However, the pipe is made of steel and the filter made of a non-combustible material exists in the end of the air intake pipe. So, this deviation is acceptable.

9.5A.3.3.44 F100-A04D, Cable Access Area

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A04D Cable Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The only combustible material in this area is the cable insulation material. The design basis fire would occur if all cable insulation in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers. The capability to safely shut down the plant would not be affected by a fire in this area because cable trays and conduits of only one train are routed through this area and because a redundant division is separated by 3-hour-rated fire barriers.

9.5A.3.3.45 F100-A05D, Electrical Equipment Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A05D Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

There is no safe shutdown equipment. Loss of equipment in the event of a fire in this area would not affect the plant safe shutdown.

9.5A.3.3.46 F100-A06D, General Access Area D – 100 ft 0 in

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A06D General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and

openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant D). Therefore, a complete loss of Division II (Quadrant D) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.47 F100-A07D, Aux. Feed Water Tank Room B

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A07D Aux. Feed Water Tank Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

There is no ignition source. Fire load and the duration of fire from assumption of ordinary combustible are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II. Therefore, a complete loss of Division II equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.48 F100-A08D, Non 1E DC and IP Equipment Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A08D Non 1E DC and IP Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour fire-rated barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.49 F100-A10B, General Access Area B - 100 ft 0 in

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A10B General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has Three-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

3-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequate fire protection provided for this fire area.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant B). Therefore, a complete loss of Division II (Quadrant B) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.50 F100-A11B, Train B Battery Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A11B Train A Battery Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant B). Therefore, a complete loss of Division II (Quadrant B) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.51 F100-AEEB, 480V Class 1E MCC Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A12B 480V Class 1E MCC 01B Room

Z100-A18B MUX N2 Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has Three-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant B). Therefore, a complete loss of Division II (Quadrant B) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.52 F100-A13B, Mechanical Penetration Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A13B Mechanical Penetration Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has Three-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.53 F100-A16D, Pipe Chase Area

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A16D Pipe Chase Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has Three-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor of this area is basement that is not required to be rated.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable

9.5A.3.3.54 F100-A32B, SFP Cooling Heat Exchanger Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

100-32B SFP Cooling Heat Exchanger Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The east wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by fuel handling area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II. Therefore, a complete loss of Division II equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

Potential for release of radioactive materials is not significant because products of combustion are exhausted through HEPA filters in the fuel building HVAC system. Also, the redundant spent fuel pool cooling pump is available to maintain cooling of radioactive spent fuel pool.

9.5A.3.3.55 F100-A36B, FH Area Supply AHU Room

Figure 9.5A-4 shows the location of this fire area, which comprises the following zone(s):

Z100-A36B FH Area Supply AHU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north and east walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north and east walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by fuel handling area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown.

9.5A.3.3.56 F120-A01D, Pipe Cable Area

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A01D Piping Cable Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed

penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II. Therefore, a complete loss of Division II equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.57 F120-A02D, Lube Oil Makeup Tank Room D

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A02D Lube Oil Makeup Tank Room D

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

A fire in this area is detected by fire detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a fire hose and portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, a manual water hose, portable extinguishers, and an automatic fire detection system provides a defense-in-

depth approach to providing reasonable assurance that the fire protection in this fire area is adequate and prevents the spread of a fire outside the fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant D). Therefore, a complete loss of Division II (Quadrant D) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.58 F120-A03D, Diesel Fuel Oil Day Tank Room D

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A03D – Diesel Fuel Oil Day Tank Room D

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

A fire in this area is detected by fire detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a fire hose and portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, a manual water hose, portable extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II (Quadrant D). Therefore, a complete loss of Division II (Quadrant

D) equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.59 F120-A05D, Electrical Equipment Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A05D Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.60 F120-A08D, 480V N1E MCC Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A08D 480V N1E MCC Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.61 F120-A09D, Electrical Penetration Room D

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A09D Electrical Equipment Room D

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers, and equipment in this area is Division II. Therefore, a complete loss of Division II equipment is acceptable because redundant trains of equipment, which are located in a separate fire area, are available for safe shutdown.

9.5A.3.3.62 F120-A11B, General Access Area B – 120 ft 0 in

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A11B General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.63 F120-A15B, 480V Class 1E MCC 03B Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A15B 480V Class 1E MCC 03B Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.64 F120-AMPB, Mechanical Penetration Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A16B Mechanical Penetration Room

Z120-A36B Hydrogen Analyzer Room

Z120-A37B Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment

located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.65 F120-A29B, AB Controlled Area (II) ECCS Equip. Rm. Exhaust ACU Rm. 1

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A21A AB Controlled Area (II) ECCS Equip. Rm. Exhaust ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.66 F120-A30B, AB Controlled Area (II) ECCS Equipment Room Exhaust ACU Room 2

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A30B AB Controlled Area (II) ECCS Equip. Rm. Exhaust ACU Room 2

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.3.67 F120-A35B, Battery Room

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A35B Battery Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 14. Based on the expected fire hazards in this area, the 3-hour-

rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.3.68 F120-AGAD, General Access Area – 120 ft 0 in

Figure 9.5A-5 shows the location of this fire area, which comprises the following zone(s):

Z120-A07D General Access Area

Z120-A18D LX Panel Room

Z120-A10D Essential Chilled Water Make-up Pump Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.69 F137-A01D, Cable Spreading Area

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A01D Cable Spreading Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

These fire areas may contain cables from Channels B and D safety-related equipment. This is because cables serving the Train B area (e.g., electrical penetration area) at elevation 137 ft 6 in goes down to elevation 120 ft 0 in area, moves horizontally to the Quadrant D area, and moves vertically up to the MCR area, which is located at elevation 156 ft 6 in. Therefore, separation between channels is not maintained in these areas. However, fire damage to these cables is acceptable because the redundant division cables and equipment are available for safe shutdown. Regardless of the safe shutdown capability, cable separation is maximized in these areas.

9.5A.3.3.70 F137-A02D, Electrical Equipment Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A02D Electrical Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed

penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

This fire area contains redundant divisions of the HVAC for the RSP room. Unless the I&C components are transferred to the RSP in the event of an MCR fire, all I&C components are set to the MCR mode during normal power operation. Therefore, fire damage to the control, instrumentation, and cables of the RSP room is acceptable because the I&C components in the MCR are available for safe shutdown.

9.5A.3.3.71 F137-A05D, PCS Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A05D PCS Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient

containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown.

9.5A.3.3.72 F137-A06D, Remote Shutdown Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A06D Remote Shutdown Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

This fire area contains redundant divisions (all four channels) of instrumentation, controls, and cables needed for safe shutdown in the event of a fire in the MCR. In addition, other areas around the RSR (e.g., F137-A02D) may contain cables from redundant divisions of safe shutdown I&C components, depending on the routing design of the cabling. However, unless the I&C components are transferred to the RSP or RCC room in the event of a control room fire, all I&C components are set to the MCR mode during normal power operation. Therefore, fire damage to the control, instrumentation, and cables is acceptable because the I&C components in the MCR are available for safe shutdown.

9.5A.3.3.73 F137-AGAD, General Access Area D - 137 ft 0 in

Figure 9.5A-6 shows the location of this fire area, which is composed of the following zone(s):

Z137-A09D General Access Area

Z137-A12D MUX N2 Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose, CO_2 hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.74 F137-A10D, 480V Class 1E MCC 03D Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A10D 480V Class 1E MCC 03D Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.75 F137-A11D, Electrical Penetration Room D

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A11D Electrical Penetration Room D

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.76 F137-A13B, General Access Area B - 137 ft 0 in

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A13B General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.77 F137-A14B, 480V N1E MCC Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A14B 480V N1E MCC Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.78 F137-A15B, 480V Class 1E MCC 04B Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A15B 480V Class 1E MCC 04B Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed

penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.79 F137-A24B, 480V Non 1E MCC 17N Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A24B 480V Non 1E MCC 17N Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers

at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.80 F137-A30D, Main Steam Enclosure

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A30D Main Steam Enclosure

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north and west walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The various walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire

hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.81 F137-A31D, MS Valve Room

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A31C MS Valve Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

Equipment from both Divisions I and II is located in this area. In the event of a fire in this area, both divisions of safe shutdown equipment may fail. To address this concern, one train of safe shutdown equipment is protected.

This area contains the two atmospheric dump valves (ADVs) for SG 2. Valve 521-V-0103 is powered from AE/CE, and valve 521-V-0104 is powered from BE/DE. Atmospheric dump isolation valve 521-V-0107 is powered from BE1 and 521-V-0108 is powered from AE2. Thus, cables from both divisions are present and could be damaged by a fire. Although a symmetric cooldown of the plant is preferred (i.e., using both SGs), a fire in this area would not affect a safe shutdown because an asymmetric cooldown could be performed using SG 1. Additionally, ADVs can be operated by using local manual actuators.

The SG 2 main steam isolation valves (MSIVs) are also in this area. However, fire damage would not prevent safe shutdown because these valves are fail-closed valves and are powered from both Division I and Division II Class 1E power sources.

9.5A.3.3.82 F137-A32B, Pipe Chase

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A32B Pipe Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.83 F137-AEPB, Electrical Penetration Room B

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A17B Penetration MUX B Room

Z137-A18B Electrical Penetration Room (B)

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the electrical and I&C equipment area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.84 F137-ASTD, Stair

Figure 9.5A-6 shows the location of this fire area, which comprises the following zone(s):

Z137-A08D Stair

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors.

There is no ignition source in this fire area and this fire area is used as access route between MCR and RSR. A fire in this area is detected by a smoke detector and is extinguished manually using portable extinguisher in accordance with NFPA 72 and 14. Because there is no ignition source in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.85 F156-A04B, Containment Entrance Area

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z156-A04B Containment Entrance Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.86 F156-AGAB, SST Room

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z156-A01B SST Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.87 F156-A15B, Pipe Chase

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z156-A15B Pipe Chase

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.88 F157-A01D, I&C Equipment Room B

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A01D I&C Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by smoke detector in accordance with NFPA 72. The fire area has automatic clean agent system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and

openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the underfloor area. Generally, the clean agent suppression system does not affect the equipment, and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.89 F157-AGAD, General Access Area D – 157 ft 0 in

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A16D	Corridor
Z157-A22D	Guest Room
Z157-A27D	General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector in accordance with NFPA 72. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, clean agent suppression system does not affect the equipment, and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of the clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.90 F157-A19D, I&C Equipment Room D

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A19D I&C Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by smoke detectors in accordance with NFPA 72. The fire area has automatic clean agent system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, the clean agent suppression system does not affect the equipment and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of an inadvertent actuation of the clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.91 F157-A20D, I&C Equipment Room

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A20D I&C Equipment Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by smoke detectors in accordance with NFPA 72. The fire area has automatic clean agent system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by using AB smoke removal fan.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, the clean agent suppression system does not affect the equipment, and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.92 F157-ACPX, Computer Room Area

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-ACPX Computer Room Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by smoke detectors in accordance with NFPA 72. The fire area has automatic clean agent system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

During normal operation, cold shutdown, and refueling, the MCR air-handling units and the MCR exhaust fan are actuated to perform ventilation and air conditioning inside the main control room envelope. In case of a fire generating smoke within the main control room, the smoke removal is accomplished by using control room area smoke removal fan.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, the clean agent suppression system does not affect the equipment and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown.

9.5A.3.3.93 F157-AMCR, Control Room Area

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-AMCR Control Room Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by smoke, heat, and flame detectors in accordance with NFPA 72. The fire area has automatic clean agent system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed

fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

During normal operation, cold shutdown, and refueling, the MCR air handling units and the MCR exhaust fan are actuated to perform ventilation and air conditioning inside the main control room envelope. In case of a fire generating smoke within the main control room, the smoke removal is accomplished by using control room area smoke removal fan.

Fire Protection Integrity

An automatically actuated clean agent suppression system is installed for the under-floor area. Generally, the clean agent suppression system does not affect the equipment and the redundant train is separated by 3-hour-rated fire barriers. Therefore, damage to equipment in this area in the event of inadvertent actuation of clean agent suppression system would not affect the capability to safely shut down the plant.

Safe Shutdown Analysis

Instrumentation and Controls for both Division I (Quadrants A and C) and Division II (B and D) safe shutdown systems are located in this area. In the event of a fire in the control room, a reactor trip is initiated and CEA insertion is verified prior to evacuation of personnel. Transfer switches for Division I and II I&C components are located at the RSP or RCC room and at each channelized I&C equipment room so that I&C components for safe shutdown systems can be transferred to the RSP. This isolates the controls in the MCR, which eliminates spurious operation of equipment due to fire damage to control cables and switches in the MCR. Thus, safe shutdown of the plant can be accomplished from the RSP room or RCC room in conjunction with the local operation of equipment as needed.

9.5A.3.3.94 F157-A28D, Breathing Air Rack

Figure 9.5A-7 shows the location of this fire area, which comprises the following zone(s):

Z157-A28D Breathing Air Rack

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.95 F174-A01D, EDG Room Normal Exhaust Fan Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A01D EDG Room Normal Exhaust Fan Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.96 F174-A05D, Electrical Equipment Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A05D 480V N1E MCC Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.97 F174-A13D, 480V N1E MCC Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A13D 480V N1E MCC Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown. Therefore, a complete loss of equipment is acceptable.

9.5A.3.3.98 F174-A14D, EDG Room Normal Supply AHU Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A14D EDG Room Normal Supply AHU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.99 F174-A15B, CTMT High/Low Volume Purge ACU Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A15B CTMT High/Low Volume Purge ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north and west walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north and west walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown.

The filters in the ACU may contain radioactive materials only if filters have been used for radiological events for the time within the allowable limit. However, the likelihood that the radioactive smoke would be released is low because the fire would be extinguished by the water spray nozzles for the charcoal filters, which are in the filter housing. Thus, no significant release is expected, which is below the 10 CFR 100 limits.

9.5A.3.3.100 F174-A16B, CTMT High Volume Purge AHU Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A16B CTMT High Volume Purge AHU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire area with 3-hour-rated fire barriers and equipment located in this area is not needed for safe shutdown.

9.5A.3.3.101 F174-A22B, HVAC Chase

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A22B HVAC Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the south wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. The south wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.102 F174-A23D, Control Room Supply AHU Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A23D Control Room Area Supply AHUs Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

During normal operation, cold shutdown, and refueling, the MCR air-handling units and the MCR exhaust fan are actuated to perform ventilation and air conditioning inside the main control room envelope. In case of a fire generating smoke within the main control room, the smoke removal is accomplished by using control room area smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.103 F174-A24D, Control Room Area Supply AHU/ACU Room

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A24D Control Room Area Supply AHU /ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

During normal operation, cold shutdown, and refueling, the MCR air-handling units and the MCR exhaust fan are actuated to perform ventilation and air conditioning inside the main control room envelope. In case of a fire generating smoke within the main control room, the smoke removal is accomplished by using control room area smoke removal fan.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

The charcoal filters in exhaust ACUs provide reasonable assurance that the potential for the release of radioactive materials is eliminated.

9.5A.3.3.104 F174-A25D, HVAC Area

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A25D HVAC Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.105 F174-AGAD, General Access Area D - 174 ft 0 in

Figure 9.5A-8 shows the location of this fire area, which comprises the following zone(s):

Z174-A02D Essential Chilled Water Compression Tank Room

Z174-A03D CCW Surge Tank Room

Z174-A12D General Access Area

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the north wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The north wall of this area is an exterior wall that is not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.106 F175-A01D, MSIV Room Supply AHU Room

Figure 9.5A-10 shows the location of this fire area. This area is comprised of the following zone(s):

Z175-A01D MSIV Room Supply AHU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete wall except exterior walls. Penetrations and openings are sealed for fire confinement. The walls of this area are exterior walls that are not required to be rated.

A fire in this area is detected by a smoke detector and extinguished manually using or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, evaluation of the inadvertent actuation effect of automatic suppression system is not required.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.3.107 F195-A02D, AB clean area Supply AHUs Room

Figure 9.5A-9 shows the location of this fire area, which comprises the following zone(s):

Z195-A02D AB clean area Supply AHU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the ceiling and west wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The ceiling and west wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area has and is served by AB clean area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.108 F195-A05D, 480V N1E Loadcenter Room

Figure 9.5A-9 shows the location of this fire area, which comprises the following zone(s):

Z195-A05D 480V N1E Loadcenter room

Fire Protection Adequacy Evaluation

The fire area is enclosed with non-rated concrete walls except the east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. Most of walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.109 F195-A08B, AB Controlled Area (II) Normal Exhaust ACU Room

Figure 9.5A-9 shows the location of this fire area, which comprises the following zone(s):

Z195-A08B AB Controlled Area (II) Normal Exhaust ACU Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with non-rated concrete walls except the east wall and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper. Most of the walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by the AB controlled area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The capability to safely shut down the plant would not be affected by a fire in this area because redundant trains are separated by 3-hour-rated fire barriers.

9.5A.3.3.110 F195-A10D, Smoke Fan Room

Figure 9.5A-9 shows the location of this fire area, which comprises the following zone(s):

Z195-A10D Smoke Fan Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with non-rated concrete walls except the north wall and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper. Most of walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. 3-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

A fire in this area would not affect safe shutdown of the plant because there are no safety-related structures or equipment that would be affected by the fire.

9.5A.3.3.111 F000-AFHL, Fuel Handling Area – Lower Area

Figures 9.5A-1 through 9.5A-3 show the location of this fire area, which comprises the following zone(s):

Z055-AFHL Fuel Handling Area – Lower Area El.55’-0”

Z078-AFHL Fuel Handling Area – Lower Area El.78’-0”

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the floor and east wall and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The floor and east wall of this area are exterior barriers that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by a smoke detector and is extinguished manually using a water hose or portable extinguisher in accordance with NFPA 72 and 14. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by Fuel Handling Area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and the only safe shutdown equipment in this area is Division II.

9.5A.3.3.112 F000-AFHU, Fuel Handling Area – Upper Area

Figures 9.5A-4 through 9.5A-7 show the location of this fire area, which comprises the following zone(s):

Z100-AFHU	Fuel Handling Area – Upper Area El.100'-0"
Z120-AFHU	Fuel Handling Area – Upper Area El.120'-0"
Z137-AFHU	Fuel Handling Area – Upper Area El.137'-6"
Z156-AFHU	Fuel Handling Area – Upper Area El.156'-0"

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the ceiling and has 3-hour-rated fire doors. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The ceiling of this area is basement that is not required to be rated.

Combustible materials in this area are listed in Table 9.5A-2. The fire load is light, and the duration of a fire is expected to be short. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

A fire in this area is detected by smoke, heat and flame detector sin accordance with NFPA 72. The fire area has automatic wet pipe sprinkler system in accordance with NFPA 13 and regulatory guidance. Additional fire suppression capability is provided by a water hose, CO_2 hose, or portable extinguisher. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

This fire area is served by fuel handling area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by an exhaust ACU.

Fire Protection Integrity

Inadvertent actuation of the automatic wet pipe sprinklers installed in this area would not affect the capability to safely shut down the plant because there is no safety-related equipment in this area.

Safe Shutdown Analysis

This fire area is separated from the adjacent fire areas with 3-hour-rated fire barriers and the only safe shutdown equipment in this area is Division II.

9.5A.3.3.113 Stairs, Elevator Hoistways, and Elevator Halls

Figures 9.5A-1 through 9.5A-10 show the locations of these fire areas. These areas are following:

F049-A01D	Elevator Hoistway
F049-A02B	Elevator Hoistway
F055-A05D	Stair
F055-A20B	Stair
F055-A60B	Elevator Hall
F055-A61D	Elevator Hall
F078-A54B	Elevator Hall
F078-A55D	Elevator Hall
F100-A45B	Elevator Hall
F100-A46D	Elevator Hall

F120-A13B	Stair
F120-A33B	Elevator Hall
F120-A34D	Elevator Hall
F137-A16B	Elevator Hall
F137-A44D	Elevator Hall
F156-A13B	Elevator Hall
F157-A13D	Vestibule
F174-A17B	Elevator Hall
F174-A18D	Elevator Hall
F195-A01D	Elevator Hall
F195-A07B	Elevator Hall

The stairs and elevator hoistway with elevator halls are enclosed with 3-hour-rated concrete walls except the floor and has 3-hour-rated fire doors.

There are no ignition sources in this area, and the fire load is expected to be light because of transient material.

A fire in this area is extinguished by fire hose and portable extinguishers. Based on the expected fire hazards in this area, the 3-hour-rated boundaries of this area provide sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, the fire protection that is provided for this fire area is adequate.

9.5A.3.4 Emergency Diesel Generator Building

9.5A.3.4.1 F000-HFSA, Diesel Fuel Oil Storage Tank Room A

Figure 9.5A-10 shows the location of this fire area, which comprises the following zone(s):

Z000-HFSA Diesel Fuel Oil Storage Tank Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall to below grade. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by smoke, temperature, and flame detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, manual extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed

type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The equipment in this fire area is Division I (Quadrant A). This area is separated from the adjacent fire areas by 3-hour-rated barriers, and there is no penetration in the barrier common to Division II (Quadrant B) DG fuel oil storage tank room. The fuel oil storage tank is separated by dikes from the rest of the area, and there is no ignition source around the tank. The probability that a fire would occur in the fuel oil transfer pump room is low, but the effect of the fire would be limited to within the pump room. An automatic preaction suppression system is installed for the DG fuel oil storage tank and fuel oil transfer pump, and a hose station around this room is also available for manual firefighting. Three-hour fire-rated dampers are installed in the HVAC openings in the 3-hour-rated barrier. Therefore, safe shutdown of the plant is not affected because the fire would not spread into the adjacent fire area, and a redundant division of equipment is located in a separate fire area.

9.5A.3.4.2 F000-HFSB, Diesel Fuel Oil Storage Tank Room B

Figure 9.5A-10 shows the location of this fire area, which comprises the following zone(s):

Z000-HFSB Diesel Fuel Oil Storage Tank Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall below grade. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by smoke, temperature, and flame detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional

fire suppression capability is provided by portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, manual extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The equipment in this fire area is Division II (Quadrant B). This area is separated from the adjacent fire areas by 3-hour-rated barriers, and there is no penetration in the barrier common to the Division I (Quadrant A) DG fuel oil storage tank room. The fuel oil storage tank is separated by dikes from the rest of the area, and there is no ignition source around the tank. The probability that a fire would occur in the fuel oil transfer pump room is low, but the effect of the fire would be limited to within the pump room. An automatic preaction suppression system is installed for the DG fuel oil storage tank and fuel oil transfer pump, and a hose station around this room is also available for manual firefighting. The 3-hour-rated dampers are installed in the HVAC openings in the 3-hour-rated barrier. Therefore, safe shutdown of the plant is not affected because the fire would not spread into the adjacent fire area, and a redundant division of equipment is located in a separate fire area.

9.5A.3.4.3 F000-HDGA, Diesel Generator Area A

Figures 9.5A-10 and 9.5A-11 show the location of this fire area, which comprises the following zone(s):

Z000-HDGA Diesel Generator Area A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall below grade. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by smoke, temperature, and flame detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a manual water hose station and portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, manual extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed

type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas by a 3-hour-rated fire barrier. The equipment in this area is Division I (Quadrant A). Therefore, safe shutdown of the plant is available using the Division II (Quadrant B) safe shutdown equipment in the event of a fire in this area.

9.5A.3.4.4 F000-HDGB, Diesel Generator Area B

Figures 9.5A-10 and 9.5A-11 show the location of this fire area, which comprises the following zone(s):

Z000-HDGB Diesel Generator Area B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall below grade. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by smoke, temperature, and flame detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a manual water hose station and portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, manual extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas by a 3-hour-rated fire barrier. The equipment in this area is Division II (Quadrant B). Therefore, safe shutdown of the plant is available using the Division I (Quadrant A) safe shutdown equipment in the event of a fire in this area.

9.5A.3.4.5 F121-H01A, Lube Oil Makeup Tank Room A

Figure 9.5A-11 shows the location of this fire area, which comprises the following zone(s):

Z121-H01A Lube Oil Makeup Tank Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall below grade. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by fire detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a fire hose and portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, a manual water hose, portable extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the lube oil spilled and burned. This fire area is separated from the adjacent areas by 3-hour-rated barriers and contains no safety-related equipment. Therefore, the design basis fire would not affect the capability to safely shut down the plant.

9.5A.3.4.6 F121-H01B, Lube Oil Makeup Tank Room B

Figure 9.5A-11 shows the location of this fire area, which comprises the following zone(s):

Z121-H01B Lube Oil Makeup Tank Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall below grade. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by fire detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a fire hose and portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, a manual water hose, portable extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the lube oil spilled and burned. This fire area is separated from the adjacent areas with 3-hour-rated fire barriers and contains no safety-related equipment. Therefore, the design basis fire would not affect the ability for safe shutdown of the plant.

9.5A.3.4.7 F121-H02A, Diesel Fuel Oil Day Tank Room A

Figure 9.5A-11 shows the location of this fire area, which comprises the following zone(s):

Z121-H02A Diesel Fuel Oil Day Tank Room A

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall below grade. Penetrations and openings are sealed for fire confinement. HVAC ductwork that passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by fire detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a fire hose and portable extinguishers. The combination of structural confinement with fire-rated barriers, an automatic fire suppression system, a manual water hose, portable extinguishers, and an automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the fuel oil spilled and ignited. This fire area is separated from the adjacent areas with 3-hour-rated barriers, and the equipment in this area is Division I (Quadrant A). A complete loss of Division I (Quadrant A) equipment is acceptable because a redundant division of equipment is located in a separate fire area and is available for safe shutdown.

9.5A.3.4.8 F121-H02B, Diesel Fuel Oil Day Tank Room B

Figure 9.5A-11 shows the location of this fire area, which comprises the following zone(s):

Z121-H02B Diesel Fuel Oil Day Tank Room B

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except the exterior wall below grade. Penetrations and openings are sealed for fire confinement. HVAC ductwork that

passes through barriers is equipped with a fire damper. The walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

A fire in this area is detected by fire detectors. The fire area has an automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. The fire area has substantial concrete walls that are designed to seismic Category I criteria. The walls may provide more than 3-hour fire resistance. Additional fire suppression capability is provided by a fire hose and portable extinguishers. The combination of a structural confinement with fire-rated barriers, an automatic fire suppression system, a manual water hose, portable extinguishers, and automatic fire detection system provides a defense-in-depth approach to providing reasonable assurance that the fire protection in this area is adequate and would prevent the spread of a fire outside this fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

An automatic preaction sprinkler system is installed in this area. However, the preaction sprinkler system is not vulnerable to inadvertent actuation because it consists of a normally closed preaction valve, which automatically opens upon a fire detection signal, and closed type sprinkler heads. Even when the preaction valve is opened by a spurious fire detection signal, the water is retained in the piping if there is no actual occurrence of fire that could melt the fusible sprinkler heads.

Safe Shutdown Analysis

The design basis fire would occur if all of the fuel oil spilled and ignited. This fire area is separated from the adjacent areas with 3-hour-rated barriers, and the equipment in this area is Division II (Quadrant B). A complete loss of Division II (Quadrant B) equipment is acceptable because a redundant division of equipment is located in a separate fire area and is available for safe shutdown.

9.5A.3.4.9 F000-HG, EDG Building – General

Figure 9.5A-10 shows the location of this fire area, which comprises the following zone(s):

Z000-HG EDG Building – General

Fire Protection Adequacy Evaluation

The fire area is enclosed with non-rated concrete walls and has 3-hour-rated fire doors. HVAC ductwork that passes through barriers is equipped with a fire damper. Most of walls of this area are exterior walls that are not required to be rated, according to NRC RG 1.189.

Combustible materials in this area are listed in Table 9.5A-2. Fire load and the duration of fire are expected to be negligible. Three-hour-rated fire barriers provide adequate separation from adjacent fire areas, and the fire is contained within the fire area.

This fire area is served by the EDG area HVAC system. Any HVAC ductwork that passes into the area is provided with automatic closing fire dampers at the fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings in the fire area boundaries. After the fire, smoke is removed from the fire area by flexible ducting or portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, an evaluation of the inadvertent actuation effect of an automatic suppression system is not applicable.

Safe Shutdown Analysis

The design basis fire would occur if all of the combustibles in this area burned. This fire area is separated from the adjacent fire areas by 3-hour-rated fire barriers. The capability to safely shut down the plant would not be affected because the safe shutdown equipment in this area is needed only for a fire in the MCR with the simultaneous loss of offsite power.

9.5A.3.5 Turbine Generator Building

9.5A.3.5.1 F067-T02, Underground Common Tunnel

Figure 9.5A-12 shows the location of this fire area. This area is comprised of the following zone(s):

Z067-T02 Underground Common Tunnel

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete wall except exterior walls to underground . Penetrations and openings are sealed for fire confinement. The walls of this area are exterior walls that are not required to be rated.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, evaluation of the inadvertent actuation effect of automatic suppression system is not required.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.5.2 F072-T01, Chemical Handling Room

Figure 9.5A-12 shows the location of this fire area. This area is comprised of the following zone(s):

Z072-T01 Chemical Handling Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior wall to underground.

Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by TGB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, evaluation of the inadvertent actuation effect of automatic suppression system is not required.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore,

complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.5.3 F072-T02, Lube Oil Storage Room

Figure 9.5A-12 shows the location of this fire area. This area is comprised of the following zone(s):

Z072-T02 Lube Oil Storage Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior wall to underground. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. The fire area has automatic water spray system in accordance with NFPA 13 and regulatory guidance. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by TGB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Inadvertent actuation of the automatic water spray system would not impact safe shutdown of the plant since there is no safe shutdown equipment in this area.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.5.4 F072-T03, Main Turbine Lube Oil Conditioner Room

Figure 9.5A-12 shows the location of this fire area. This area is comprised of the following zone(s):

Z072-T03 Main Turbine Lube Oil Conditioner Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior wall to underground. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. The fire area has automatic water spray system in accordance with NFPA 13 and regulatory guidance. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by TGB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Inadvertent actuation of the automatic water spray system would not impact safe shutdown of the plant since there is no safe shutdown equipment in this area.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.5.5 F073-T06, Caustic/Acid Day Tank & Pump Room

Figure 9.5A-12 shows the location of this fire area. This area is comprised of the following zone(s):

Z073-T06 Caustic/Acid Day Tank & Pump Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior wall to underground. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by TGB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, evaluation of the inadvertent actuation effect of automatic suppression system is not required.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.5.6 F100-T11, Turbine Lube Oil Reservoir Room

Figure 9.5A-12 shows the location of this fire area. This area is comprised of the following zone(s):

Z100-T11 Turbine Lube Oil Reservoir Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. The fire area has automatic water spray system in accordance with NFPA 13 and regulatory guidance. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by TGB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area

boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Inadvertent actuation of the automatic water spray system would not impact safe shutdown of the plant since there is no safe shutdown equipment in this area.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.5.7 F000-TB, Turbine Generator Building - General

Figures 9.5A-12 through 9.5A-17 show the location of this fire area. This area is comprised of the following zone(s):

Z055-T01 Condenser Pit Area

Z060-T01 Condensate Overflow Storage Sump Pit Area

Z073-T02 TGB Basement Floor

Z100-T01 TBG Bldg. Ground Floor

Z122-T01 Excitation Control Cubicle Rm

Z136-T01 TGB Operating Floor

Z136-T02 Clean Working Rm

Z170-T01 TB Deaerator Floor

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior wall. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. The fire area has automatic water spray system, automatic preaction sprinkler system in accordance with NFPA 13 and regulatory guidance. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by TGB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Inadvertent actuation of automatic suppression system would not impact safe shutdown of the plant since there is no safe shutdown equipment in this area.

Safe Shutdown Analysis

The design basis fire would occur if all the combustibles in this area burned. The area that has a high fire loads, such as an oil tank room, is separated from this area by 3-hour-rated fire barrier. Even though the steel structure of turbine generator building is collapsed, the aux. building would not be affected since the AB is separated from turbine generator building by 3-hour-rated fire barriers. Therefore, the ability to safety shutdown the plant would not be affected.

There is no significant release of radioactive materials by a fire in this area since radioactive materials are in closed metal tank or containers.

9.5A.3.5.8 F073-T11, Switchgear Area – 73 ft 0 in

Figure 9.5A-12 shows the location of this fire area. This area is comprised of the following zone(s):

Z073-T11 Switchgear Area – 73 ft 0 in

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior wall. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by TGB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, evaluation of the inadvertent actuation effect of automatic suppression system is not required.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.5.9 F100-T15, Switchgear Area – 100 ft 0 in

Figure 9.5A-14 shows the location of this fire area. This area is comprised of the following zone(s):

Z100-T15 Switchgear Area – 100 ft 0 in

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior wall. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by TGB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, evaluation of the inadvertent actuation effect of automatic suppression system is not required.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.5.10 F122-T01, Switchgear Area – 122 ft 0 in

Figure 9.5A-16 shows the location of this fire area. This area is comprised of the following zone(s):

Z122-T01 Switchgear Area – 122 ft 0 in

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior wall. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by TGB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, evaluation of the inadvertent actuation effect of automatic suppression system is not required.

Safe Shutdown Analysis

This fire area is completely separated from the adjacent fire areas with 3-hour-rated fire barriers and equipment located in this area are not needed for safe shutdown. Therefore, complete loss of equipment in the event of a fire in this area does not affect the plant safe shutdown.

9.5A.3.6 Compound Building

9.5A.3.6.1 F100-P17, Flammable Gas Storage Room

Figure 9.5A-21 shows the location of this fire area. This area is comprised of the following zone(s):

Z100-P17 Flammable Gas Storage Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except east wall. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. The fire area has automatic wet pipe sprinkler system in accordance with NFPA 13 and regulatory guidance. Based on the expected fire hazards within this area, 3-hour-rated rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by CPB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Inadvertent actuation of the automatic wet pipe sprinklers installed in this area would not affect the capability to safely shutdown the plant since there is no safety-related equipment in this area.

Safe Shutdown Analysis

The design basis fire would occur if all combustibles in this fire area burned. But, the design basis fire would not affect the ability to safely shutdown the plant since this fire area is completely separated from the adjacent fire areas by 3-hour-rated fire barriers and equipment located in this fire area are all non-safety related. However, there is a probability of gas explosion because hydrogen, propane and acetylene gas cylinders are installed in this area. But, the cylinders are equipped with a flame arrester to prevent an explosion and the air exhaust fan is installed to prevent the accumulation of the gas in this area. If the explosion occur, the pressure would be released to outside through the door in the east wall. Therefore, the additional analysis for the effects of gas explosion is not needed.

9.5A.3.6.2 F100-P18, Non-Flammable Gas Storage Room

Figure 9.5A-21 shows the location of this fire area. This area is comprised of the following zone(s):

Z100-P18 Non-Flammable Gas Storage Room

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by a smoke detector and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by CPB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area

boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Because no automatic suppression systems are installed in this area, evaluation of the inadvertent actuation effect of automatic suppression system is not required.

Safe Shutdown Analysis

Since there are small quantities of combustibles in this area, the design basis fire is not considered. In addition, there is no safe shutdown equipment in this area. Therefore, the safe shutdown of the plant is available in the event of a fire in this area.

9.5A.3.6.3 F000-AC, Compound Building – Access Control Area

Figures 9.5A-18 through 9.5A-24 show the location of this fire area. This area is comprised of the following zone(s):

Z063-AC Compound Building – Access Control Area – El. 63′

Z085-AC Compound Building – Access Control Area – El. 85′

Z100-AC Compound Building – Access Control Area – El. 100′

Z120-AC Compound Building – Access Control Area – El. 120′

Z139-AC Compound Building – Access Control Area – El. 139′

Z157-AC Compound Building – Access Control Area – El. 157′

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior walls. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by smoke and temperature detectors and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. The fire area has automatic wet pipe sprinkler system in accordance with NFPA 13 and regulatory guidance. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by CPB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Inadvertent actuation of the automatic wet pipe sprinklers installed in this area would not affect the capability to safely shutdown the plant since there is no safety-related equipment in this area.

Safe Shutdown Analysis

The design basis fire would occur if all combustibles in this fire area burned. But, the design basis fire would not affect the ability to safely shutdown the plant since this fire area is completely separated from the adjacent fire areas by 3-hour-rated fire barriers and equipment located in this fire area are all non-safety related.

9.5A.3.6.4 F000-RW, Compound Building – Radwaste Area

Figures 9.5A-18 through 9.5A-24 show the location of this fire area. This area is comprised of the following zone(s):

Z063-RW Compound Building – Radwaste Area – El.63′

Z085-RW Compound Building – Radwaste Area – El.85′

Z100-RW Compound Building – Radwaste Area – El.100′

Z120-RW Compound Building – Radwaste Area – El.120′

Z139-RW Compound Building – Radwaste Area – El.139′

Fire Protection Adequacy Evaluation

The fire area is enclosed with 3-hour-rated concrete walls except exterior walls. Penetrations and openings are sealed for fire confinement. HVAC ductwork passing into barrier is equipped with fire damper.

A fire in this area is detected by smoke, flame and temperature detectors and is extinguished manually using water hose, or portable extinguishers in accordance with NFPA 72 and 14. The fire area has automatic wet pipe sprinkler system in accordance with NFPA 13 and regulatory guidance. Based on the expected fire hazards within this area, 3-hour-rated boundaries of this area provides sufficient containment of any unsuppressed fire that can be expected to occur. On this basis, there is adequated fire protection provided for this fire area.

This fire area is served by CPB HVAC system. Any HVAC ductwork passing into the area is provided with automatic closing fire dampers at fire area boundaries. Smoke migration into the area is mitigated by sealed penetrations and openings of the fire area boundaries. After the fire, smoke is subsequently removed from the fire area by using the flexible ducting or the portable fans.

Fire Protection Integrity

Inadvertent actuation of the automatic wet pipe sprinklers installed in this area would not affect the capability to safely shutdown the plant since there is no safety-related equipment in this area.

Safe Shutdown Analysis

The design basis fire would occur if all combustibles in this fire area burned. But, the design basis fire would not affect the ability to safely shutdown the plant since this fire area is completely separated from the adjacent fire areas by 3-hour-rated fire barriers and equipment located in this fire area are all non-safety related.

Radioactive laundry system treats all liquid wastes within RW area which have the potential for radioactive contamination e.g., personnel decontamination and contaminated laundry waste. The treating process is conducted in steel containers and monitored. Therefore, in case that a fire accident occurs in the CPB, no significant release is expected, which is well below the 10CFR100 limits.

Burning of filters could result in releases of radioactive products, however, this is within radiological design basis since all filters are in closed metal tanks or containers and all air leaving this area passes through charcoal filters which are monitored by radiation detectors. Charcoal filters are also protected by deluge systems.

9.5A.4 References

1. NRC RG 1.189, "Fire Protection for Nuclear Power Plants," Revision 2, U.S. Nuclear Regulatory Commission, October 2009.

2. ASTM E 119, "Standard Test Methods for Fire Tests of Building Construction and Materials."

3. NFPA 72, "National Fire Alarm Code," National Fire Protection Association.

4. ANSI/IEEE Std. 383, "American National Standard IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, Inc., 3 Park Avenue, 17th Floor, New York, N.Y. 10016-5997.

5. NEI 00-01, "Guidance for Post Fire Safe Shutdown Circuit Analysis," Rev. 3, National Energy Institute, October 2011.

6 NFPA 14, "Standard for the Installation of Standpipe and Hose Systems," 2010 Edition, National Fire Protection Association, Quancy, MA.

Table 9.5A-1

Estimated Fire Severity for Offices and Light Commercial Occupancies

Heat Potential Assumed (1) kJ/m^2(Btu/ft^2)	Equivalent Fire Severity Approximately Equivalent to that of a Test Under Standard Curve for the Following Periods
454,261 (40,000)	30 min
908,522 (80,000)	1 hr
1,362,783 (120,000)	1.5 hr
1,817,044 (160,000)	2 hr
2,727,567 (240,000)	3 hr

Source: Fire Protection Handbook, 19th Edition, NFPA, Section 12, Chapter 5, Table 12.5.1.

(1) Heat of combustion of contents taken at 18,608 kJ/kg (8,000 Btu/lb)

Table 9.5A-2 (1 of 318)

Fire Hazard Analysis Summary

Z069-C01 : ICI Cavity			
Zone Description		Protection Measures	
• F000-CNB : Containment Building		Detection	• Flame Detector
Wall	• Z100-C02A • Z100-C02B	Fire Extinguish	• None
Floor	• Basement	Suppression System	• None
Ceiling	• Z000-CRP	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• ICI Guide Tube[R] • ICI Cavity Sump Pumps		Major Combustible (kJ (Btu))	• Grease 1.14E4 (1.09E4)
		Floor Area (m^2(ft^2))	81 (874)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.34E3 (4.70E2)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (2 of 318)

<table>
<tr><td colspan="4">Z100-C02A : SG Cavity 1</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-CNB : Containment Building</td><td>Detection</td><td>• Flame Detector
• Explosion proof type fixed temperature detector</td></tr>
<tr><td>Wall</td><td>• Z100-C02B
• Z000-CAN</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z069-C01</td><td>Suppression System</td><td>• Automatic water spray system for RCP Motors.</td></tr>
<tr><td>Ceiling</td><td>• Roof</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Steam Generator^{R}
• Reactor Coolant Pumps 1A& 1B^{R}
• RCS Cold Leg Temperature Element^{S}
• RCS Hot Leg Temperature Element^{S}</td><td>Major Combustible (kJ (Btu))</td><td>• None</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>153 (1,650)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>2.75E3 (2.42E2)</td></tr>
<tr><td>Fire Severity (min)</td><td>Less than 1 min</td></tr>
</table>

Table 9.5A-2 (3 of 318)

Z100-C02B : SG Cavity 2			
Zone Description		Protection Measures	
• F000-CNB : Containment Building		Detection	• Flame Detector • Explosion proof type fixed temperature detector
Wall	• Z100-C02A • Z000-CAN	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z069-C01	Suppression System	• Automatic water spray system for RCP Motors.
Ceiling	• Roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Steam Generator[R] • Reactor Coolant Pumps 2A& 2B[R] • RCS Cold Leg Temperature Element[S] • RCS HotLeg Temperature Element[S]		Major Combustible (kJ (Btu))	• Grease 4.42E4 (4.19E4) • Cable insulation 1.44E6 (1.36E6)
		Floor Area (m^2(ft^2))	153 (1,650)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.30E4 (1.15E3)
		Fire Severity (min)	1

Table 9.5A-2 (4 of 318)

Z100-C03 : Reactor Drain Tank Room			
Zone Description		Protection Measures	
• F000-CNB : Containment Building		Detection	• Analog type photoelectric smoke detector
Wall	• Z100-C02A • Z100-C02B • Z000-CAN	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z000-CAN	Suppression System	• None
Ceiling	• Z000-CAN	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Reactor Drain Tank[R]		Major Combustible (kJ (Btu))	• Cable insulation 2.67E6 (2.53E6)
		Floor Area (m^2(ft^2))	35 (387)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.57E4 (6.67E3)
		Fire Severity (min)	5

Table 9.5A-2 (5 of 318)

Z100-C04 : Letdown Heat Exchanger Room			
Zone Description		Protection Measures	
• F000-CNB : Containment Building		Detection	• Analog type photoelectric smoke detector
Wall	• Z100-C02A • Z100-C02B • Z000-CAN	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z000-CAN	Suppression System	• None
Ceiling	• Z000-CAN	Access/Egress	• Doors • Personnel Air Locks
Major Equipment		Combustible & Fire Loading	
• Letdown Heat Exchanger[R]		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	17(189)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.41E4 (2.12E3)
		Fire Severity (min)	2

Table 9.5A-2 (6 of 318)

<table>
<tr><td colspan="4">Z128-C01: Regenerative Heat Exchanger Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-CNB : Containment Building</td><td>Detection</td><td>• None</td></tr>
<tr><td>Wall</td><td>• Z100-C02A
• Z100-C02B
• Z000-CAN</td><td>Fire Extinguish</td><td>• None</td></tr>
<tr><td>Floor</td><td>• Z000-CAN</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Z000-CAN</td><td>Access/Egress</td><td>• Ladder</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Regenerative Heat Exchanger[R]</td><td>Major Combustible
(kJ (Btu))</td><td>• None</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>19 (210)</td></tr>
<tr><td>Fire Load
(kJ/ m^2 (Btu/ft^2))</td><td>2.17E4 (1.91E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>1</td></tr>
</table>

Table 9.5A-2 (7 of 318)

Z136-C02 : Pressurizer Cavity				
Zone Description		Protection Measures		
• F000-CNB : Containment Building		Detection	• None	
Wall	• Z100-C02A • Z100-C02B • Z000-CAN	Fire Extinguish	• Water hose • Dry chemical	
Floor	• Z000-CAN	Suppression System	• None	
Ceiling	• Open to containment atmosphere	Access/Egress	• Doors • Personnel Air Locks	
Major Equipment		Combustible & Fire Loading		
• Pressurizer[R] • POSRVs[R]		Major Combustible (kJ (Btu))		• None
		Floor Area ($m^2(ft^2)$)		29 (310)
		Fire Load (kJ/ m^2 (Btu/ft^2))		1.47E4 (1.29E3)
		Fire Severity (min)		1

Table 9.5A-2 (8 of 318)

Z156-C01 : Operating Area			
Zone Description		Protection Measures	
• F000-CNB : Containment Building		Detection	• Analog type photoelectric smoke detector
Wall	• Aux. building	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z000-CAN	Suppression System	• None
Ceiling	• Open to containment atmosphere	Access/Egress	• Personnel Air Locks
Major Equipment		Combustible & Fire Loading	
• SIT Vent Isolation Valve[SR] • Reactor Coolant Fan Coolers		Major Combustible (kJ (Btu))	• Cable insulation 4.95E7 (4.69E7)
		Floor Area (m^2(ft^2))	680 (7,325)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.00E4 (7.04E3)
		Fire Severity (min)	5

Table 9.5A-2 (9 of 318)

<table>
<tr><td colspan="5">Z000-CAN : Containment Annulus Area</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="3">Protection Measures</td></tr>
<tr><td colspan="2">• F000-CNB : Containment Building</td><td>Detection</td><td colspan="2">• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• Z100-C02A
• Z100-C02B
• Aux. building</td><td>Fire Extinguish</td><td colspan="2">• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td colspan="2">• None</td></tr>
<tr><td>Ceiling</td><td>• Open to containment atmosphere</td><td>Access/Egress</td><td colspan="2">• Personnel Air Locks</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="3">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Safety Injection Tanks[R]
• PZR Pressure Transmitter[S]
• SG Pressure Transmitter[S]
• Lube Oil Collection Tank
• SIT Outlet Isolation Valve[SR]</td><td colspan="2">Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.55E8 (1.47E8)
• Lube oil 3.17E8 (3.01E8)</td></tr>
<tr><td colspan="2">Floor Area (m^2(ft^2))</td><td>654 (7,036)</td></tr>
<tr><td colspan="2">Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>8.47E5 (7.46E4)</td></tr>
<tr><td colspan="2">Fire Severity (min)</td><td>56</td></tr>
</table>

Table 9.5A-2 (10 of 318)

Z000-CRP : Refueling Pool Area			
Zone Description		Protection Measures	
• F000-CNB : Containment Building		Detection	• None
Wall	• Z000-CAN	Fire Extinguish	• None
Floor	• Z000-CAN	Suppression System	• None
Ceiling	• Open to containment atmosphere	Access/Egress	• None
Major Equipment		Combustible & Fire Loading	
• Reactor Vessel[R] • CEA Drive Machine		Major Combustible (kJ (Btu))	• Cable insulation 2.41E6 (2.29E6)
		Floor Area (m^2(ft^2))	186 (2,000)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.57E4 (1.39E3)
		Fire Severity (min)	1

Table 9.5A-2 (11 of 318)

<table>
<tr><td colspan="4">Z050-A01C : CS Pump & Mini Flow Heat Exchanger Room A</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F050-A01C : CS Pump & Mini Flow Heat Exchanger Room A</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-A14C
• F055-AGAC (Z055-A07C)
• F050-A02C</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A11C</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Containment Spray pump[R]
• CS pump Room Cubicle Cooler
• CS Miniflow Heat Exchanger
• Sump Pump[R]</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 3.09E6 (2.93E6)
• Lube oil 2.08E6 (1.97E6)
• Grease 1.64E4 (1.55E4)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>72 (771)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>7.95E4 (7.00E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>5</td></tr>
</table>

Table 9.5A-2 (12 of 318)

Z050-A02C : Safety Injection Pump Room C			
Zone Description		Protection Measures	
• F050-A02C : Safety Injection Pump Room C		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A14C • F055-AGAC (Z055-A07C) • F050-A01C	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-AAFC	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• SI pump[R] • SI pump Room Cubicle Cooler • Sump Pump[R]	Major Combustible (kJ (Btu))	• Cable insulation 1.06E6 (1.00E6) • Grease 1.64E4 (1.55E4)
	Floor Area (m^2(ft^2))	86 (927)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.84E4 (1.62E3)
	Fire Severity (min)	1

Table 9.5A-2 (13 of 318)

Z050-A03A : Safety Injection Pump Room A			
Zone Description		Protection Measures	
• F050-A03A : Safety Injection Pump Room A		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A18A • F055-AGAA • F050-A02C • F050-A04A	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A20A	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• SI pump[R] • SI pump Room Cubicle Cooler • Sump Pump[R]		Major Combustible (kJ (Btu))	• Cable insulation 6.43E5 (6.09E5) • Grease 1.64E4 (1.55E4)
		Floor Area (m^2(ft^2))	72 (771)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.63E4 (1.44E3)
		Fire Severity (min)	1

Table 9.5A-2 (14 of 318)

Z050-A04A : SC Pump & Mini Flow Heat Exchanger Room A			
Zone Description		Protection Measures	
• F050 -A04A : SC Pump & Mini Flow Heat Exchanger Room A		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A21A • F055-AGAA • F055-A20A • F049-A02A • F050-A03A	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A20A • F078-A25A	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• SC pump[SR] • SC pump Room Cubicle Cooler[S] • Sump Pump[R] • SC Miniflow Heat Exchanger[S]	Major Combustible (kJ (Btu))	• Cable insulation 1.36E7 (1.29E7) • Grease 1.64E4 (1.55E4)
	Floor Area (m^2(ft^2))	73 (784)
	Fire Load (kJ/ m^2 (Btu/ft^2))	2.06E5 (1.82E4)
	Fire Severity (min)	14

Table 9.5A-2 (15 of 318)

<table>
<tr><td colspan="4">Z055-A01C : Containment Spray Heat Exchanger Room A</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F055-A01C : Containment Spray Heat Exchanger Room A</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-AGAC (Z055-A57C, Z055-A07C)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A01C
• F078-AGAC (Z078-A29C)</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• CS Hx Room Cubicle Cooler^S
• CS Heat Exchanger^S</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 3.89E6 (3.68E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>113 (1,219)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.88E4 (3.42E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>3</td></tr>
</table>

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<table>
<tr><td colspan="5">Z055-A02A : CCW Pump Room A</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="3">Protection Measures</td></tr>
<tr><td colspan="2">• F055-A02A : CCW Pump Room A</td><td>Detection</td><td colspan="2">• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-AGAC (Z055-A07C)
• F055-A02C
• F055-A19A
• F000-AC (Z063-AC)</td><td>Fire Extinguish</td><td colspan="2">• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td colspan="2">• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A53C
• F078-AGAC (Z078-A57C)</td><td>Access/Egress</td><td colspan="2">• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="3">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• CCW Pump Room Cubicle Cooler[S]
• Component Cooling Water Pump[S]</td><td colspan="2">Major Combustible (kJ (Btu))</td><td>• Cable insulation 5.93E6 (5.62E6)
• Lube oil 2.58E5 (2.45E5)</td></tr>
<tr><td colspan="2">Floor Area (m^2(ft^2))</td><td>92 (994)</td></tr>
<tr><td colspan="2">Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>7.34E4 (6.47E3)</td></tr>
<tr><td colspan="2">Fire Severity (min)</td><td>5</td></tr>
</table>

Table 9.5A-2 (17 of 318)

<table>
<tr><td colspan="4">Z055-A02C : CCW Pump Room C</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F055-A02C : CCW Pump Room C</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-AGAC (Z055-A07C)
• F050-A02C</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A52C</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• CCW Pump Room Cubicle Cooler[S]
• Component Cooling Water Pump[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.47E7 (1.39E7)
• Lube oil 2.58E5 (2.45E5)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>110 (1,189)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.48E5 (1.31E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>10</td></tr>
</table>

Table 9.5A-2 (18 of 318)

Z055-A04C : Seismic CAT-I Fire Water Tank Room			
Zone Description		Protection Measures	
• F055-A04C : Seismic CAT-I Fire Water Tank Room		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A04D • F055-AGAC (Z055-A03C) • F067-T02	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A06C • F078-A07C	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Seismic CAT-I Fire Pump • Seismic CAT-I Fire Tank		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	123 (1,321)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.44E3 (3.03E2)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (19 of 318)

<table>
<tr><td colspan="4">Z055-A10C : Tendon Gallery Entrance Area</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F055-A10C : Tendon Gallery Entrance Area</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-A14C
• F055-AGAC (Z055-A03C)
• F055-AGAD (Z055-A10D)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A09C
• F078-A14C
• F100-AGAC (Z100-A09C)</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• None</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>69 (747)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>6.08E3 (5.35E2)</td></tr>
<tr><td>Fire Severity (min)</td><td>Less than 1 min</td></tr>
</table>

Table 9.5A-2 (20 of 318)

<table>
<tr><td colspan="4">Z055-A14C : Pipe Chase & Valve Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F055-A14C : Pipe Chase & Valve Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-A10C
• F055-AGAC (Z055-A03C)
• F050-A01C
• F050-A02C
• F000-CNB (Z000-CAN)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A12C
• F100-A16C</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 3.28E6 (3.11E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>142 (1,528)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>2.67E4 (2.35E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>2</td></tr>
</table>

Table 9.5A-2 (21 of 318)

Z055-A18A : Pipe Chase & Valve Room			
Zone Description		Protection Measures	
• F055-A18A : Pipe Chase & Valve Room		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A21A • F050-A03A • F000-CNB (Z000-CAN)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A23A • F100-A16C	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 5.74E6 (5.44E6)
		Floor Area (m^2(ft^2))	59 (634)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.07E5 (9.44E3)
		Fire Severity (min)	7

Table 9.5A-2 (22 of 318)

Z055-A21A : Pipe Chase & Valve Room			
Zone Description		Protection Measures	
• F055-A21A : Pipe Chase & Valve Room		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A22A • F055-A18A • F050-A04A • F000-ACVL (Z055-ACVL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A12A • F078-A25A	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.34E6 (1.27E6)
		Floor Area (m^2(ft^2))	204 (2,192)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.07E3 (7.99E2)
		Fire Severity (min)	1

Table 9.5A-2 (23 of 318)

Z055-A22A : Pipe Chase			
Zone Description		Protection Measures	
• F055-A22A : Pipe Chase		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A22B • F055-A21A • F000-ACVL (Z055-ACVL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A21A	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	55 (590)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.70E3 (6.78E2)
		Fire Severity (min)	1

Table 9.5A-2 (24 of 318)

Z055-A30A : SC Heat Exchanger Room			
Zone Description		Protection Measures	
• F055-A30A : SC Heat Exchanger Room		Detection	• Analog type photoelectric smoke detector
Wall	• F055-AGAC (Z055-A07C, Z055-A57C)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A01C • F000-ACVL (Z078-ACVL)	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• SC Heat Exchanger[SR] • Cubicle Cooler[S]	Major Combustible (kJ (Btu))	• Cable insulation 8.60E6 (8.15E6)
	Floor Area (m^2(ft^2))	148 (1,598)
	Fire Load (kJ/ m^2 (Btu/ft^2))	6.37E4 (5.61E3)
	Fire Severity (min)	4

Table 9.5A-2 (25 of 318)

Z055-A42A : Charging Pump Room			
Zone Description		Protection Measures	
• F055-A42A : Charging Pump Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-ACVL (Z055-ACVL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F000-ACVL (Z068-ACVL)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Charging Pump[SR] • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Lube oil 1.08E5 (1.02E5)
		Floor Area (m^2(ft^2))	40 (430)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.28E5 (2.01E4)
		Fire Severity (min)	15

Table 9.5A-2 (26 of 318)

Z055-A19A : General Access Area A- 55'-0"			
Zone Description		Protection Measures	
• F055-A19A : General Access Area A- 55'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A30A • F000-AC (Z055-AC) • F050-A04A • F050-A03A	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A19A	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• SI Pump Flowrate • Containment Spray Heat Exchanger • Charging Pump Suction Pressure Switch • SC Hx. Outlet Iso. Valves[S] • SCS Test Return Line Iso. Valve	Major Combustible (kJ (Btu))	• Cable insulation 1.63E7 (1.55E7)
	Floor Area (m^2(ft^2))	176 (1,899)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.02E5 (8.97E3)
	Fire Severity (min)	7

Table 9.5A-2 (27 of 318)

Z055-A03C : Central Water Chiller Room			
Zone Description		Protection Measures	
• F055-AGAC : General Access Area C- 55'-0"		Detection	• Analog type photoelectric smoke detector • Analog type heat detector
Wall	• F055-A04C • F055-A01C • Z055-A08C • Z055-A57C	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A02C • F078-A03C	Access/Egress	• Door • Stair

Major Equipment	Combustible & Fire Loading	
• Central Water Chiller	Major Combustible (kJ (Btu))	• Cable insulation 1.87E7 (1.77E7)
	Floor Area (m^2(ft^2))	421 (4,529)
	Fire Load (kJ/ m^2 (Btu/ft^2))	4.89E4 (4.30E3)
	Fire Severity (min)	3

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Z055-A07C : General Access Area			
Zone Description		Protection Measures	
• F055-AGAC : General Access Area C- 55'-0"		Detection	• Analog type photoelectric smoke detector • Analog type heat detector
Wall	• F055-A01C • F055-A02C • Z055-A03C • Z055-A57C	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-AGAC (Z078-10C, Z078-A29C)	Access/Egress	• Door • Stair
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 2.82E6 (2.67E6)
		Floor Area (m^2(ft^2))	189 (2,038)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.76E4 (1.55E3)
		Fire Severity (min)	1

Table 9.5A-2 (29 of 318)

Z055-A08C : Floor Drain Sump Pump Room			
Zone Description		Protection Measures	
• F055-AGAC : General Access Area C- 55'-0"		Detection	• Analog type photoelectric smoke detector • Analog type heat detector
Wall	• Z055-A03C • Z055-A57C	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A02C	Access/Egress	• Door • Stair
Major Equipment		Combustible & Fire Loading	
• Floor drain sump pump		Major Combustible (kJ (Btu))	• Cable insulation 1.79E6 (1.70E6) • Grease 1.64E4 (1.55E4)
		Floor Area (m^2(ft^2))	14 (149)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.67E5 (1.47E4)
		Fire Severity (min)	11

Table 9.5A-2 (30 of 318)

Z055-A57C : Piping& Cable Area			
Zone Description		Protection Measures	
• F055-AGAC : General Access Area C- 55'-0"		Detection	• Analog type photoelectric smoke detector • Analog type heat detector
Wall	• F055-A01C • F055-A02C • Z055-A17C • Z055-A08C	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F065-A01C	Access/Egress	• Door • Stair
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	289 (3,111)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.46E2 (1.29)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (31 of 318)

Z065-A01C : Diesel Fuel Oil Storage Tank Room C			
Zone Description		Protection Measures	
• F065-A01C : Diesel Fuel Oil Storage Tank Room C		Detection	• Explosion proof type fixed temperature detector • Flame detector
Wall	• F078-A01C • F078-AGAC (Z078-A29C) • F078-A52C	Fire Extinguish	• Dry chemical • Wheeled dry chemical
Floor	• F055-AGAC (Z055-A57C)	Suppression System	• Automatic preaction sprinkler system
Ceiling	• Exterior roof	Access/Egress	• Ladder • Stairwell
Major Equipment		Combustible & Fire Loading	
• Diesel Fuel Oil Storage Tank^S • Diesel Fuel Oil Transfer Pump^S • Exhaust Fan^S		Major Combustible (kJ (Btu))	• Fuel Oil 1.73E10 (1.64E10)
		Floor Area (m^2(ft^2))	169 (1,814)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.03E8 (9.03E6)
		Fire Severity (hr)	112.9

Table 9.5A-2 (32 of 318)

Z068-A05A : HVAC Chase			
Zone Description		Protection Measures	
• F068-A05A : HVAC Chase		Detection	• None
Wall	• F000-ACVL (Z068-ACVL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F000-ACVL (Z055-ACVL)	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.46E7 (1.38E7)
		Floor Area (m^2(ft^2))	6 (63)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.74E6 (2.41E5)
		Fire Severity (hr)	3

Table 9.5A-2 (33 of 318)

<table>
<tr><td colspan="4">Z078-A01C : PNS SWGR Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F078-A01C : PNS SWGR Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector
• Analog type heat detector</td></tr>
<tr><td>Wall</td><td>• F078-A02C
• F065-A01C
• F078-AGAC (Z078-A10C, Z078-A29C)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F055-A01C
• F055-AGAC (Z055-A57C)</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F000-ADGC</td><td>Access/Egress</td><td>• Door
• Stair</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 4.16kV Non 1E Switchgear
• Cubicle Cooler</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 3.78E7 (3.59E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>92 (994)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>4.51E5 (3.97E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>30</td></tr>
</table>

Table 9.5A-2 (34 of 318)

<table>
<tr><td colspan="4">Z078-A02C : Class 1E Switchgear 01C Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F078-A02C : Class 1E Switchgear 01C Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F078-A03C
• F078-A01C
• F000-TB</td><td>Fire Extinguish</td><td>• Water hose
• CO_2 hose
• CO_2 chemical</td></tr>
<tr><td>Floor</td><td>• F055-AGAC (Z055-A07C)</td><td>Suppression System</td><td>• Automatic preaction sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F000-ADGC</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 4.16kV 1E Switchgear[S]
• Cubicle Cooler[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.14E7 (1.08E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>105 (1,127)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.19E5 (1.05E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>8</td></tr>
</table>

Table 9.5A-2 (35 of 318)

<table>
<tr><td colspan="4">Z078-A03C : Class 1E Loadcenter 01C Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F078-A03C : Class 1E Loadcenter 01C Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F078-A02C
• F078-A01C
• F078-A04C
• F078-A05C
• F000-TB</td><td>Fire Extinguish</td><td>• Water hose
• CO_2 hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F055-AGAC (Z055-A03C)</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F000-ADGC</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Class 1E 480V Loadcenter^S
• Class 1E 480V MCCs^S
• Cubicle Cooler^S</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 3.72E7 (3.53E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>135 (1,455)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.03E5 (2.67E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>20</td></tr>
</table>

Table 9.5A-2 (36 of 318)

Z078-A04C : MISC. Electrical Equip. Room			
Zone Description		Protection Measures	
• F078-A04C : MISC. Electrical Equip. Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A03C • F078-A05C • F078-A06C	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F055-A04C • F055-AGAC (Z055-A03C)	Suppression System	• None
Ceiling	• F000-ADGC	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 480V N1E MCC • Normal LTG Transformer • Normal LTG Panel • Essential LTG Transformer • Essential LTG Panel		Major Combustible (kJ (Btu))	• Cable insulation 1.05E7 (9.99E6)
		Floor Area (m^2(ft^2))	57 (613)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.04E5 (1.79E4)
		Fire Severity (min)	13

Table 9.5A-2 (37 of 318)

Z078-A05C: Train C DC&IP Equip. Room			
Zone Description		Protection Measures	
• F078-A05C : Train C DC&IP Equip. Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A07C • F078-A03C • F078-A04C • F000-TB	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F055-AGAC (Z055-A03C)	Suppression System	• None
Ceiling	• F000-ADGC	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• 120V AC Class 1E Inverter[S] • Regulation Transformer[S] • 125V DC Control Center[S] • 125V DC Class 1E Battery Charger[S] • Class 1E Spare Battery Charger • SI Inverter • Cubicle Cooler[S]	Major Combustible (kJ (Btu))	• Cable insulation 1.21E7 (1.15E7)
	Floor Area (m^2(ft^2))	91 (981)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.46E5 (1.28E4)
	Fire Severity (min)	10

Table 9.5A-2 (38 of 318)

Z078-A06C : N1E Battery Room			
Zone Description		Protection Measures	
• F078-A06C : N1E Battery Room		Detection	• Analog type photoelectric smoke detector • Explosion proof type fixed temperature detector
Wall	• F078-A06D • F078-A04C • F078-AGAC (Z078-A10C)	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F055-AGAC (Z055-A03C) • F055-A04C	Suppression System	• None
Ceiling	• F100-AGAC (Z100-A06C) • F100-A05C	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• 125V DC N1E Battery	Major Combustible (kJ (Btu))	• Cable insulation 1.32E6 (1.25E6) • Battery 9.48E6 (8.98E6)
	Floor Area (m^2(ft^2))	70 (749)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.69E5 (1.49E4)
	Fire Severity (min)	11

Table 9.5A-2 (39 of 318)

Z078-A07C : Train C Battery Room			
Zone Description		Protection Measures	
• F078-A07C : Train C Battery Room		Detection	• Analog type photoelectric smoke detector • Explosion proof type fixed temperature detector
Wall	• F078-A07D • F078-A05C • F078-A06C	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F055-A04C	Suppression System	• None
Ceiling	• F100-A05C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Class 1E 125V DC Battery[S]		Major Combustible (kJ (Btu))	• Cable insulation 1.99E6 (1.89E6) • Battery 9.48E6 (8.98E6)
		Floor Area (m^2(ft^2))	78 (844)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.58E4 (1.39E4)
		Fire Severity (min)	10

Table 9.5A-2 (40 of 318)

Z078-A09C : HVAC Chase			
Zone Description		Protection Measures	
• F078-A09C : HVAC Chase		Detection	• None
Wall	• F078-A14C • F055-A10C • F078-AGAC (Z078-A10C)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A10C	Suppression System	• None
Ceiling	• Exterior Roof	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.15E7 (1.09E7)
		Floor Area (m^2(ft^2))	8 (88)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.54E6 (1.36E5)
		Fire Severity (hr)	1.7

Table 9.5A-2 (41 of 318)

Z078-A11C : Essential Chiller Room			
Zone Description		Protection Measures	
• F078-A11C : Essential Chiller Room A		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A14C • F078-A12C • F078-AGAC (Z078-A10C) • F078-AAFC	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F050-A01C	Suppression System	• None
Ceiling	• F100-A07C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Essential Chilled Water Pump^S • Essential Chiller^S • ECW Isolation Valve^S • ECW Modulating Valve^S • Cubicle Cooler^S		Major Combustible (kJ (Btu))	• Cable insulation 6.24E5 (5.92E5)
		Floor Area (m^2(ft^2))	87 (935)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.31E4 (1.15E3)
		Fire Severity (min)	1

Table 9.5A-2 (42 of 318)

Z078-A12C : Essential Water Chiller Room			
Zone Description		Protection Measures	
• F078-A12C : Essential Water Chiller Room C		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A10C • F055-A14C • F078-A11C	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F055-A14C	Suppression System	• None
Ceiling	• F100-A08C	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• Essential Chilled Water Pump[S] • Essential Chiller[S] • ECW Isolation Valve[S] • ECW Modulating Valve[S] • Cubicle Cooler[S]	Major Combustible (kJ (Btu))	• Cable insulation 8.36E6 (7.93E6)
	Floor Area (m^2(ft^2))	114 (1,228)
	Fire Load (kJ/ m^2 (Btu/ft^2))	8.06E4 (7.10E3)
	Fire Severity (min)	5

Table 9.5A-2 (43 of 318)

Z078-A14C : Buttress Opening			
Zone Description		Protection Measures	
• F078-A14C : Buttress Opening		Detection	• None
Wall	• F078-A09D F078-A09C • F050-A02C	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A10C • F055-AGAD (Z055-A11D)	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	42 (454)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.00E4 (8.82E2)
	Fire Severity (min)	1

Table 9.5A-2 (44 of 318)

Z078-A16C : HVAC Chase			
Zone Description		Protection Measures	
• F078-A16C : HVAC Chase		Detection	• None
Wall	• F055-A14C • F078-AAFC • F100-A07C • F100-A08C • F100-A16C • F120-A09C • F137-A11C • F137-A31C • F157-A19C • F174-A14C	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A14C	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door • Ladders
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	5 (52)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.74E4 (7.96E3)
		Fire Severity (min)	6

Table 9.5A-2 (45 of 318)

Z078-A19A : Corridor			
Zone Description		Protection Measures	
• F078-A19A : General Access Area A- 78'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A56A • F078-A53C • F078-A20A • F078-A25A	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A19A	Suppression System	• None
Ceiling	• F100-A11A	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• Cable insulation 1.07E8 (1.02E8)
	Floor Area (m^2(ft^2))	143 (1,535)
	Fire Load (kJ/ m^2 (Btu/ft^2))	8.27E5 (7.28E4)
	Fire Severity (min)	55

Table 9.5A-2 (46 of 318)

Z078-A20A : Motor-Driven AFW Pump Room A			
Zone Description		Protection Measures	
• F078-A20A : Motor-Driven AFW Pump Room A		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A18A • F078-A23A • F078-A19A • F078-AAFC	Fire Extinguish	• Water hose • Dry chemical
Floor	• F050-A03A • F050-A04A	Suppression System	• None
Ceiling	• F100-A07C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Aux. Feedwater Motor-Driven Pump^{S} • Cubicle Cooler^{S} • Suction Pressure Transmitter^{S} • Discharge Pressure transmitter^{S}		Major Combustible (kJ (Btu))	• Cable insulation 5.97E6 (5.66E5)
		Floor Area (m^2(ft^2))	90 (968)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.23E4 (1.08E3)
		Fire Severity (min)	1

Table 9.5A-2 (47 of 318)

Z078-A21A : Pipe Chase			
Zone Description		Protection Measures	
• F078-A21A : Pipe Chase		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A21B • F078-A25A • F000-ACVL (Z078-ACVL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A22A • F055-A21A	Suppression System	• None
Ceiling	• F100-A13A • F000-ACVU	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	102 (1,096)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.14E3 (3.65E2)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (48 of 318)

Z078-A23A : Buttress Opening			
Zone Description		Protection Measures	
• F078-A23A : Buttress Opening		Detection	• None
Wall	• F078-A20A • F078-A25A • F055-A18A	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A18A	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	54 (584)
	Fire Load (kJ/ m^2 (Btu/ft^2))	7.78E3 (6.85E2)
	Fire Severity (min)	1

Table 9.5A-2 (49 of 318)

Z078-A25A : Class 1E Switchgear 01A Room			
Zone Description		Protection Measures	
• F078-A25A : Class 1E Switchgear 01A Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A21A • F078-A20A • F078-A19A • F078-A23A • F000-ACVL (Z078-ACVL)	Fire Extinguish	• Water hose • CO_2 chemical
Floor	• F055-A04A • F055-A21A	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F100-A12A • F100-A13A	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• Class 1E 4.16kV Switchgear[S] • Class 1E 480V Loadcenter[S] • Cubicle Cooler[S]	Major Combustible (kJ (Btu))	• Cable insulation 2.88E7 (2.73E7)
	Floor Area (m^2(ft^2))	217 (2,333)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.46E5 (1.29E4)
	Fire Severity (min)	10

Table 9.5A-2 (50 of 318)

<table>
<tr><td colspan="4">Z078-A52C : 480V N1E MCC Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F078-A52C : 480V N1E MCC Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F065-A01C
• F078-AGAC (Z078-A57C, Z078-A10C)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F055-A02C</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Exterior wall</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 480V Non 1E MCC 01M
• 480V Non 1E MCC 02M
• 480V Non 1E MCC 03M
• 480V Non 1E MCC 05M
• Cubicle Cooler</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 3.17E7 (3.01E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>110 (1,189)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.16E5 (2.78E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>21</td></tr>
</table>

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<table>
<tr><td colspan="4">Z078-A53C : 480V N1E Loadcenter Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F078-A53C : 480V N1E Loadcenter Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F078-AGAC (Z078-A57C)
• F078-A19A
• F000-RW (Z078-RW)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F055-A02A</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 480V Non 1E Loadcenter</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 8.56E6 (8.12E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>42 (454)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>2.23E5 (1.97E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>15</td></tr>
</table>

Table 9.5A-2 (52 of 318)

Z078-A56A : Train A DC & IP Equip. Room			
Zone Description		Protection Measures	
• F078-A56A : Train A DC & IP Equip. Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-ACVL (Z078-ACVL) • F078-A19A • F000-RW (Z078-RW)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A19A	Suppression System	• None
Ceiling	• F100-A11A	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• 120V AC Class 1E Inverter[S] • 125V DC Control Center[S] • 125V DC Class 1E Battery Chargers[S] • Class 1E Spare Battery Charger[S] • SI Inverter • Cubicle Cooler[S]	Major Combustible (kJ (Btu))	• Cable insulation 1.05E7 (9.99E6)
	Floor Area (m^2(ft^2))	65 (703)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.78E5 (1.56E4)
	Fire Severity (min)	12

Table 9.5A-2 (53 of 318)

Z078-AAFC : Turbine Driven AFW Pump Room A			
Zone Description		Protection Measures	
• F078-AAFC : Turbine Driven AFW Pump Room A		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A11C • F078-A20A • F078-AGAC (Z078-A10C)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F050-A02C	Suppression System	• None
Ceiling	• F100-A07C	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• Aux. Feedwater Turbine Driven Pump^{S} • Auxiliary Feedwater Pump Turbine Steam Supply Isolation Valve^{S} • Suction Pressure Transmitter^{S} • Discharge Pressure Transmitter^{S} • Cubicle Cooler^{S}	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	89 (954)
	Fire Load (kJ/ m^2 (Btu/ft^2))	4.76E3 (4.19E2)
	Fire Severity (min)	Less than 1 min

Table 9.5A-2 (54 of 318)

Z078-A10C : General Access Area			
Zone Description		Protection Measures	
• F078-AGAC : General Access Area C- 78'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z078-A29C • Z078-A57C • F078-A01C, A02C, A04C, A06C,A09C, A11C, A12C, A14C • F078-AAFC • F078-A52C	Fire Extinguish	• Water hose • CO_2 hose • Dry chemical • CO_2 chemical
Floor	• F055-AGAC	Suppression System	• None
Ceiling	• F100-AGAC	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• Refrigerant Removal Exhaust Fan	Major Combustible (kJ (Btu))	• Cable insulation 4.21E7 (3.99E7)
	Floor Area (m^2(ft^2))	178 (1,914)
	Fire Load (kJ/ m^2 (Btu/ft^2))	2.61E5 (2.30E4)
	Fire Severity (min)	17

Table 9.5A-2 (55 of 318)

Z078-A29C : CCW Makeup Pump Room			
Zone Description		Protection Measures	
• F078-AGAC : General Access Area C- 78'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z078-A10C • F078-A01C • F065-A01C	Fire Extinguish	• Water hose • CO_2 hose • Dry chemical • CO_2 chemical
Floor	• F055-AGAC	Suppression System	• None
Ceiling	• F100-AGAC	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• CCW Makeup Pump	Major Combustible (kJ (Btu))	• Cable insulation 1.74E7 (1.65E7) • Lube oil 3.45E4 (3.27E4)
	Floor Area (m^2(ft^2))	27 (288)
	Fire Load (kJ/ m^2 (Btu/ft^2))	7.16E5 (6.30E4)
	Fire Severity (min)	47

Table 9.5A-2 (56 of 318)

Z078-A57C : Piping & Cable Area			
Zone Description		Protection Measures	
• F078-AGAC : General Access Area C- 78'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z078-A10C • F078-A53C • F078-A52C	Fire Extinguish	• Water hose • CO_2 hose • Dry chemical • CO_2 chemical
Floor	• F055-A02A	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 2.35E5 (2.23E5)
		Floor Area (m^2(ft^2))	45 (486)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.73E4 (1.52E3)
		Fire Severity (min)	1

Table 9.5A-2 (57 of 318)

<table>
<tr><td colspan="4">Z000-ADGC : Diesel Generator Room A</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-ADGC : Diesel Generator Room A</td><td>Detection</td><td>• Analog type photoelectric smoke detector
• Flame detector</td></tr>
<tr><td>Wall</td><td>• F100-A04C
• F100-AGAC (Z100-A06C)
• F000-TB</td><td>Fire Extinguish</td><td>• Water hose
• CO_2 hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F078-A01C ~ F078-A05C</td><td>Suppression System</td><td>• Automatic preaction sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F137-A01C ~ F137-A04C
• F137-A35C ~ F137-A38C</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Class 1E Diesel Generator[S]
• EDG Room Normal Supply Fan
• EDG Control Room Electrical Duct Heater
• LT&HT Water Expansion Tank & Diesel Fuel Oil Tank & Lube oil Makeup Tank Room Duct Heater</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 5.17E7 (4.90E7)
• Lube oil 2.41E8 (2.28E8)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>395 (4,255)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>8.46E5 (7.45E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>56</td></tr>
</table>

Table 9.5A-2 (58 of 318)

Z100-A04C : Cable Access Area			
Zone Description		Protection Measures	
• F100-A04C : Cable Access Area		Detection	• Analog type photoelectric smoke detector
Wall	• F100-A05C • F000-ADGC • F100-AGAC (Z100-A06C)	Fire Extinguish	• Water hose • Dry chemical • CO_2 chemical
Floor	• F078-A04C • F078-A05C	Suppression System	• None
Ceiling	• F000-ADGC • F120-A01C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Cable Tray & Conduits		Major Combustible (kJ (Btu))	• Cable insulation 2.16E6 (2.05E6)
		Floor Area (m^2(ft^2))	45 (485)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.93E4 (5.22E3)
		Fire Severity (min)	4

Table 9.5A-2 (59 of 318)

Z100-A05C : Electrical Equipment Room			
Zone Description		Protection Measures	
• F100-A05C : Electrical Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• F100-A05D • F100-A04C • F100-AGAC (Z100-A06C)	Fire Extinguish	• Water hose • Dry chemical • CO_2 chemical
Floor	• F078-A06C • F078-A07C	Suppression System	• None
Ceiling	• F120-A05C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 13.8kV Non 1E SWGR 01M • 480V Non 1E Loadcenter 11M • 480V Non 1E MCC 10M • Electrical Equipment Room CC		Major Combustible (kJ (Btu))	• Cable insulation 5.97E7 (5.66E7)
		Floor Area (m^2(ft^2))	123 (1,321)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.35E5 (4.71E4)
		Fire Severity (min)	35

Table 9.5A-2 (60 of 318)

Z100-A07C : Aux. Feed Water Tank Room A			
Zone Description		Protection Measures	
• F100-A07C : Aux. Feed Water Tank Room A		Detection	• None
Wall	• F100-AGAC • F100-A08C • F100-A16C • F100-AEEA • F100-A10A	Fire Extinguish	• None
Floor	• F078-A11C • F078-A20A • F078-AAFC	Suppression System	• None
Ceiling	• F137-A10C • F137-A31C	Access/Egress	• None
Major Equipment		Combustible & Fire Loading	
• Aux. Feedwater Tank^{S}		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	249 (2,683)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.69E3 (1.49E2)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (61 of 318)

<table>
<tr><td colspan="4">Z100-A08C : Non 1E DC & IP Equip. Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F100-A08C : Non 1E DC & IP Equip. Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F100-AGAC
• F100-A07C
• F100-A16C</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F078-A12C</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F120-A09C</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 125V DC MCC 01M
• 125V DC Battery Charger
• 120V AC Non 1E IP Inverter
• 120V AC Non 1E IPS Inverter
• Regulating Transformer</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 6.22E7 (5.89E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>114 (1,228)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>5.99E5 (5.28E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>40</td></tr>
</table>

Table 9.5A-2 (62 of 318)

Z100-A10A : General Access Area A- 100'-0"			
Zone Description		Protection Measures	
• F100-A10A : General Access Area A- 100'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F100-AGAD • F100-A07C • F100-A16C	Fire Extinguish	• Water hose • Dry chemical
Floor	• F078-A12C	Suppression System	• None
Ceiling	• F120-A09C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 4.54E7 (4.31E7)
		Floor Area (m^2(ft^2))	104 (1,124)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.79E5 (4.22E4)
		Fire Severity (min)	32

Table 9.5A-2 (63 of 318)

Z100-A11A : Train A Battery Room			
Zone Description		Protection Measures	
• F100-A11A : Train A Battery Room		Detection	• Explosion proof type fixed temperature detector
Wall	• F100-A10A • F100-A20A • F100-AC	Fire Extinguish	• Water hose • Dry chemical
Floor	• F078-A56A	Suppression System	• None
Ceiling	• F120-AGAA (Z120-A11A)	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 125V DC Class 1E Battery[S] • Class 1E Battery Room Supply Fan[S] • Class 1E Battery Room Exhaust Fan[S]		Major Combustible (kJ (Btu))	• Cable insulation 2.15E6 (2.04E6) • Battery 1.09E7 (1.03E7)
		Floor Area (m^2(ft^2))	66 (711)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.14E5 (1.88E4)
		Fire Severity (min)	14

Table 9.5A-2 (64 of 318)

Z100-A13A : Mechanical Penetration Room			
Zone Description		Protection Measures	
• F100-A13A : Mechanical Penetration Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-ACVU • F100-A20A • F100-A12A	Fire Extinguish	• Water hose • Dry chemical
Floor	• F078-AEEA • F078-A21A	Suppression System	• None
Ceiling	• F000-AHV (Z120-A14A) • F120-A16A	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• SC Containment Isolation Valve [S] • SCS Test Return Line Isolation Valve • SC Warmup Bypass Valve [S]		Major Combustible (kJ (Btu))	• Cable insulation 1.40E6 (1.33E6)
		Floor Area (m^2(ft^2))	192 (2,062)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.98E3 (8.79E2)
		Fire Severity (min)	1

Table 9.5A-2 (65 of 318)

Z100-A16C : Pipe Chase Area			
Zone Description		Protection Measures	
• F100-A16C : Pipe Chase Area		Detection	• None
Wall	• F000-CNB • F100-A07C • F100-A08C • F078-A23A	Fire Extinguish	• Dry chemical
Floor	• F055-A18A • F055-A14C	Suppression System	• None
Ceiling	• F120-A06C	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	65 (704)
	Fire Load (kJ/ m^2 (Btu/ft^2))	6.45E3 (5.68E2)
	Fire Severity (min)	Less than 1min

Table 9.5A-2 (66 of 318)

Z100-A23A : AB Controlled Area (I) Supply AHU Room			
Zone Description		Protection Measures	
• F100-A23A : AB Controlled Area (I) Supply AHU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F100-A38A • F100-A20A	Fire Extinguish	• Dry chemical • Water hose
Floor	• F000-ACVU	Suppression System	• None
Ceiling	• F120-A21A	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• AB Controlled Area (I) Supply AHU	Major Combustible (kJ (Btu))	• Cable insulation 4.88E5 (4.62E5) • Prefilter 3.54E5 (3.36E5)
	Floor Area (m^2(ft^2))	95 (1,024)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.42E4 (1.25E3)
	Fire Severity (min)	1

Table 9.5A-2 (67 of 318)

Z100-A24A : SFP Cooling Heat Exchanger Room			
Zone Description		Protection Measures	
• F100-A24A : SFP Cooling Heat Exchanger Room		Detection	• Analog type photoelectric smoke detector
Wall	• F100-A38A • F000-ACVU (Z100-ACVU)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F000-ACVL (Z100-ACVL)	Suppression System	• None
Ceiling	• F120-A24A	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• Spent Fuel Pool Cooing Heat Exchanger^{SR} • Spent Fuel Pool Cooling Pump^{SR} • Cubicle Cooler	Major Combustible (kJ (Btu))	• Cable insulation 6.69E5 (6.34E5) • Lube oil 1.73E5 (1.64E5)
	Floor Area (m^2(ft^2))	106 (1,144)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.27E4 (1.12E3)
	Fire Severity (min)	1

Table 9.5A-2 (68 of 318)

Z100-A38A : Fuel Handling Area Normal Exhaust ACU Room			
Zone Description		Protection Measures	
• F100-A38A : Fuel Handling Area Normal Exhaust ACU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F100-A24A • F000-ACVU (Z100-ACVU) • F100-A20A	Fire Extinguish	• Dry chemical • Water hose
Floor	• F000-ACVL (Z100-ACVL)	Suppression System	• Manually actuated deluge system for charcoal filters
Ceiling	• F120-A21A	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• FH Area Normal Exhaust ACU[R]	Major Combustible (kJ (Btu))	• Cable insulation 1.09E6 (1.03E6) • HEPA filter 3.38E5 (3.20E5) • Prefilter 3.38E5 (3.20E5)
	Floor Area (m^2(ft^2))	122 (1,313)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.86E4 (1.64E3)
	Fire Severity (min)	1

Table 9.5A-2 (69 of 318)

<table>
<tr><td colspan="4">Z100-A12A: 480V Class 1E MCC 01A Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F100-AEEA : 480V Class 1E MCC 01A Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• Z100-A18A
• F100-A13A
• F100-A10A,
• F100-A07C
• F078-A23A</td><td>Fire Extinguish</td><td>• Dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F078-A25A</td><td>Suppression System</td><td>• Manually actuated deluge system for charcoal filters</td></tr>
<tr><td>Ceiling</td><td>• F000-AHV (Z120-A14A)</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Class 1E 480V MCC[S]
• Cubicle Cooler</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 2.52E7 (2.29E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>39 (417)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>6.87E5 (6.05E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>45</td></tr>
</table>

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<table>
<tr><td colspan="4">Z100-A18A: MUX N1 Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F100-AEEA : 480V Class 1E MCC 01A Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• Z100-A12A
• F100-A13A
• F100-A10A,
• F100-A07C
• F078-A23A</td><td>Fire Extinguish</td><td>• Dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F078-A25A</td><td>Suppression System</td><td>• Manually actuated deluge system for charcoal filters</td></tr>
<tr><td>Ceiling</td><td>• F000-AHV (Z120-A14A)</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• MUX cabinet
• LX</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.40E7 (1.32E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>39 (417)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.97E5 (3.49E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>26</td></tr>
</table>

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Z100-A06C : General Access Area C- 100'-0"			
Zone Description		Protection Measures	
• F100-AGAC : General Access Area C- 100'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z100-A09C • F100-A07C • F100-A08C • F100-A04C • F000-ADGC	Fire Extinguish	• Dry chemical • Water hose • CO_2 hose
Floor	• F078-AGAC	Suppression System	• None
Ceiling	• F120-AGAC	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.36E8 (1.29E8)
		Floor Area (m^2(ft^2))	324 (3,485)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.62E5 (4.07E4)
		Fire Severity (min)	31

Table 9.5A-2 (72 of 318)

Z100-A09C : Tendon Access Room			
Zone Description		Protection Measures	
• F100-AGAC : General Access Area C-100'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z100-A06C • F100-A08C	Fire Extinguish	• Dry chemical • Water hose • CO_2 hose
Floor	• F078-AGAC	Suppression System	• None
Ceiling	• F120-AGAC	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.44E7 (1.36E7)
		Floor Area (m^2(ft^2))	57 (617)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.76E5 (2.43E4)
		Fire Severity (min)	18

Table 9.5A-2 (73 of 318)

Z120-A01C : Piping Cable Area				
Zone Description		Protection Measures		
• F120-A01C : Piping Cable Area		Detection	• Analog type photoelectric smoke detector	
Wall	• F120-A05C • F000-ADGC • F120-AGAC • F000-TB	Fire Extinguish	• Dry chemical • Water hose • CO_2 hose	
Floor	• F100-A04C	Suppression System	• None	
Ceiling	• F137-A03C	Access/Egress	• Door	
Major Equipment		Combustible & Fire Loading		
• Cable Trays & Conduits		Major Combustible (kJ (Btu))	• Cable insulation 4.47E7 (4.23E7)	
		Floor Area (m^2(ft^2))	21 (230)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.30E6 (2.02E5)	
		Fire Severity (hr)	2.5	

Table 9.5A-2 (74 of 318)

Z120-A02C : Lube oil Makeup Tank Room C			
Zone Description		Protection Measures	
• F120-A02C : Lube oil Makeup Tank Room C		Detection	• Explosion proof type fixed temperature detector
Wall	• F120-A03C • F000-ADGC • F000-TB	Fire Extinguish	• Dry chemical • Water hose • Wheeled dry chemical
Floor	• F000-ADGC	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F137-A02C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Lube oil Makeup Tank[S]		Major Combustible (kJ (Btu))	• Lube oil 1.06E8 (1.01E8)
		Floor Area (m^2(ft^2))	14 (151)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.77E6 (7.72E5)
		Fire Severity (hr)	9.7

Table 9.5A-2 (75 of 318)

F120-A03C : Diesel Fuel Oil Day Tank Room C			
Zone Description		Protection Measures	
• F120-A03C : Diesel Fuel Oil Day Tank Room C		Detection	• Explosion proof type fixed temperature detector
Wall	• F120-A03C • F000-ADGC • F000-TB	Fire Extinguish	• Dry chemical • Water hose • Wheeled dry chemical
Floor	• F000-ADGC	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F137-A02C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Diesel Fuel Oil Day Tank[S]		Major Combustible (kJ (Btu))	• Fuel Oil 1.46E8 (1.38E8) • Cable insulation 2.63E6 (2.49E6)
		Floor Area (m^2(ft^2))	13 (143)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.12E7 (9.85E5)
		Fire Severity (hr)	12.3

Table 9.5A-2 (76 of 318)

<table>
<tr><td colspan="4">Z120-A05C : Electrical Equipment Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F120-A05C : Electrical Equipment Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F120-A05D
• F120-AGAC (Z120-A07C)
• F000-TB</td><td>Fire Extinguish</td><td>• Dry chemical
• Water hose
• CO_2 hose</td></tr>
<tr><td>Floor</td><td>• F100-A05C</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F137-A03C</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 480V Non 1E Loadcenter 01M
• 480V Non 1E Loadcenter 03M
• 480V Non 1E MCC 07M
• 480V Non 1E MCC 08M
• Electrical Equipment Room CC</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 5.16E7 (4.89E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>123 (1,321)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>4.63E5 (4.07E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>31</td></tr>
</table>

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Z120-A08C : 480V N1E MCC Room			
Zone Description		Protection Measures	
• F120-A08C : 480V N1E MCC Room		Detection	• Analog type photoelectric smoke detector
Wall	• F120-AGAC (Z120-A07C)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-AGAC	Suppression System	• None
Ceiling	• F137-A30C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E MCCs		Major Combustible (kJ (Btu))	• Cable insulation 1.61E7 (1.52E7)
		Floor Area (m^2(ft^2))	15 (165)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.15E6 (1.02E5)
		Fire Severity (hr)	1.3

Table 9.5A-2 (78 of 318)

Z120-A09C : Electrical Equipment Room C			
Zone Description		Protection Measures	
• F120-A09C : Electrical Equipment Room C		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A09C • F100-A07C • F120-A06C • F078-A16C • F120-AGAC (Z120-A07C)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-A08C • F100-AGAC	Suppression System	• None
Ceiling	• F037-A11C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E MCC 33M • Electrical Penetration Room CC[S]		Major Combustible (kJ (Btu))	• Cable insulation 9.42E7 (8.93E7)
		Floor Area (m^2(ft^2))	168 (1,805)
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.18E5 (5.44E4)
		Fire Severity (min)	41

Table 9.5A-2 (79 of 318)

<table>
<tr><td colspan="4">Z120-A16A : Mechanical Penetration Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F120-A16A : Mechanical Penetration Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F120-A24A
• F078-A23A
• F000-AHV (F120-A14A)
• F000-AFHU (Z100-AFHU)</td><td>Fire Extinguish</td><td>• Dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F100-A13A
• F000-ACVU</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F137-AEPA
• F137-A15A</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 2.81E6 (2.66E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>162 (1,747)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>2.05E4 (1.80E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>1</td></tr>
</table>

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<table>
<tr><td colspan="5">Z120-A21A :AB Controlled Area (I) Emergency Exhaust ACU Room 1</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="3">Protection Measures</td></tr>
<tr><td colspan="2">• F120-A21A :AB Controlled Area (I) Emergency Exhaust ACU Room 1</td><td>Detection</td><td colspan="2">• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-ACVU (Z120-ACVU)
• F000-RW</td><td>Fire Extinguish</td><td colspan="2">• Dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F100-A23A
• F100-A38A</td><td>Suppression System</td><td colspan="2">• Manually actuated deluge system for charcoal filter</td></tr>
<tr><td>Ceiling</td><td>• F137-ANEA</td><td>Access/Egress</td><td colspan="2">• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="3">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• AB Controlled Area (I) Emergency Exhaust ACU[R]</td><td colspan="2">Major Combustible (kJ (Btu))</td><td>• Prefilter 9.45E5 (8.96E5)
• HEPA filter 4.73E5 (4.48E5)
• Carbon adsorber 1.79E8 (1.69E8)</td></tr>
<tr><td colspan="2">Floor Area (m^2(ft^2))</td><td>143 (1,535)</td></tr>
<tr><td colspan="2">Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>2.52E6 (2.22E5)</td></tr>
<tr><td colspan="2">Fire Severity (hr)</td><td>2.8</td></tr>
</table>

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Z120-A24A : FH Area Emergency Exhaust ACU Room			
Zone Description		Protection Measures	
• F120-A24A : FH Area Emergency Exhaust ACU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-ACVU (Z120-ACVU) • F000-AFHU (Z120-AFHU)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-A24A • F000-ACVU (Z100-ACVU)	Suppression System	• Manually actuated deluge system for charcoal filter
Ceiling	• F137-A25A	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• FH Area Emergency Exhaust ACU[R]		Major Combustible (kJ (Btu))	• Prefilter 6.75E4 (6.40E4) • HEPA filter 1.35E5 (1.28E5) • Carbon adsorber 2.93E7 (2.78E7) • Cable insulation 1.07E7 (1.01E7)
		Floor Area (m^2(ft^2))	98 (1,057)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.08E5 (6.23E4)
		Fire Severity (min)	47

Table 9.5A-2 (82 of 318)

<table>
<tr><td colspan="4">Z120-A25A : HVAC Chase</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F120-A25A : HVAC Chase</td><td>Detection</td><td>• None</td></tr>
<tr><td>Wall</td><td>• F120-A32A
• F137-ANEA
• F156-A16A</td><td>Fire Extinguish</td><td>• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F000-ACVU (Z100-ACVU)</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• None</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>13 (144)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.15E4 (2.78E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>2</td></tr>
</table>

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Z120-A32A :AB Controlled Area (I) Emergency Exhaust ACU Room 2			
Zone Description		Protection Measures	
• F120-A32A :AB Controlled Area (I) Emergency Exhaust ACU Room 2		Detection	• Analog type photoelectric smoke detector
Wall	• F000-ACVU (Z120-ACVU) • F000-RW	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-A23A • F100-A38A	Suppression System	• Manually actuated deluge system for charcoal filter
Ceiling	• F137-ANEA	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• AB Controlled Area (I) Emergency Exhaust ACU[R]		Major Combustible (kJ (Btu))	• Prefilter 9.45E5 (8.96E5) • HEPA filter 4.73E5 (4.48E5) • Carbon adsorber 1.79E8 (1.69E8)
		Floor Area (m^2(ft^2))	143 (1,535)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.52E6 (2.25E5)
		Fire Severity (hr)	3

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<table>
<tr><td colspan="4">Z120-A11A : General Access Area</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F120-AGAA : General Access Area A-120'-0"</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F100-A07C
• F120-ACVU (Z120-ACVU)
• Z120-A18A
• F000-AHV (Z120-A14A)</td><td>Fire Extinguish</td><td>• Dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F100-A11A</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F137-A31C
• F137-A20A</td><td>Access/Egress</td><td>• Doors
• Stair</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Essential Chilled Water Makeup Pump</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 8.47E7 (8.03E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>154 (1,657)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>6.05E5 (5.33E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>40</td></tr>
</table>

Table 9.5A-2 (85 of 318)

Z120-A18A : Lx Panel Room			
Zone Description		Protection Measures	
• F120-AGAA : General Access Area A-120'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F120-ACVU (Z120-ACVU)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-A11A	Suppression System	• None
Ceiling	• F137-A31C	Access/Egress	• Doors • Stair
Major Equipment		Combustible & Fire Loading	
• Lx panel		Major Combustible (kJ (Btu))	• Cable insulation 1.54E7 (1.46E7)
		Floor Area (m^2(ft^2))	11 (121)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.51E6 (1.33E5)
		Fire Severity (hr)	1.7

Table 9.5A-2 (86 of 318)

Z120-A07C : General Access Area			
Zone Description		Protection Measures	
• F120-AGAC : General Access Area A-120'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z120-A10C • Z120-A18C • F120-A08C • F100-A07C • F120-A09C • F078-A09C • F078-A14C • F120-A05C • F120-A01C	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-AGAC (Z100-A06C)	Suppression System	• None
Ceiling	• F137-A31C • F137-A09C	Access/Egress	• Doors • Stair
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 9.25E7 (8.77E7)
		Floor Area (m^2(ft^2))	255 (2,742)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.00E5 (3.52E4)
		Fire Severity (min)	26

Table 9.5A-2 (87 of 318)

<table>
<tr><td colspan="4">Z120-A10C : ECW Makeup Pump Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F120-AGAC : General Access Area C-120'-0"</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• Z120-A07C
• Z120-A18C
• F120-A08C</td><td>Fire Extinguish</td><td>• Dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F100-AGAC (Z100-A06C)</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F137-A31C</td><td>Access/Egress</td><td>• Doors
• Stair</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Essential Chilled Water Makeup Pump</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.48E7 (1.40E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>23 (252)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>6.96E5 (6.13E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>46</td></tr>
</table>

Table 9.5A-2 (88 of 318)

Z120-A18C : Lx Panel Room			
Zone Description		Protection Measures	
• F120-AGAC : General Access Area- 120'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z120-A07C • Z120-A10C • F120-A08C	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-AGAC (Z100-A06C)	Suppression System	• None
Ceiling	• F137-A31C	Access/Egress	• Doors • Stair
Major Equipment		Combustible & Fire Loading	
• Lx Panel		Major Combustible (kJ (Btu))	• Cable insulation 1.19E7(1.13E7)
		Floor Area (m^2(ft^2))	27 (288)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.90E5 (4.31E4)
		Fire Severity (min)	32

Table 9.5A-2 (89 of 318)

Z137-A01C : Cable Spreading Area			
Zone Description		Protection Measures	
• F137-A01C : Cable Spreading Area		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A02C • F000-ADGC • F137-A30C • F137-A09C • F000-TB	Fire Extinguish	• Dry chemical • CO_2 hose • Water hose • CO_2 chemical
Floor	• F000-ADGC	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F057-A01C	Access/Egress	• Doors • Stair
Major Equipment		Combustible & Fire Loading	
• Cable Trays and Conduits		Major Combustible (kJ (Btu))	• Cable insulation 2.24E7 (2.13E7)
		Floor Area (m^2(ft^2))	96 (1,035)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.57E5 (2.26E4)
		Fire Severity (min)	17

Table 9.5A-2 (90 of 318)

Z137-A02C : Electrical Equipment Room			
Zone Description		Protection Measures	
• F137-A02C : Electrical Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A01C • F137-A04C • F137-A36C • F137-A38C • F000-TB	Fire Extinguish	• Dry chemical • CO_2 hose • Water hose • CO_2 chemical
Floor	• F000-ADGC	Suppression System	• None
Ceiling	• F157-ATOC	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E MCC • 480V Non 1E Loadcenter • MG Set Room CC		Major Combustible (kJ (Btu))	• Cable insulation 5.65E7 (5.36E7)
		Floor Area (m^2(ft^2))	165 (1,771)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.78E5 (3.33E4)
		Fire Severity (min)	25

Table 9.5A-2 (91 of 318)

Z137-A03C : CEDM M/G Set Room			
Zone Description		Protection Measures	
• F137-A03C : CEDM M/G Set Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A09C • F137-A04C • F137-A35C • F137-A37C • F000-TB	Fire Extinguish	• Dry chemical • Water hose • CO_2 chemical
Floor	• F000-ADGC	Suppression System	• None
Ceiling	• F157-AMCR	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• CEDM MG Set		Major Combustible (kJ (Btu))	• Cable insulation 2.61E7 (2.48E7)
		Floor Area (m^2(ft^2))	123 (1,328)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.33E5 (2.05E4)
		Fire Severity (min)	15

Table 9.5A-2 (92 of 318)

Z137-A04C : CEDM Power Control Cabinet Room			
Zone Description		Protection Measures	
• F137-A04C : CEDM Power Control Cabinet Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A02C • F137-A03C • F137-A35C • F137-A36C • F137-A37C • F137-A38C • F000-TB	Fire Extinguish	• Water hose • CO_2 chemical
Floor	• F000-ADGC	Suppression System	• None
Ceiling	• F157-AMCR	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• CEDM MG Control Cabinet		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	38 (409)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.11E4 (9.78E2)
		Fire Severity (min)	1

Table 9.5A-2 (93 of 318)

Z137-A09C : General Access Area C- 137'-0"			
Zone Description		Protection Measures	
• F137-A09C : General Access Area C- 137'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A05D • F137-A03C • F137-A10C • F137-A11C • F137-A37C • F137-A38C	Fire Extinguish	• Water hose • CO_2 chemical • CO_2 hose • Dry chemical
Floor	• F120-AGAC (Z120-A07C)	Suppression System	• None
Ceiling	• F157-A16C • F157-AMCR • F157-A25C	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 5.13E7 (4.86E7)
		Floor Area (m^2(ft^2))	223 (2,400)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.53E7 (2.23E4)
		Fire Severity (min)	17

Table 9.5A-2 (94 of 318)

Z137-A10C : 480V Class 1E MCC 03C Room			
Zone Description		Protection Measures	
• F137-A10C : 480V Class 1E MCC 03C Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A11C • F137-A09C • F137-A30C • F137-A31C	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F100-A07C	Suppression System	• None
Ceiling	• F157-A16C	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Class 1E 480V MCC 03C[S] • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 7.32E6 (6.94E6)
		Floor Area (m^2(ft^2))	62 (671)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.29E5 (1.14E4)
		Fire Severity (min)	9

Table 9.5A-2 (95 of 318)

Z137-A11C : Electrical Penetration Room (C)			
Zone Description		Protection Measures	
• F137-A11C : Electrical Penetration Room (C)		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A09C • F137-A10C • F078-A09C • F120-A06C • F000-CNB	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F120-A09C	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F157-A19C • F157-A20C	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E MCC 32M • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 7.25E7 (6.87E7)
		Floor Area (m^2(ft^2))	186 (2,005)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.28E5 (3.77E4)
		Fire Severity (min)	28

Table 9.5A-2 (96 of 318)

Z137-A15A : 480V Class 1E MCC 04A Room			
Zone Description		Protection Measures	
• F137-A15A : 480V Class 1E MCC 04A Room		Detection	• Analog type photoelectric smoke detector
Wall	• F00-AFHU • (Z137-AFHU) • F137-AEPA • (Z137-A18A) • F137-A20A • F000-CNB	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F120-A16A	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Class 1E 480V MCC 04A[S] • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 3.74E6 (3.54E6)
		Floor Area (m^2(ft^2))	38 (413)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.11E5 (9.75E3)
		Fire Severity (min)	7

Table 9.5A-2 (97 of 318)

Z137-A20A : General Access Area				
Zone Description		Protection Measures		
• F137-A20A : General Access Area A- 137-0"		Detection	• Analog type photoelectric smoke detector	
Wall	• F137-A31C • F137-ANEA • F137-A41A • F137-AEPA • F000-AHV • F137-A25A	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical	
Floor	• F000-ACVU (Z137-ACVU)	Suppression System	• None	
Ceiling	• F156-A13A • F156-A14A • Exterior roof	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• None		Major Combustible (kJ (Btu))	• Cable insulation 5.25E7 (4.98E7)	
		Floor Area (m^2(ft^2))	380 (4,087)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.52E5 (1.34E4)	
		Fire Severity (min)	10	

Table 9.5A-2 (98 of 318)

Z137-A23A : 480V Class 1E MCC 03A Room			
Zone Description		Protection Measures	
• F137-A23A : 480V Class 1E MCC 03A Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A25A • F137-ANEA (Z137-A22A) • F137-A41A	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F000-ACVU (Z100-ACVU)	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Class 1E 480V MCC 03A[S] • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 6.53E6 (6.19E6)
		Floor Area (m^2(ft^2))	53 (567)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.36E5 (1.20E4)
		Fire Severity (min)	9

Table 9.5A-2 (99 of 318)

Z137-A25A : Fuel Handling Area Emergency Exhaust ACU Room			
Zone Description		Protection Measures	
• F137-A25A : Fuel Handling Area Emergency Exhaust ACU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A23A • F137-A41A	Fire Extinguish	• Water hose • Dry chemical
Floor	• F120-A24A	Suppression System	• Manually actuated deluge system for filters
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Fuel Handling Area Emergency Exhaust ACU		Major Combustible (kJ (Btu))	• Cable insulation 1.68E6 (1.59E6) • HEPA filters 6.75E4 (6.40E4) • Prefilters 1.35E5 (1.28E5) • Carbon adsorber 1.68E6 (1.59E6)
		Floor Area (m^2(ft^2))	87 (935)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.59E5 (8.44E4)
		Fire Severity (hr)	1.1

Table 9.5A-2 (100 of 318)

Z137-A30C : Main Steam Enclosure			
Zone Description		Protection Measures	
• F137-A30C : Main Steam Enclosure		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A01C • F137-A09C • F137-A10C • F137-A31C	Fire Extinguish	• Water hose • Dry chemical
Floor	• F000-ADGC • F120-AGAC	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Main Steam Enclosure Electrical Unit Heater.		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	253 (2,725)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.67E3 (1.47E2)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (101 of 318)

Z137-A31C : MS Valve Room			
Zone Description		Protection Measures	
• F137-A31C : MS Valve Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-CNB • F078-A23A • F137-A10C • F137-A30C	Fire Extinguish	• Water hose • Dry chemical
Floor	• F100-A07C • F120-A06C • F120-AGAC	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• MSIVs[S] • MSIVBVs[S] • ADIVs[S] • ADVs[S] • AF Turbine Steam Supply Valve[S]	Major Combustible (kJ (Btu))	• Fyrquel, EHC 8.39E4 (7.96E4)
	Floor Area (m^2(ft^2))	299 (3,219)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.69E3 (1.49E2)
	Fire Severity (min)	Less than 1 min

Table 9.5A-2 (102 of 318)

Z137-A35C : Reactor Trip Switchgear Room				
Zone Description		Protection Measures		
• F137-A35C : Reactor Trip Switchgear Room		Detection	• None	
Wall	• F137-A03C • F137-A04C • F137-A36C • F000-TB	Fire Extinguish	• CO_2 chemical	
Floor	• F000-ADGC	Suppression System	• None	
Ceiling	• F157-AMCR	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• Reactor Trip Switchgear		Major Combustible (kJ (Btu))	• Cable insulation 2.77E6 (2.63E6)	
		Floor Area (m^2(ft^2))	11 (118)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.99E5 (2.64E4)	
		Fire Severity (min)	20	

Table 9.5A-2 (103 of 318)

Z137-A36C : Reactor Trip Switchgear Room			
Zone Description		Protection Measures	
• F137-A36C : Reactor Trip Switchgear Room		Detection	• None
Wall	• F137-A02C • F137-A04C • F137-A35C • F000-TB	Fire Extinguish	• CO_2 chemical
Floor	• F000-ADGC	Suppression System	• None
Ceiling	• F157-AMCR	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• Reactor Trip Switchgear	Major Combustible (kJ (Btu))	• Cable insulation 4.15E6 (3.93E6)
	Floor Area (m^2(ft^2))	12 (124)
	Fire Load (kJ/ m^2 (Btu/ft^2))	4.05E5 (3.56E4)
	Fire Severity (min)	27

Table 9.5A-2 (104 of 318)

Z137-A37C : Reactor Trip Switchgear Room			
Zone Description		Protection Measures	
• F137-A37C : Reactor Trip Switchgear Room		Detection	• None
Wall	• F137-A03C • F137-A04C • F137-A09C • F137-A38C	Fire Extinguish	• CO_2 chemical
Floor	• F000-ADGC	Suppression System	• None
Ceiling	• F157-AMCR	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Reactor Trip Switchgear		Major Combustible (kJ (Btu))	• Cable insulation 4.07E6 (3.86E6)
		Floor Area (m^2(ft^2))	11 (118)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.18E5 (3.68E4)
		Fire Severity (min)	28

Table 9.5A-2 (105 of 318)

Z137-A38C : Reactor Trip Switchgear Room			
Zone Description		Protection Measures	
• F137-A38C : Reactor Trip Switchgear Room		Detection	• None
Wall	• F137-A02C • F137-A04C • F137-A09C • F137-A37C	Fire Extinguish	• CO_2 chemical
Floor	• F000-ADGC	Suppression System	• None
Ceiling	• F157-AMCR	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Reactor Trip Switchgear		Major Combustible (kJ (Btu))	• Cable insulation 2.78E6 (2.63E6)
		Floor Area (m^2(ft^2))	12 (124)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.85E5 (2.51E4)
		Fire Severity (min)	19

Table 9.5A-2 (106 of 318)

<table>
<tr><td colspan="5">Z137-A41A : Remote Control Console Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="3">Protection Measures</td></tr>
<tr><td colspan="2">• F137-A41A : Remote Control Console Room</td><td>Detection</td><td colspan="2">• None</td></tr>
<tr><td>Wall</td><td>• F137-A23A
• F137-A20A
• F137-A25A
• F137-ANEA (Z137-A22A)</td><td>Fire Extinguish</td><td colspan="2">• Water hose
• CO_2 chemical
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F000-ACVU (Z120-ACVU)</td><td>Suppression System</td><td colspan="2">• None</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td colspan="2">• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="3">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Remote Control Console</td><td colspan="2">Major Combustible (kJ (Btu))</td><td>• None</td></tr>
<tr><td colspan="2">Floor Area (m^2(ft^2))</td><td>47 (510)</td></tr>
<tr><td colspan="2">Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>8.90E3 (7.84E2)</td></tr>
<tr><td colspan="2">Fire Severity (min)</td><td>1</td></tr>
</table>

Table 9.5A-2 (107 of 318)

Z137-A17A : Penetration MUX A Room			
Zone Description		Protection Measures	
• F137-AEPA : Electrical Penetration Room A		Detection	• Analog type photoelectric smoke detector
Wall	• Z137-A18A • F137-A20A • F000-AHV	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F000-AHV (Z120-A14A)	Suppression System	• Automatic preaction sprinkler system
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 8.47E6 (8.03E6)
		Floor Area (m^2(ft^2))	96 (1,039)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.65E4 (8.50E3)
		Fire Severity (min)	6

Table 9.5A-2 (108 of 318)

Z137-A18A : Electrical Penetration Room (A)			
Zone Description		Protection Measures	
• F137-AEPA : Electrical Penetration Room A		Detection	• Analog type photoelectric smoke detector
Wall	• Z137-A17A • F137-A20A • F137-A15A • F078-A23A • F000-CNB	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F120-A16A	Suppression System	• Automatic preaction sprinkler system
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 2.33E7 (2.21E7)
		Floor Area (m^2(ft^2))	81 (869)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.18E5 (2.80E4)
		Fire Severity (min)	21

Table 9.5A-2 (109 of 318)

Z137-A21A : Electrical Equipment Room			
Zone Description		Protection Measures	
• F137-ANEA : Electrical Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• Z137-A22A • F137-A20A • F120-A25A	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F120-A21A • F120-A32A	Suppression System	• None
Ceiling	• F156-A14A • Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E MCC • 480V Non 1E LC		Major Combustible (kJ (Btu))	• Cable insulation 1.38E7 (1.31E7)
		Floor Area (m^2(ft^2))	177 (1,901)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.32E4 (8.20E3)
		Fire Severity (min)	6

Table 9.5A-2 (110 of 318)

Z137-A22A : Electrical Equipment Room			
Zone Description		Protection Measures	
• F137-ANEA : Electrical Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• Z137-A21A • F137-A20A • F137-A23A • F137-A41A	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F120-A21A • F120-A32A	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Class 1E EEA Return Fan[S]		Major Combustible (kJ (Btu))	• Cable insulation 8.21E6 (7.78E6)
		Floor Area (m^2(ft^2))	97 (1,043)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.32E4 (8.20E3)
		Fire Severity (min)	6

Table 9.5A-2 (111 of 318)

Z156-A14A : AB Controlled Area (I) Normal Exhaust ACU Room			
Zone Description		Protection Measures	
• F156-A14A : AB Controlled Area (I) Normal Exhaust ACU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F156-A13A • F156-A16A • Exterior wall	Fire Extinguish	• Dry chemical
Floor	• F137-A20A • F137-ANEA (Z137-A21A)	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• AB Controlled Area (I) Normal Exhaust ACUs		Major Combustible (kJ (Btu))	• Prefilter 4.73E5 (4.48E5) • HEPA filters 9.45E5 (8.96E5) • Carbon adsorber 1.79E8 (1.69E8) • Cable insulation 8.38E5 (7.94E5)
		Floor Area (m^2(ft^2))	286 (3,74)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.26E6 (1.11E5)
		Fire Severity (hr)	1.4

Table 9.5A-2 (112 of 318)

Z156-A16A : SIS Filling Tank Room			
Zone Description		Protection Measures	
• F156-A16A : SIS Filling Tank Room		Detection	• None
Wall	• F156-A13A • F156-A14A • Exterior wall	Fire Extinguish	• Dry chemical
Floor	• F137-A20A	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• SIS Filling Tank		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	37 (397)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.14E4 (1.01E3)
		Fire Severity (min)	1

Table 9.5A-2 (113 of 318)

Z157-ATOC : TSC Office			
Zone Description		Protection Measures	
• F157-ATOC : TSC Office		Detection	• Analog type photoelectric smoke detector
Wall	• F157-AMCR • F000-ADGC • Exterior wall	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F137-A01C • F137-A02C	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-A24C • F174-A01C • F174-AGAC	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.14E7 (1.08E7)
		Floor Area (m^2(ft^2))	226 (2,438)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.53E4 (4.87E3)
		Fire Severity (min)	4

Table 9.5A-2 (114 of 318)

Z157-A16C : Corridor			
Zone Description		Protection Measures	
• F157-AGAC : General Access Area C-157'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F157-A18C • F157-A19C • F157-A20C • Z157-A13C	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A09C	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F174-A13C • F174-AGAC	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	147 (1,583)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.87E3 (2.53E2)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (115 of 318)

Z157-A13C : Vestibule			
Zone Description		Protection Measures	
• F157-AGAC : General Access Area C-157'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F157-AMCR • F157-A02C • F157-A25C • Z157-A16C	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A09C	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F174-AGAC	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	30 (324)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.40E4 (1.23E3)
		Fire Severity (min)	1

Table 9.5A-2 (116 of 318)

Z157-A27C : General Access Area					
Zone Description		Protection Measures			
• F000-AC : Compound Building – Access Area		Detection	• Analog type photoelectric smoke detector		
Wall	• F137-A31C • F157-A16C	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical		
Floor	• F137-A30C	Suppression System	• None		
Ceiling	• Exterior roof	Access/Egress	• Doors		
Major Equipment		Combustible & Fire Loading			
• None		Major Combustible (kJ (Btu))	• None		
		Floor Area (m^2(ft^2))	20 (216)		
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.10E4 (1.85E3)		
		Fire Severity (min)	1		

Table 9.5A-2 (117 of 318)

Z157-A18C : Clean Agent Room			
Zone Description		Protection Measures	
• F157-A18C : Clean Agent Room		Detection	• None
Wall	• F157-A19C • F137-A31C • F157-A16C	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A10C	Suppression System	• None
Ceiling	• F174-A13C	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	16 (173)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.63E4 (2.31E3)
		Fire Severity (min)	2

Table 9.5A-2 (118 of 318)

Z157-A19C : I&C Equipment Room			
Zone Description		Protection Measures	
• F157-A19C : I&C Equipment Room		Detection	• Analog type photoelectric smoke detector • Air Sampling smoke detector
Wall	• F157-A20C • F157-A16C • F157-A18C • F137-A31C • F078-A16C	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A11C	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-A14C	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cabinets • Cubicle Cooler^S		Major Combustible (kJ (Btu))	• Cable insulation 1.07E7 (1.02E7)
		Floor Area (m^2(ft^2))	98 (1,055)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.21E5 (1.06E4)
		Fire Severity (min)	8

Table 9.5A-2 (119 of 318)

Z157-A20C : I&C Equipment Room			
Zone Description		Protection Measures	
• F157-A20C : I&C Equipment Room		Detection	• Analog type photoelectric smoke detector • Air Sampling smoke detector
Wall	• F157-A19C • F157-A16C • F157-A25C • F078-A09C	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F137-A11C	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-A14C • F174-A05C	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cabinets • Cubicle Cooler		Major Combustible (kJ (Btu))	• Cable insulation 8.37E6 (7.93E6)
		Floor Area (m^2(ft^2))	106 (1,136)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.72E4 (7.68E3)
		Fire Severity (min)	6

Table 9.5A-2 (120 of 318)

Z157-A25C : I&C Equipment Room			
Zone Description		Protection Measures	
• F157-A25C : I&C Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• F157-AMCR • F157-A16C • F157-A20C	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F137-A09C	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-AGAC	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cabinets • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 1.59E7 (1.51E7)
		Floor Area (m^2(ft^2))	59 (638)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.95E4 (2.60E4)
		Fire Severity (min)	19

Table 9.5A-2 (121 of 318)

Z174-A01C : EDG Room Normal Exhaust Fan Room			
Zone Description		Protection Measures	
• F174-A01C : EDG Room Normal Exhaust Fan Room		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A24C • F000-ADGC • F174-AGAC • F000-TB	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-ATOC	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• EDG Room Normal Exhaust Fan[S]		Major Combustible (kJ (Btu))	• Cable insulation 2.98E6 (2.83E6)
		Floor Area (m^2(ft^2))	42 (449)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.37E4 (7.37E3)
		Fire Severity (min)	6

Table 9.5A-2 (122 of 318)

Z174-A05C : 480V N1E MCC Room			
Zone Description		Protection Measures	
• F174-A05C : 480V N1E MCC Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A09C • F000-CNB • F174-A14C • F174-AGAC	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-A20C	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E MCC		Major Combustible (kJ (Btu))	• Cable insulation 2.20E7 (2.08E7)
		Floor Area (m^2(ft^2))	66 (706)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.69E5 (3.25E4)
		Fire Severity (min)	24

Table 9.5A-2 (123 of 318)

Z174-A13C : 480V N1E MCC Room			
Zone Description		Protection Measures	
• F174-A13C : 480V N1E MCC Room		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A14C • F174-AGAC • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-A16C • F157-A18C	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• 480V Non 1E MCC	Major Combustible (kJ (Btu))	• Cable insulation 8.56E6 (8.11E6)
	Floor Area (m^2(ft^2))	58 (624)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.63E5 (1.43E4)
	Fire Severity (min)	11

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<table>
<tr><td colspan="4">Z174-A14C : EDG Room Normal Supply AHU Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F174-A14C : EDG Room Normal Supply AHU Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F078-A16C
• F174-A13C
• F174-AGAC
• F000-CNB</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F157-A19C
• F157-A20C</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• EDG Room Normal Supply AHU^S
• AB Clean Area Exhaust Fan^S
• AB smoke Removal Fan^S</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 9.06E6 (8.59E6)
• Prefilter 1.01E5 (9.60E4)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>145 (1,558)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>6.96E4 (6.13E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>5</td></tr>
</table>

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Z174-A23C : Control Room Area Supply AHU Room			
Zone Description		Protection Measures	
• F174-A23C : Control Room Area Supply AHU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A23D • F174-A24C • F174-A25C • F174-AGAC	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-AMCR	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Control Room Area Supply AHUs		Major Combustible (kJ (Btu))	• Prefilter 2.53E5 (2.40E5)
		Floor Area (m^2(ft^2))	74 (797)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.12E3 (8.03E2)
		Fire Severity (min)	1

Table 9.5A-2 (126 of 318)

Z174-A24C : Control Room Area Supply AHU/ACU Room				
Zone Description		Protection Measures		
• F174-A24C : Control Room Area Supply AHU/ACU Room		Detection	• Analog type photoelectric smoke detector	
Wall	• F174-A23C • F174-A25C • F174-AGAC • F000-TB	Fire Extinguish	• Water hose • Dry chemical	
Floor	• F157-AMCR • F157-AMAX	Suppression System	• Manually Actuated Deluge System	
Ceiling	• Exterior roof	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• Control Room Area Supply AHUs • Control Room Emergency Makeup ACU[R]		Major Combustible (kJ (Btu))	• Prefilter 4.56E5 (4.32E5) • HEPA filters 1.01E5 (9.60E4) • Carbon adsorber 4.83E7 (4.58E7)	
		Floor Area (m^2(ft^2))	232 (2,500)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.19E5 (3.69E4)	
		Fire Severity (min)	28	

Table 9.5A-2 (127 of 318)

Z174-A25C : HVAC Area			
Zone Description		Protection Measures	
• F174-A25C : HVAC Area		Detection	• None
Wall	• F174-A23C • F174-A24C • F174-A25D • F000-TB	Fire Extinguish	• None
Floor	• F157-AMCR	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	46 (499)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.11E3 (8.02E2)
		Fire Severity (min)	1

Table 9.5A-2 (128 of 318)

<table>
<tr><td colspan="4">Z174-A02C : ECW Compression Tank Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F174-AGAC : General Access Area C-174'-0"</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F174-A01C
• F174-A24C
• Z174-A03C
• Z174-A12C</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F157-ATOC</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Essential Chilled Water Compression Tank</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 2.13E6 (2.02E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>35 (374)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>7.59E4 (6.68E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>5</td></tr>
</table>

Table 9.5A-2 (129 of 318)

Z174-A03C : CCW Surge Tank Room			
Zone Description		Protection Measures	
• F174-AGAC : General Access Area C-174'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A24C • Z174-A02C • Z174-A12C	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-ATOC	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• CCW Surge Tank[S]		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	35 (374)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.28E4 (1.13E3)
		Fire Severity (min)	1

Table 9.5A-2 (130 of 318)

<table>
<tr><td colspan="4">Z174-A12C : General Access Area</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F174-AGAC : General Access Area C-174'-0"</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F174-A24C
• F174-A23C
• F174-A05C
• F174-A14C
• F174-A13C
• Z174-A02C
• Z174-A03C</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F157-A25C
• F157-A16C</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F195-A02C</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.16E7 (1.10E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>211 (2,268)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>6.06E4 (5.34E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>4</td></tr>
</table>

Table 9.5A-2 (131 of 318)

Z175-A01C : MSIV Room Supply AHU Room				
Zone Description		Protection Measures		
• F175-A01C : MSIV Room Supply AHU Room		Detection	• Analog type photoelectric smoke detector	
Wall	• F137-A31C • Exterior wall	Fire Extinguish	• Dry chemical	
Floor	• F137-A31C	Suppression System	• None	
Ceiling	• Exterior roof	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• MSIV Room Supply AHU		Major Combustible (kJ (Btu))	• Prefilter 1.35E5 (1.28E5)	
		Floor Area (m^2(ft^2))	42 (448)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.34E4 (1.18E3)	
		Fire Severity (min)	1	

Table 9.5A-2 (132 of 318)

Z195-A02C : AB Clean Area Supply AHUs Room			
Zone Description		Protection Measures	
• F195-A02C : AB Clean Area Supply AHUs Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A14C • F195-A05C	Fire Extinguish	• Water hose • Dry chemical
Floor	• F174-AGAC	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• AB Clean Area Supply AHUs		Major Combustible (kJ (Btu))	• Prefilter 2.70E5 (2.56E5)
		Floor Area (m^2(ft^2))	137 (1,480)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.03E3 (4.43E2)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (133 of 318)

Z195-A05C : 480V N1E Loadcenter Room			
Zone Description		Protection Measures	
• F195-A05C : 480V N1E Loadcenter Room		Detection	• Analog type photoelectric smoke detector
Wall	• F195-A02C • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• F174-A13C • F174-A14C	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E Loadcenter		Major Combustible (kJ (Btu))	• Cable insulation 7.29E6 (6.91E6)
		Floor Area (m^2(ft^2))	105 (1,128)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.65E4 (6.73E3)
		Fire Severity (min)	5

Table 9.5A-2 (134 of 318)

Z195-A09C : HVAC Exhaust Penthouse			
Zone Description		Protection Measures	
• F195-A09C : HVAC Exhaust Penthouse		Detection	• None
Wall	• Exterior wall • F174-AGAC (Z174-A03C)	Fire Extinguish	• None
Floor	• F174-A24C	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	11 (122)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.74E4 (3.29E3)
		Fire Severity (min)	2

Table 9.5A-2 (135 of 318)

Z055-ACVL : CVCS Area – Lower Area El.55'-0"			
Zone Description		Protection Measures	
• F000-ACVL : CVCS Area - General Lower Area		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A42A • F055-A30A • F055-A19A • F055-A21A • F055-A22A • F000-AHV (Z055-A46B) • F000-AFHL (Z055-AFHL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• Z068-ACVL	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Charging Pump Miniflow HX[R] • Floor Drain Sump Pump • Equipment Drain Sump Pump		Major Combustible (kJ (Btu))	• Grease 6.54E4 (6.20E4) • Cable insulation 4.23E6 (4.01E6)
		Floor Area (m^2(ft^2))	663 (7,136)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.24E3 (6.38E2)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (136 of 318)

Z068-ACVL : CVCS Area – Lower Area El.68'-0"			
Zone Description		Protection Measures	
• F000-ACVL : CVCS Area - General (Lower)		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A30A/B • F055-A21A/B • F055-A22A/B • F000-AHV (Z055-A46B) • F000-AFHL (Z055-AFHL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z055-ACVL • F000-AFHL (Z055-AFHL)	Suppression System	• None
Ceiling	• Z078-ACVL • F000-AFHL (Z078-AFHL)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	1,326 (14,272)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.85E2 (33.9)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (137 of 318)

Z078-ACVL : CVCS Area – Lower Area El.78'-0"			
Zone Description		Protection Measures	
• F000-ACVL : CVCS Area - General Lower Area		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A25A • F078-A21A • F000-AHV • F000-AFHL (Z078-AFHL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z068-ACVL	Suppression System	• None
Ceiling	• Z100-ACVL	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cubicle Cooler • SFP Clean-Up Pump • Exchanger • Filter		Major Combustible (kJ (Btu))	• Lube oil 2.62E4 (2.48E4) • Cable insulation 7.06E7 (6.69E7)
		Floor Area (m^2(ft^2))	756 (8,139)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.03E5 (9.05E3)
		Fire Severity (min)	7

Table 9.5A-2 (138 of 318)

<table>
<tr><td colspan="4">Z100-ACVU: CVCS Area - Upper Area El.100’</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-ACVU : CVCS Area - Upper Area</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F100-A24A
• F100-A23A
• F100-A38A
• F100-A13A
• F100-A11A
• F100-A10A
• F000-AFHU (Z100-AFHU)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z078-ACVL
• F000-AFHL (Z078-AFHL)</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Z120-ACVU</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Volume Control Tank
• Volume Control Rank Outlet Iso. Valve[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 8.05E7 (7.63E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>477 (5,134)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.86E5 (1.63E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>12</td></tr>
</table>

Table 9.5A-2 (139 of 318)

Z120-ACVU: CVCS Area - Upper Area El.120’			
Zone Description		Protection Measures	
• F000-ACVU : CVCS Area - Upper Area		Detection	• Analog type photoelectric smoke detector
Wall	• F120-A21A • F120-A32A • F120-A16A • F000-AHV • F120-AGAA	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z100-ACVU	Suppression System	• None
Ceiling	• F137-A20A • F137-ANEA • F137-A23A • F137-A41A	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Boric Acid Batching Tank		Major Combustible (kJ (Btu))	• Cable insulation 3.17E7 (3.00E7)
		Floor Area (m^2(ft^2))	528 (5,685)
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.60E4 (5.81E3)
		Fire Severity (min)	4

Table 9.5A-2 (140 of 318)

Z050-A01D : CS Pump & Miniflow Heat Exchanger Room				
Zone Description		Protection Measures		
• F050-A01D : CS Pump & Miniflow Heat Exchanger Room		Detection	• Analog type photoelectric smoke detector	
Wall	• F055-A14D • F055-AGAD (Z055-A07D) • F050-A02D	Fire Extinguish	• Water hose • Dry chemical	
Floor	• Basement	Suppression System	• None	
Ceiling	• F078-A11D	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• Containment Spray pump[R] • CS pump Room Cubicle Cooler • CS Miniflow Heat Exchanger • Sump Pump[R]		Major Combustible (kJ (Btu))	• Cable insulation 3.04E6 (2.88E6) • Lube oil 2.08E6 (1.97E6) • Grease 1.64E4 (1.55E4)	
		Floor Area (m^2(ft^2))	72 (771)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.88E4 (6.94E3)	
		Fire Severity (min)	5	

Table 9.5A-2 (141 of 318)

Z050-A02D : Safety Injection Pump Room D			
Zone Description		Protection Measures	
• F050-A02D : Safety Injection Pump Room D		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A14D • F055-AGAD (Z055-A07D) • F050-A01D	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-AAFD	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• SI pump[R] • SI pump Room Cubicle Cooler • Sump Pump[R]	Major Combustible (kJ (Btu))	• Cable insulation 1.08E6 (1.02E6) • Grease 1.64E4 (1.55E4)
	Floor Area (m^2(ft^2))	86 (927)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.86E4 (1.64E3)
	Fire Severity (min)	1

Table 9.5A-2 (142 of 318)

Z050-A03B : Safety Injection Pump Room B			
Zone Description		Protection Measures	
• F050-A03B : Safety Injection Pump Room B		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A18B • F055-AGAB • F050-A02D • F050-A04B	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A20B	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• SI pump[R] • SI pump Room Cubicle Cooler • Sump Pump[R]	Major Combustible (kJ (Btu))	• Cable insulation 4.74E5 (4.49E5) • Grease 1.64E4 (1.55E4)
	Floor Area (m^2(ft^2))	72 (771)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.40E4 (1.23E3)
	Fire Severity (min)	1

Table 9.5A-2 (143 of 318)

<table>
<tr><td colspan="4">Z050-A04B : SC Pump & Mini Flow Heat Exchanger Room B</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F050 -A04B : SC Pump & Mini Flow Heat Exchanger Room B</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-A21B
• F055-AGAB
• F055-A20B
• F049-A02B
• F050-A03B</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A20B
• F078-AEEB (Z078-A25B)</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• SC pump^{SR}
• SC pump Room Cubicle Cooler^S
• Sump Pump^R
• SC Miniflow Heat Exchanger^S</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.39E7 (1.32E7)
• Grease 1.64E4 (1.55E4)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>73 (784)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>2.10E5(1.85E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>14</td></tr>
</table>

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<table>
<tr><td colspan="4">Z055-A01D : Containment Spray Heat Exchanger Room B</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F055-A01D : Containment Spray Heat Exchanger Room B</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-AGAD (Z055-A57D, Z055-A07D)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A01D
• F078-AGAD (Z078-A29D)</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• CS Hx Room Cubicle Cooler[S]
• CS Heat Exchanger[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 3.89E6 (3.68E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>113 (1,219)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.88E4 (3.42E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>3</td></tr>
</table>

Table 9.5A-2 (145 of 318)

Z055-A02B : CCW Pump Room B			
Zone Description		Protection Measures	
• F055-A02B : CCW Pump Room B		Detection	• Analog type photoelectric smoke detector
Wall	• F055-AGAD (Z055-A07D) • F055-A02D • F055-A19B	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A53D • F078-AGAD (Z078-A57D)	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• CCW Pump Room Cubicle Cooler^S • Component Cooling Water Pump^S	Major Combustible (kJ (Btu))	• Cable insulation 3.39E6 (3.21E6) • Lube oil 2.58E5 (2.45E5)
	Floor Area (m^2(ft^2))	92 (994)
	Fire Load (kJ/ m^2 (Btu/ft^2))	4.50E4 (3.96E3)
	Fire Severity (min)	3

Table 9.5A-2 (146 of 318)

Z055-A02D : CCW Pump Room D			
Zone Description		Protection Measures	
• F055-A02D : CCW Pump Room D		Detection	• Analog type photoelectric smoke detector
Wall	• F055-AGAD (Z055-A07D) • F050-A02D	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A52D	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• CCW Pump Room Cubicle Cooler[S] • Component Cooling Water Pump[S]		Major Combustible (kJ (Btu))	• Cable insulation 1.08E7 (1.02E7) • Lube oil 2.58E5 (2.45E5)
		Floor Area (m^2(ft^2))	110 (1,189)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.10E5 (9.63E3)
		Fire Severity (min)	7

Table 9.5A-2 (147 of 318)

Z055-A04D : Seismic CAT-I Fire Water Tank Room				
Zone Description		Protection Measures		
• F055-A04D : Seismic CAT-I Fire Water Tank Room B		Detection	• Analog type photoelectric smoke detector	
Wall	• F055-A04C • F055-AGAD (Z055-A03D) • F067-T02	Fire Extinguish	• Water hose • Dry chemical	
Floor	• Basement	Suppression System	• None	
Ceiling	• F078-A06D • F078-A07D	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• Seismic CAT-I Fire Pump • Seismic CAT-I Fire Tank		Major Combustible (kJ (Btu))	• None	
		Floor Area (m^2(ft^2))	123 (1,321)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.44E3 (3.03E2)	
		Fire Severity (min)	Less than 1 min	

Table 9.5A-2 (148 of 318)

<table>
<tr><td colspan="4">Z055-A14D : Pipe Chase & Valve Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F055-A14D : Pipe Chase & Valve Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-A10D
• F055-AGAD (Z055-A03D)
• F050-A01D
• F050-A02D
• F000-CNB (Z000-CAN)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A12D
• F100-A16D</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 3.76E6 (3.56E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>142 (1,528)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.01E4 (2.65E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>2</td></tr>
</table>

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<table>
<tr><td colspan="4">Z055-A18B : Pipe Chase & Valve Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F055-A18B : Pipe Chase & Valve Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-A21B
• F050-A03B
• F000-CNB (Z000-CAN)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A23B
• F100-A16D</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• None</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>59 (634)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>7.17E3 (6.31E2)</td></tr>
<tr><td>Fire Severity (min)</td><td>Less than 1 min</td></tr>
</table>

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Z055-A21B : Pipe Chase & Valve Room			
Zone Description		Protection Measures	
• F055-A21B : Pipe Chase & Valve Room		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A22B • F055-A18B • F050-A04B • F000-AFHL (Z055-AFHL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A12B • F078-AEEB (Z078-A25B)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 6.74E6 (6.39E6)
		Floor Area (m^2(ft^2))	204 (2,192)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.64E4 (3.21E3)
		Fire Severity (min)	2

Table 9.5A-2 (151 of 318)

Z055-A22B : Pipe Chase			
Zone Description		Protection Measures	
• F055-A22B : Pipe Chase		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A22A • F055-A21B • F000-AFHL (Z055-AFHL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A21B	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	55 (590)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.70E3 (6.78E2)
		Fire Severity (min)	1

Table 9.5A-2 (152 of 318)

Z055-A30B : SC Heat Exchanger Room			
Zone Description		Protection Measures	
• F055-A30B : SC Heat Exchanger Room		Detection	• Analog type photoelectric smoke detector
Wall	• F055-AGAD (Z055-A07D, Z055-A57D)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A01D • F000-AFHL (Z078-AFHL)	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• SC Heat Exchanger^{SR} • Cubicle Cooler^{S}	Major Combustible (kJ (Btu))	• Cable insulation 6.72E6 (6.37E6)
	Floor Area (m^2(ft^2))	148 (1,598)
	Fire Load (kJ/ m^2 (Btu/ft^2))	4.98E4 (4.38E3)
	Fire Severity (min)	3

Table 9.5A-2 (153 of 318)

<table>
<tr><td colspan="4">Z055-A54B : Auxiliary Charging Pump Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F055-A54B : Auxiliary Charging Pump Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-AFHL (Z055-AFHL)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F000-ACVL (Z068-ACVL)</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Aux. Charging Pump[SR]
• Cubicle Cooler[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Lube oil 2.29E6 (2.17E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>35 (382)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.18E5 (2.80E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>21</td></tr>
</table>

Table 9.5A-2 (154 of 318)

Z055-A55B : Charging Pump Room			
Zone Description		Protection Measures	
• F055-A55B : Charging Pump Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-AFHL (Z055-AFHL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F000-ACVL (Z068-ACVL)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Charging Pump[SR] • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Lube oil 7.20E4 (6.82E4) • Cable insulation 3.01E5 (2.85E5)
		Floor Area ($m^2(ft^2)$)	71 (766)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.24E4 (1.09E3)
		Fire Severity (min)	1

Table 9.5A-2 (155 of 318)

Z055-A19B : General Access Area B- 55'-0"			
Zone Description		Protection Measures	
• F055-A19B : General Access Area B- 55'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A30B • F050-A04B • F050-A03B	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A19B	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• SI Pump Flowrate • Containment Spray Heat Exchanger • Charging Pump Suction Pressure Switch • SC Hx. Outlet Iso. Valves^S • SCS Test Return Line Iso. Valve		Major Combustible (kJ (Btu))	• Cable insulation 1.23E7 (1.17E7)
		Floor Area (m^2(ft^2))	176 (1,899)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.69E4 (6.77E3)
		Fire Severity (min)	5

Table 9.5A-2 (156 of 318)

<table>
<tr><td colspan="4">Z055-A03D : Central Water Chiller Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F055-AGAD : General Access Area D- 55'-0"</td><td>Detection</td><td>• Analog type photoelectric smoke detector
• Analog type heat detector</td></tr>
<tr><td>Wall</td><td>• F055-A04D
• F055-A01D
• Z055-A08D
• Z055-A57D</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F078-A02D
• F078-A03D</td><td>Access/Egress</td><td>• Door
• Stair</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Central Water Chiller</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 2.32E7 (2.20E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>421 (4,529)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>6.07E4 (5.35E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>4</td></tr>
</table>

Table 9.5A-2 (157 of 318)

Z055-A07D: General Access Area			
Zone Description		Protection Measures	
• F055-AGAD : General Access Area D- 55'-0"		Detection	• Analog type photoelectric smoke detector • Analog type heat detector
Wall	• F055-A01D • F055-A02D • Z055-A03D • Z055-A57D	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-AGAD (Z078-10D, Z078-A29D)	Access/Egress	• Door • Stair
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.43E6 (1.36E6)
		Floor Area (m^2(ft^2))	184 (1,986)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.05E4 (9.27E2)
		Fire Severity (min)	1

Table 9.5A-2 (158 of 318)

Z055-A08D : Floor Drain Sump Pump Room			
Zone Description		Protection Measures	
• F055-AGAD : General Access Area D- 55'-0"		Detection	• Analog type photoelectric smoke detector • Analog type heat detector
Wall	• Z055-A03D • Z055-A57D	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A02D	Access/Egress	• Door • Stair

Major Equipment	Combustible & Fire Loading	
• Floor drain sump pump	Major Combustible (kJ (Btu))	• Cable insulation 1.62E6 (1.53E6) • Grease 3.27E4 (3.10E4)
	Floor Area (m^2(ft^2))	14 (149)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.56E5 (1.37E4)
	Fire Severity (min)	10

Table 9.5A-2 (159 of 318)

Z055-A11D: Storage Room			
Zone Description		Protection Measures	
• F055-AGAD : General Access Area D- 55'-0"		Detection	• Analog type photoelectric smoke detector • Analog type heat detector
Wall	• Z055-A03D • F055-A14D • F000-CNB	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A09D • F078-A13D • F078-A14C	Access/Egress	• Door • Stair
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	77 (825)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.50E2 (4.85)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (160 of 318)

Z055-A57D: Piping& Cable Area			
Zone Description		Protection Measures	
• F055-AGAD : General Access Area D- 55'-0"		Detection	• Analog type photoelectric smoke detector • Analog type heat detector
Wall	• F055-A01D • F055-A02D • Z055-A17D • Z055-A08D	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F065-A01D	Access/Egress	• Door • Stair
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.17E7 (1.11E7)
		Floor Area (m^2(ft^2))	289 (3,111)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.44E4 (3.91E3)
		Fire Severity (min)	3

Table 9.5A-2 (161 of 318)

Z065-A01D : Diesel Fuel Oil Storage Tank Room D			
Zone Description		Protection Measures	
• F065-A01D : Diesel Fuel Oil Storage Tank Room D		Detection	• Explosion proof type fixed temperature detector • Flame detector
Wall	• F078-A01D • F078-AGAD (Z078-A29D) • F078-A52D	Fire Extinguish	• Dry chemical • Wheeled dry chemical
Floor	• F055-AGAD (Z055-A57D)	Suppression System	• Automatic preaction sprinkler system
Ceiling	• Exterior roof	Access/Egress	• Ladder • Stairwell
Major Equipment		Combustible & Fire Loading	
• Diesel Fuel Oil Storage Tank[S] • Diesel Fuel Oil Transfer Pump[S] • Exhaust Fan[S]		Major Combustible (kJ (Btu))	• Fuel Oil 1.73E10 (1.64E10)
		Floor Area (m^2(ft^2))	169 (1,814)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.03E8 (9.03E6)
		Fire Severity (hr)	112.9

Table 9.5A-2 (162 of 318)

Z078-A01D: PNS SWGR Room			
Zone Description		Protection Measures	
• F078-A01D: PNS SWGR Room		Detection	• Analog type photoelectric smoke detector • Analog type heat detector
Wall	• F078-A02D • F065-A01D • F078-AGAD (Z078-A10D, Z078-A29D)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A01D • F055-AGAD (Z055-A57D)	Suppression System	• None
Ceiling	• F000-ADGD	Access/Egress	• Door • Stair
Major Equipment		Combustible & Fire Loading	
• 4.16kV Non 1E Switchgear • Cubicle Cooler		Major Combustible (kJ (Btu))	• Cable insulation 4.48E7 (4.25E7)
		Floor Area (m^2(ft^2))	92 (994)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.34E5 (4.70E4)
		Fire Severity (min)	35

Table 9.5A-2 (163 of 318)

Z078-A02D : Class 1E Switchgear 01D Room			
Zone Description		Protection Measures	
• F078-A02D : Class 1E Switchgear 01D Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A03D • F078-A01D • F000-TB	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical
Floor	• F055-AGAD (Z055-A07D)	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F000-ADGD	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• 4.16kV 1E Switchgear[S] • Cubicle Cooler[S]	Major Combustible (kJ (Btu))	• Cable insulation 1.43E7 (1.36E7)
	Floor Area (m^2(ft^2))	105(1,127)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.50E5 (1.32E4)
	Fire Severity (min)	10

Table 9.5A-2 (164 of 318)

Z078-A03D : Class 1E Load Center 01D Room			
Zone Description		Protection Measures	
• F078-A03D : Class 1E Load Center 01D Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A02D • F078-A01D • F078-A04D • F078-A05D • F000-TB	Fire Extinguish	• Water hose • CO_2 hose • Dry chemical
Floor	• F055-AGAD (Z055-A03D)	Suppression System	• None
Ceiling	• F000-ADGD	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Class 1E 480V Loadcenter[S] • Class 1E 480V MCCs[S] • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 3.20E7 (3.03E7)
		Floor Area (m^2(ft^2))	135 (1,455)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.60E5 (2.29E4)
		Fire Severity (min)	17

Table 9.5A-2 (165 of 318)

<table>
<tr><td colspan="4">Z078-A04D: MISC. Electrical Equip. Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F078-A04D: MISC. Electrical Equip. Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F078-A03D
• F078-A05D
• F078-A06D</td><td>Fire Extinguish</td><td>• Water hose
• CO_2 hose
• CO_2 chemical
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F055-A04D
• F055-AGAD (Z055-A03D)</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F000-ADGD</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 480V N1E MCC
• Normal LTG Transformer
• Normal LTG Panel
• Essential LTG Transformer
• Essential LTG Panel</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 8.69E6 (8.24E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>57 (613)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.68E5 (1.48E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>11</td></tr>
</table>

Table 9.5A-2 (166 of 318)

Z078-A05D : Train D DC&IP Equip. Room			
Zone Description		Protection Measures	
• F078-A05D : Train D DC&IP Equip. Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A07D • F078-A03D • F078-A04D • F000-TB	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F055-AGAD (Z055-A03D)	Suppression System	• None
Ceiling	• F000-ADGD	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• 120V AC Class 1E Inverter[S] • Regulation Transformer[S] • 125V DC Control Center[S] • 125V DC Class 1E Battery Charger[S] • Cubicle Cooler[S]	Major Combustible (kJ (Btu))	• Cable insulation 2.18E7 (2.07E7)
	Floor Area (m^2(ft^2))	91 (981)
	Fire Load (kJ/ m^2 (Btu/ft^2))	2.63E5 (2.32E4)
	Fire Severity (min)	17

Table 9.5A-2 (167 of 318)

Z078-A06D : N1E Battery Room			
Zone Description		Protection Measures	
• F078-A06D : N1E Battery Room		Detection	• Analog type photoelectric smoke detector • Explosion proof type fixed temperature detector
Wall	• F078-A06C • F078-A04D • F078-AGAD (Z078-A10D)	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F055-AGAD (Z055-A03D) • F055-A04D	Suppression System	• None
Ceiling	• F100-AGAD (Z100-A06D) • F100-A05D	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 125V DC N1E Battery		Major Combustible (kJ (Btu))	• Cable insulation 4.71E6 (4.46E6) • Battery 9.48E6 (8.98E6)
		Floor Area (m^2(ft^2))	70 (749)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.18E5 (1.92E4)
		Fire Severity (min)	14

Table 9.5A-2 (168 of 318)

Z078-A07D : Train D Battery Room			
Zone Description		Protection Measures	
• F078-A07D : Train D Battery Room		Detection	• Analog type photoelectric smoke detector • Explosion proof type fixed temperature detector
Wall	• F078-A07C • F078-A05D • F078-A06D	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F055-A04D	Suppression System	• None
Ceiling	• F100-A05D	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Class 1E 125V DC Battery[S]		Major Combustible (kJ (Btu))	• Cable insulation 3.19E5 (3.03E5) • Battery 9.48E6 (8.98E6)
		Floor Area (m^2(ft^2))	78 (844)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.37E5 (1.21E4)
		Fire Severity (min)	9

Table 9.5A-2 (169 of 318)

Z078-A09D: HVAC Chase				
Zone Description		Protection Measures		
• F078-A09D: HVAC Chase		Detection	• None	
Wall	• F078-A14D • F055-A10D • F078-A13D	Fire Extinguish	• Water hose • Dry chemical	
Floor	• F055-AGAD (Z055-A11D)	Suppression System	• None	
Ceiling	• Exterior Roof	Access/Egress	• Door	
Major Equipment		Combustible & Fire Loading		
• None		Major Combustible (kJ (Btu))	• None	
		Floor Area (m^2(ft^2))	8 (88)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.16E4 (4.55E3)	
		Fire Severity (min)	3	

Table 9.5A-2 (170 of 318)

Z078-A11D: Essential Chiller Room			
Zone Description		Protection Measures	
• F078-A11D: Essential Chiller Room B		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A14D • F078-A12D • F078-A13D • F078-AAFD	Fire Extinguish	• Water hose • CO_2 hose • Dry chemical
Floor	• F050-A01D	Suppression System	• None
Ceiling	• F100-A07D	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Essential Chilled Water Pump^S • Essential Chiller^S • ECW Isolation Valve^S • ECW Modulating Valve^S • Cubicle Cooler^S		Major Combustible (kJ (Btu))	• Cable insulation 5.34E5 (5.06E5)
		Floor Area (m^2(ft^2))	87 (935)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.20E4 (1.06E3)
		Fire Severity (min)	1

Table 9.5A-2 (171 of 318)

Z078-A12D: Essential Water Chiller Room			
Zone Description		Protection Measures	
• F078-A12D: Essential Water Chiller Room D		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A10D • F055-A14D • F078-A11D	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F055-A14D	Suppression System	• None
Ceiling	• F100-A08D	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Essential Chilled Water Pump^S • Essential Chiller^S • ECW Isolation Valve^S • ECW Modulating Valve^S • Cubicle Cooler^S		Major Combustible (kJ (Btu))	• Cable insulation 8.53E6 (8.09E6)
		Floor Area (m^2(ft^2))	114 (1,228)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.23E4 (7.24E3)
		Fire Severity (min)	5

Table 9.5A-2 (172 of 318)

Z078-A13D:Duct Room			
Zone Description		Protection Measures	
• F078-A13D:Duct Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A12D • F078-A09D • F078-AGAD (Z078-A10D)	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F055-AGAD (Z055-A11D)	Suppression System	• None
Ceiling	• F100-A08D	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Non-1E Battery Room Exhaust Fan • Class 1E Battery Room Supply Fan^{S}		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	62 (665)
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.83E3 (6.02E2)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (173 of 318)

Z078-A16D: HVAC Chase			
Zone Description		Protection Measures	
• F078-A16D: HVAC Chase		Detection	• None
Wall	• F055-A14D • F078-AAFD • F100-A07D • F100-A08D • F100-A16D • F120-A09D • F137-A11D • F137-A31D • F157-A19D • F174-A14D	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A14D	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door • Ladders
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	5 (52)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.74E4 (7.96E3)
		Fire Severity (min)	6

Table 9.5A-2 (174 of 318)

Z078-A19B: Corridor			
Zone Description		Protection Measures	
• F078-A19A : General Access Area B- 78'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A56B • F078-A53D • F078-A20B • F078-AEEB	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A19B	Suppression System	• None
Ceiling	• F100-A11B	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.53E8 (1.45E8)
		Floor Area (m^2(ft^2))	179 (1,931)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.37E5 (8.25E4)
		Fire Severity (hr)	1

Table 9.5A-2 (175 of 318)

<table>
<tr><td colspan="4">Z078-A20B : Motor-Driven AFW Pump Room B</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F078-A20B : Motor-Driven AFW Pump Room B</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F055-A18B
• F078-A23B
• F078-A19B
• F078-AAFD</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F050-A03B
• F050-A04B</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F100-A07D</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Aux. Feedwater Motor-Driven Pump[S]
• Cubicle Cooler[S]
• Suction Pressure Transmitter[S]
• Discharge Pressure transmitter[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 7.15E5 (6.78E5)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>90 (968)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.36E4 (1.08E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>1</td></tr>
</table>

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Z078-A21B: Pipe Chase				
Zone Description		Protection Measures		
• F078-A21B: Pipe Chase		Detection	• Analog type photoelectric smoke detector	
Wall	• F078-A21A • F078-AEEB (Z078-A25B) • F000-AFHL (Z078-AFHL)	Fire Extinguish	• Water hose • Dry chemical	
Floor	• F055-A22B • F055-A21B	Suppression System	• None	
Ceiling	• F100-A13B • F100-A14B	Access/Egress	• Door	
Major Equipment		Combustible & Fire Loading		
• None		Major Combustible (kJ (Btu))	• None	
		Floor Area (m^2(ft^2))	102 (1,096)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.14E3 (3.65E2)	
		Fire Severity (min)	Less than 1 min	

Table 9.5A-2 (177 of 318)

Z078-A23B: Buttress Opening			
Zone Description		Protection Measures	
• F078-A23B: Buttress Opening		Detection	• None
Wall	• F078-A20B • F078-AEEB (Z078-A25B) • F055-A18B	Fire Extinguish	• Dry chemical
Floor	• F055-A18B	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	54 (584)
	Fire Load (kJ/ m^2 (Btu/ft^2))	7.78E3 (6.85E2)
	Fire Severity (min)	1

Table 9.5A-2 (178 of 318)

<table>
<tr><td colspan="4">Z078-A25B : Class 1E Switchgear 01B Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F078-AEEB : Class 1E Switchgear 01B Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F078-A21B
• F078-A20B
• F078-A23B
• F000-AFHL (Z078-AFHL)</td><td>Fire Extinguish</td><td>• Water hose
• CO_2 chemical</td></tr>
<tr><td>Floor</td><td>• F055-A04B
• F055-A21B</td><td>Suppression System</td><td>• Automatic preaction sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F100-A12B
• F100-A13B</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Class 1E 4.16kV Switchgear^S
• Class 1E 480V Loadcenter^S
• Cubicle Cooler^S</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 5.26E7 (4.98E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>284 (1,973)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.16E5 (2.78E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>21</td></tr>
</table>

Table 9.5A-2 (179 of 318)

Z078-A47B : Electrical Equipment Room			
Zone Description		Protection Measures	
• F078-A47B : Electrical Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A14C • F055-AGAC • F050-A02C	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A11C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 480V N1E MCC • 480V N1E Loadcenter • Cubicle Cooler		Major Combustible (kJ (Btu))	• Cable insulation 3.14E7 (2.97E7)
		Floor Area (m^2(ft^2))	86 (927)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.01E5 (3.53E4)
		Fire Severity (min)	26

Table 9.5A-2 (180 of 318)

Z078-A51B : Boric Acid Makeup Pump Room			
Zone Description		Protection Measures	
• F078-A51B : Boric Acid Makeup Pump Room		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A14C • F055-AGAC • F050-A02C	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A11C	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• Boric Acid Makeup pumps	Major Combustible (kJ (Btu))	• Cable insulation 8.81E5 (8.35E5)
	Floor Area (m^2(ft^2))	45 (487)
	Fire Load (kJ/ m^2 (Btu/ft^2))	2.14E5 (1.89E4)
	Fire Severity (min)	14

Table 9.5A-2 (181 of 318)

Z078-A52D : 480V N1E MCC Room			
Zone Description		Protection Measures	
• F078-A52D : 480V N1E MCC Room		Detection	• Analog type photoelectric smoke detector
Wall	• F065-A01D • F078-AGAD (Z078-A57D, Z078-A10D)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A02D	Suppression System	• None
Ceiling	• Exterior wall	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E MCC 01N • 480V Non 1E MCC 02N • 480V Non 1E MCC 05N • Cubicle Cooler		Major Combustible (kJ (Btu))	• Cable insulation 3.16E7 (3.00E7)
		Floor Area (m^2(ft^2))	110 (1,189)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.15E5 (2.77E4)
		Fire Severity (min)	21

Table 9.5A-2 (182 of 318)

Z078-A53D : 480V N1E Loadcenter Room			
Zone Description		Protection Measures	
• F078-A53D : 480V N1E Loadcenter Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-AGAD (Z078-A57D) • F078-A19B	Fire Extinguish	• Water hose • Dry chemical
Floor	• F055-A02B	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E Loadcenter		Major Combustible (kJ (Btu))	• Cable insulation 1.17E7 (1.11E7)
		Floor Area (m^2(ft^2))	42 (454)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.04E5 (2.68E4)
		Fire Severity (min)	20

Table 9.5A-2 (183 of 318)

<table>
<tr><td colspan="4">Z078-A56B : Train B DC & IP Equip. Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F078-A56B : Train B DC & IP Equip. Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-AFHL (Z078-AFHL)
• F078-A19B</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F055-A19B</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F100-A11B</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 120V AC Class 1E Inverter[S]
• 125V DC Control Center[S]
• 125V DC Class 1E Battery Chargers[S]
• Class 1E Spare Battery Charger[S]
• Cubicle Cooler[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 8.69E6 (8.24E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>65 (703)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.46E5 (1.29E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>10</td></tr>
</table>

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Z078-A58B : Swing Loadcenter Room			
Zone Description		Protection Measures	
• F078-AEEB : Class 1E Switchgear 01B Room		Detection	• Analog type photoelectric smoke detector
Wall	• Z078-A25B • F078-A23B • F078-A21B	Fire Extinguish	• Water hose • CO_2 chemical
Floor	• F055-A21B	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F100-A13B	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Swing Loadcenter[S]		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	33 (360)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.26E4 (1.11E3)
		Fire Severity (min)	1

Table 9.5A-2 (185 of 318)

Z078-AAFD : Turbine Driven AFW Pump Room B			
Zone Description		Protection Measures	
• F078-AAFD : Turbine Driven AFW Pump Room B		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A11D • F078-A20B • F078-AGAD (Z078-A10D)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F050-A02D	Suppression System	• None
Ceiling	• F100-A07D	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• Aux. Feedwater Turbine Driven Pump[S] • Auxiliary Feedwater Pump Turbine Steam Supply Isolation Valve[S] • Suction Pressure Transmitter[S] • Discharge Pressure Transmitter[S] • Cubicle Cooler[S]	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	89 (954)
	Fire Load (kJ/ m^2 (Btu/ft^2))	4.76E3 (4.19E2)
	Fire Severity (min)	Less than 1 min

Table 9.5A-2 (186 of 318)

Z078-A10D : General Access Area			
Zone Description		Protection Measures	
• F078-AGAD : General Access Area D- 78'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z078-A29D • Z078-A57D • F078-A01D, A02D, A04D, A06D,A09D, A11D, A12D, A14C • F078-AAFD • F078-A52D	Fire Extinguish	• Water hose • CO_2 hose • Dry chemical • CO_2 chemical
Floor	• F055-AGAD	Suppression System	• None
Ceiling	• F100-A06D	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Chiller Room Supply Fan		Major Combustible (kJ (Btu))	• Cable insulation 4.19E7 (3.97E7)
		Floor Area (m^2(ft^2))	178 (1,914)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.59E5 (2.28E4)
		Fire Severity (min)	17

Table 9.5A-2 (187 of 318)

Z078-A29B : CCW Makeup Pump Room				
Zone Description		Protection Measures		
• F078-AGAB : General Access Area B- 78'-0"		Detection	• Analog type photoelectric smoke detector	
Wall	• Z078-A19B • F078-A56B	Fire Extinguish	• Water hose • CO_2 hose • Dry chemical • CO_2 chemical	
Floor	• F055-A19B	Suppression System	• None	
Ceiling	• F100-A10B	Access/Egress	• Door	
Major Equipment		Combustible & Fire Loading		
• CCW Makeup Pump		Major Combustible (kJ (Btu))	• Cable insulation 1.74E7 (1.65E7) • Lube oil 3.45E4 (3.27E4)	
		Floor Area (m^2(ft^2))	27 (288)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.37E5 (5.61E4)	
		Fire Severity (min)	42	

Table 9.5A-2 (188 of 318)

Z078-A57D : Piping & Cable Area			
Zone Description		Protection Measures	
• F078-AGAD : General Access Area D- 78'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z078-A10D • F078-A53D • F078-A52D	Fire Extinguish	• Water hose • CO_2 hose • Dry chemical • CO_2 chemical
Floor	• F055-A02B	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 2.29E5 (2.17E5)
		Floor Area (m^2(ft^2))	45 (486)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.64E4 (1.44E3)
		Fire Severity (min)	1

Table 9.5A-2 (189 of 318)

Z000-ADGD : Diesel Generator Room B			
Zone Description		Protection Measures	
• F000-ADGD : Diesel Generator Room B		Detection	• Analog type photoelectric smoke detector • Flame detector
Wall	• F100-A04D • F100-A06D • F000-TB	Fire Extinguish	• Water hose • CO_2 hose • Dry chemical
Floor	• F078-A01D ~ F078-A05D	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F137-A01D • F137-A02D • F137-ASTD	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Class 1E Diesel Generator[S] • EDG Room Normal Supply Fan • EDG Control Room Electrical Duct Heater • LT&HT Water Expansion Tank & Diesel Fuel Oil Tank & Lube oil Makeup Tank Room Duct Heater		Major Combustible (kJ (Btu))	• Cable insulation 4.00E7 (3.79E7) • Lube oil 2.41E8 (2.28E8)
		Floor Area (m^2(ft^2))	395 (4,255)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.16E5 (7.18E4)
		Fire Severity (min)	54

Table 9.5A-2 (190 of 318)

Z100-A04D : Cable Access Area			
Zone Description		Protection Measures	
• F100-A04D : Cable Access Area		Detection	• Analog type photoelectric smoke detector
Wall	• F100-A05D • F000-ADGD • F100-A06D	Fire Extinguish	• Water hose • Dry chemical • CO_2 chemical
Floor	• F078-A04D • F078-A05D	Suppression System	• None
Ceiling	• F000-ADGD • F120-A01D	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Cable Tray & Conduits		Major Combustible (kJ (Btu))	• Cable insulation 2.03E6 (1.92E6)
		Floor Area (m^2(ft^2))	45 (485)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.64E4 (4.96E3)
		Fire Severity (min)	4

Table 9.5A-2 (191 of 318)

Z100-A05D : Electrical Equipment Room			
Zone Description		Protection Measures	
• F100-A05D : Electrical Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• F100-A05C • F100-A04D • F100-A06D	Fire Extinguish	• Water hose • Dry chemical • CO_2 chemical
Floor	• F078-A06D • F078-A07D	Suppression System	• None
Ceiling	• F120-A05D	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• 13.8kV Non 1E SWGR 01N • 480V Non 1E Loadcenter 11N • 480V Non 1E MCC 10N • Electrical Equipment Room CC	Major Combustible (kJ (Btu))	• Cable insulation 6.80E7 (6.44E7)
	Floor Area (m^2(ft^2))	123 (1,321)
	Fire Load (kJ/ m^2 (Btu/ft^2))	6.09E5 (5.37E4)
	Fire Severity (min)	40

Table 9.5A-2 (192 of 318)

F100-A06D : General Access Area D- 100'-0"			
Zone Description		Protection Measures	
• F100-A06D : General Access Area D- 100'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F000-ADGD • F100-A04D • F100-A05D • F100-A07D • F100-A08D	Fire Extinguish	• Dry chemical • Water hose
Floor	• F078-AGAD	Suppression System	• None
Ceiling	• F120-AGAD	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.55E8 (1.47E8)
		Floor Area (m^2(ft^2))	348 (3,744)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.91E5 (4.33E4)
		Fire Severity (min)	32

Table 9.5A-2 (193 of 318)

<table>
<tr><td colspan="4">Z100-A07D : Aux. Feed Water Tank Room B</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F100-A07D : Aux. Feed Water Tank Room</td><td>Detection</td><td>• None</td></tr>
<tr><td>Wall</td><td>• F100-A06D
• F100-A08D
• F100-A16D
• F100-AEEB
• F100-A10B</td><td>Fire Extinguish</td><td>• None</td></tr>
<tr><td>Floor</td><td>• F078-A11D
• F078-A20B
• F078-AAFD</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F137-A10D
• F137-A31D</td><td>Access/Egress</td><td>• None</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Aux. Feedwater Tank[S]</td><td>Major Combustible (kJ (Btu))</td><td>• None</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>249 (2,683)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.69E3 (1.49E2)</td></tr>
<tr><td>Fire Severity (min)</td><td>Less than 1 min</td></tr>
</table>

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<table>
<tr><td colspan="4">Z100-A08D : Non 1E DC & IP Equip. Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F100-A08D : Non 1E DC & IP Equip. Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F100-A06D
• F100-A07D
• F100-A16D</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F078-A12D</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F120-A09D</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 125V DC MCC 01N
• 125V DC Battery Charger
• 120V AC Non 1E IP Inverter
• 120V AC Non 1E IPS Inverter
• Regulating Transformer</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 5.39E7 (5.11E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>185 (1,989)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.21E5 (2.82E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>21</td></tr>
</table>

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Z100-A10B : General Access Area B- 100'-0"			
Zone Description		Protection Measures	
• F100-A10B : General Access Area B- 100'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A14C • F055-AGAC • F050-A02C	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F078-A11C	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 7.27E7 (6.89E7)
		Floor Area (m^2(ft^2))	80 (856)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.01E6 (8.86E4)
		Fire Severity (hr)	1.1

Table 9.5A-2 (196 of 318)

Z100-A11B : Train B Battery Room			
Zone Description		Protection Measures	
• F100-A11B : Train B Battery Room		Detection	• Explosion proof type fixed temperature detector
Wall	• F100-A10B • F000-AFHU (Z100-AFHU)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F078-A56B	Suppression System	• None
Ceiling	• F120-A11B • F120-A13B • F120-A35B	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• 125V DC Class 1E Battery^S • Class 1E Battery Room Supply Fan^S • Class 1E Battery Room Exhaust Fan^S	Major Combustible (kJ (Btu))	• Cable insulation 9.34E6 (8.85E6) • Battery 1.09E7 (1.03E7)
	Floor Area (m^2(ft^2))	66 (711)
	Fire Load (kJ/ m^2 (Btu/ft^2))	3.22E5 (2.84E4)
	Fire Severity (min)	21

Table 9.5A-2 (197 of 318)

Z100-A12B: 480V Class 1E MCC 01B Room			
Zone Description		Protection Measures	
• F100-AEEB : 480V Class 1E MCC 01B Room		Detection	• Analog type photoelectric smoke detector
Wall	• F100-A10B • F100-A13B • F100-A07D • Z100-A18B	Fire Extinguish	• Dry chemical • Water hose
Floor	• F078-AEEB	Suppression System	• Manually actuated deluge system for charcoal filters
Ceiling	• F120-A15B	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Class 1E 480V MCC^S • Cubicle Cooler		Major Combustible (kJ (Btu))	• Cable insulation 2.75E7 (2.61E7)
		Floor Area (m^2(ft^2))	39 (417)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.82E5 (6.88E4)
		Fire Severity (min)	52

Table 9.5A-2 (198 of 318)

Z100-A13B : Mechanical Penetration Room			
Zone Description		Protection Measures	
• F100-A13B : Mechanical Penetration Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A21B • F000-AFHU (Z100-AFHU) • F078-A23B • F078-A21B	Fire Extinguish	• Water hose • Dry chemical
Floor	• F078-AEEB • F078-A21B	Suppression System	• None
Ceiling	• F120-A16B	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• SC Containment Isolation Valve [S] • SCS Test Return Line Isolation Valve • SC Warmup Bypass Valve [S]		Major Combustible (kJ (Btu))	• Cable insulation 2.50E6 (2.37E6)
		Floor Area (m^2(ft^2))	112 (1,207)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.68E4 (2.36E3)
		Fire Severity (min)	2

Table 9.5A-2 (199 of 318)

Z100-A16D : Pipe Chase			
Zone Description		Protection Measures	
• F100-A16D : Pipe Chase		Detection	• None
Wall	• F000-CNB • F100-A07D • F100-A08D • F078-A23B	Fire Extinguish	• Dry chemical
Floor	• F055-A18B • F055-A14D	Suppression System	• None
Ceiling	• F120-A06D	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	65 (704)
	Fire Load (kJ/ m^2 (Btu/ft^2))	6.45E3 (5.68E2)
	Fire Severity (min)	Less than 1min

Table 9.5A-2 (200 of 318)

Z100-A18B: MUX N2 Room			
Zone Description		Protection Measures	
• F100-AEEB : 480V Class 1E MCC 01B Room		Detection	• Analog type photoelectric smoke detector
Wall	• F100-A10B • F100-A13B • F100-A07D • Z100-A12B	Fire Extinguish	• Dry chemical • Water hose
Floor	• F078-AEEB	Suppression System	• Manually actuated deluge system for charcoal filters
Ceiling	• F120-A15B	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• MUX cabinet • LX		Major Combustible (kJ (Btu))	• Cable insulation 1.55E7 (1.47E7)
		Floor Area (m^2(ft^2))	39 (417)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.40E5 (3.88E4)
		Fire Severity (min)	29

Table 9.5A-2 (201 of 318)

Z100-A32B : Spent Fuel Pool Cooling Hx Room			
Zone Description		Protection Measures	
• F100-A32B : Spent Fuel Pool Cooling Hx Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-AFHU (Z100-AFHU)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F000-AFHL	Suppression System	• None
Ceiling	• F120-A29B	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• Spent Fuel Pool Cooing Heat Exchanger[SR] • Spent Fuel Pool Cooling Pump[SR] • Cubicle Cooler	Major Combustible (kJ (Btu))	• Lube oil 4.92E4 (4.66E4)
	Floor Area (m^2(ft^2))	131 (1,409)
	Fire Load (kJ/ m^2 (Btu/ft^2))	3.20E5 (2.81E4)
	Fire Severity (min)	21

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Z100-A36B : FH Area Supply AHU Room			
Zone Description		Protection Measures	
• F100-A36B : FH Area Supply AHU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-AFHU (Z100-AFHU)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F078-A47B	Suppression System	• None
Ceiling	• F120-A29B	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• FH Area Normal Supply AHU	Major Combustible (kJ (Btu))	• Cable insulation 1.28E7 (1.22E7) • Prefilter 2.70E6 (2.56E6)
	Floor Area (m^2(ft^2))	86 (927)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.67E5 (1.47E4)
	Fire Severity (min)	11

Table 9.5A-2 (203 of 318)

Z120-A01D : Piping Cable Area			
Zone Description		Protection Measures	
• F120-A01D : Piping Cable Area		Detection	• Analog type photoelectric smoke detector
Wall	• F120-A05D • F000-ADGD • F120-AGAD • F000-TB	Fire Extinguish	• Dry chemical • Water hose • CO_2 hose
Floor	• F100-A04D	Suppression System	• None
Ceiling	• F137- ASTD	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• Cable Trays & Conduits	Major Combustible (kJ (Btu))	• Cable insulation 4.47E7 (4.23E7)
	Floor Area (m^2(ft^2))	21 (230)
	Fire Load (kJ/ m^2 (Btu/ft^2))	2.30E6 (2.02E5)
	Fire Severity (hr)	2.5

Table 9.5A-2 (204 of 318)

<table>
<tr><td colspan="4">Z120-A02D : Lube oil Makeup Tank Room D</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F120-A02D : Lube oil Makeup Tank Room D</td><td>Detection</td><td>• Explosion proof type fixed temperature detector</td></tr>
<tr><td>Wall</td><td>• F120-A03D
• F000-ADGD
• F000-TB</td><td>Fire Extinguish</td><td>• Dry chemical
• Water hose
• Wheeled dry chemical</td></tr>
<tr><td>Floor</td><td>• F000-ADGD</td><td>Suppression System</td><td>• Automatic preaction sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F137-A02D</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Lube oil Makeup Tank^{S}</td><td>Major Combustible (kJ (Btu))</td><td>• Lube oil 1.06E8 (1.01E8)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>14 (151)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>8.77E6 (7.72E5)</td></tr>
<tr><td>Fire Severity (hr)</td><td>9.7</td></tr>
</table>

Table 9.5A-2 (205 of 318)

F120-A03D : Diesel Fuel Oil Day Tank Room D			
Zone Description		Protection Measures	
• F120-A03D : Diesel Fuel Oil Day Tank Room D		Detection	• Explosion proof type fixed temperature detector
Wall	• F120-A03D • F000-ADGD • F000-TB	Fire Extinguish	• Dry chemical • Water hose • Wheeled dry chemical
Floor	• F000-ADGD	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F137-A02D	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Diesel Fuel Oil Day Tank[S]		Major Combustible (kJ (Btu))	• Fuel Oil 1.46E8 (1.38E8) • Cable insulation 8.29E6 (7.86E6)
		Floor Area (m^2(ft^2))	13 (143)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.16E7 (1.02E6)
		Fire Severity (hr)	12.8

Table 9.5A-2 (206 of 318)

Z120-A05D : Electrical Equipment Room			
Zone Description		Protection Measures	
• F120-A05D : Electrical Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• F120-A05C • F120-AGAD (Z120-A07D) • F000-TB	Fire Extinguish	• Dry chemical • Water hose • CO_2 hose
Floor	• F100-A05D	Suppression System	• None
Ceiling	• F137-A05D	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• 480V Non 1E Loadcenter 01N • 480V Non 1E Loadcenter 03N • 480V Non 1E MCC 07N • 480V Non 1E MCC 08N • Electrical Equipment Room CC	Major Combustible (kJ (Btu))	• Cable insulation 1.24E8 (1.17E8)
	Floor Area (m^2(ft^2))	123 (1,321)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.11E6 (9.78E4)
	Fire Severity (hr)	1.2

Table 9.5A-2 (207 of 318)

Z120-A08D : 480V N1E MCC Room			
Zone Description		Protection Measures	
• F120-A08D : 480V N1E MCC Room		Detection	• Analog type photoelectric smoke detector
Wall	• F120-AGAD (Z120-A07D)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-AGAD	Suppression System	• None
Ceiling	• F137-A30D	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E MCCs		Major Combustible (kJ (Btu))	• Cable insulation 1.96E7 (1.86E7)
		Floor Area (m^2(ft^2))	15 (165)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.40E6 (1.24E5)
		Fire Severity (hr)	1.6

Table 9.5A-2 (208 of 318)

Z120-A09D : Electrical Penetration Room (D)				
Zone Description		Protection Measures		
• F120-A09D : Electrical Penetration Room (D)		Detection	• Analog type photoelectric smoke detector	
Wall	• F078-A09D • F100-A07D • F120-A06D • F078-A16D • F120-AGAD (Z120-A07D)	Fire Extinguish	• Dry chemical • Water hose	
Floor	• F100-A08D • F100-AGAD	Suppression System	• None	
Ceiling	• F037-A11D	Access/Egress	• Door	
Major Equipment		Combustible & Fire Loading		
• 480V Non 1E MCC 33N • Electrical Penetration Room CC		Major Combustible (kJ (Btu))	• Cable insulation 5.57E7 (5.28E7)	
		Floor Area (m^2(ft^2))	168 (1,805)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.66E5 (3.22E4)	
		Fire Severity (min)	24	

Table 9.5A-2 (209 of 318)

Z120-A11B : General Access Area			
Zone Description		Protection Measures	
• F120-A11B : General Access Area B- 120'-0""		Detection	• Analog type photoelectric smoke detector
Wall	• F120-A15B • F000-AFHU (Z120-AFHU) • F100-A07D	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-A10B	Suppression System	• None
Ceiling	• F137-A31D • F137-A24B	Access/Egress	• Doors • Stair
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 6.51E7 (6.17E7)
		Floor Area (m^2(ft^2))	126 (1,352)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.70E5 (5.02E4)
		Fire Severity (min)	38

Table 9.5A-2 (210 of 318)

Z120-A15B : 480V Class 1E MCC 03B Room			
Zone Description		Protection Measures	
• F120-A15B : 480V Class 1E MCC 03B Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A23B • F120-A11B • F120-AMPB • F100-A07D	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-AEEB	Suppression System	• None
Ceiling	• F137-A15B	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• 480V Class 1E MCC[S] • Cubicle Cooler[S]	Major Combustible (kJ (Btu))	• Cable insulation 4.07E7 (3.86E7)
	Floor Area (m^2(ft^2))	77 (833)
	Fire Load (kJ/ m^2 (Btu/ft^2))	5.79E5 (5.10E4)
	Fire Severity (min)	38

Table 9.5A-2 (211 of 318)

<table>
<tr><td colspan="4">Z120-A16B : Mechanical Penetration Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F120-AMPB : Mechanical Penetration Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• Z120-A36B
• Z120-A37B
• F078-A23B
• F120-A15B
• F000-AFHU (Z100-AFHU)</td><td>Fire Extinguish</td><td>• Dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F100-A13B
• F078-A21B</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F137-AEPB
• F137-A32B</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.74E7 (1.65E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>162 (1,747)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.18E5 (1.04E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>8</td></tr>
</table>

Table 9.5A-2 (212 of 318)

Z120-A36B : Hydrogen Analyzer Room			
Zone Description		Protection Measures	
• F120-AMPB : Mechanical Penetration Room		Detection	• Analog type photoelectric smoke detector
Wall	• Z120-A16B • Z120-A37B • F120-A15B	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-A13B	Suppression System	• None
Ceiling	• F137-AEPB	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Containment Hydrogen Analyzer Cabinets		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	44 (475)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.56E3 (8.42E2)
		Fire Severity (min)	1

Table 9.5A-2 (213 of 318)

Z120-A37B : Access Area			
Zone Description		Protection Measures	
• F120-AMPB : Mechanical Penetration Room		Detection	• Analog type photoelectric smoke detector
Wall	• Z120-A16B • Z120-A36B • F000-AFHU (Z100-AFHU)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-A13B	Suppression System	• None
Ceiling	• F137-AEPB	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area ($m^2(ft^2)$)	44 (475)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.56E3 (8.42E2)
		Fire Severity (min)	1

Table 9.5A-2 (214 of 318)

Z120-A29B : AB Controlled Area (II) Emergency Exhaust ACU Room 1				
Zone Description		Protection Measures		
• F120-A29B : AB Controlled Area (II) Emergency Exhaust ACU Room 1		Detection	• Analog type photoelectric smoke detector	
Wall	• F000-AFHU (Z120-AFHU)	Fire Extinguish	• Dry chemical • Water hose	
Floor	• F100-A32B • F000-AFHU (Z100-AFHU)	Suppression System	• Manually actuated deluge system for charcoal filter	
Ceiling	• F000-AFHU (Z137-AFHU)	Access/Egress	• Door	
Major Equipment		Combustible & Fire Loading		
• AB Controlled Area (II) Emergency Exhaust ACU[R]		Major Combustible (kJ (Btu))	• Prefilter 9.45E5 (8.96E5) • HEPA filter 4.73E5 (4.48E5) • Carbon adsorber 1.79E8 (1.69E8)	
		Floor Area (m^2(ft^2))	142 (1,530)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.53E6 (2.22E5)	
		Fire Severity (hr)	2.8	

Table 9.5A-2 (215 of 318)

Z120-A30B : AB Controlled Area (II) Emergency Exhaust ACU Room 2			
Zone Description		Protection Measures	
• F120-A30B : AB Controlled Area (II) Emergency Exhaust ACU Room 2		Detection	• Analog type photoelectric smoke detector
Wall	• F000-AFHU (Z120-AFHU)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-A32B • F000-AFHU (Z100-AFHU)	Suppression System	• Manually actuated deluge system for charcoal filter
Ceiling	• F000-AFHU (Z137-AFHU)	Access/Egress	• Door

Major Equipment	Combustible & Fire Loading	
• AB Controlled Area (II) Emergency Exhaust ACU[R]	Major Combustible (kJ (Btu))	• Prefilter 9.45E5 (8.96E5) • HEPA filter 4.73E5 (4.48E5) • Carbon adsorber 1.79E8 (1.69E8)
	Floor Area (m^2(ft^2))	178 (1,913)
	Fire Load (kJ/ m^2 (Btu/ft^2))	2.02E6 (1.78E5)
	Fire Severity (min)	2.2

Table 9.5A-2 (216 of 318)

Z120-A35B : Battery Room			
Zone Description		Protection Measures	
• F120-A35B : Battery Room		Detection	• None
Wall	• F120-A11B • F000-AFHU (Z120-AFHU)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F120-A11B • F000-AFHU (Z100-AFHU)	Suppression System	• None
Ceiling	• F000-AFHU • (Z137-AFHU)	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• 125V DC N1E Battery • Battery Room Exhaust Fan • Battery Room Supply Fan		Major Combustible (kJ (Btu))	• Battery 2.27E7 (2.15E7)
		Floor Area (m^2(ft^2))	59 (630)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.95E5 (3.48E4)
		Fire Severity (min)	26

Table 9.5A-2 (217 of 318)

Z120-A07D : General Access Area			
Zone Description		Protection Measures	
• F120-AGAD : General Access Area D-120'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z120-A10D • F120-A08D • F100-A07D • F120-A09D • F078-A09D • F078-A14C • F120-A05D • F120-A01D	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-AGAD (Z100-A06D)	Suppression System	• None
Ceiling	• F137-A31D • F137-A09D	Access/Egress	• Doors • Stair

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• Cable insulation 1.70E8 (1.61E8)
	Floor Area (m^2(ft^2))	255 (2,742)
	Fire Load (kJ/ m^2 (Btu/ft^2))	7.34E5 (6.46E4)
	Fire Severity (min)	48

Table 9.5A-2 (218 of 318)

Z120-A10D : ECW Makeup Pump Room			
Zone Description		Protection Measures	
• F120-AGAD : General Access Area D-120'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z120-A07D • Z120-A18D • F120-A08D	Fire Extinguish	• Dry chemical • Water hose
Floor	• F100-AGAD (Z100-A06D)	Suppression System	• None
Ceiling	• F137-A31D	Access/Egress	• Doors • Stair
Major Equipment		Combustible & Fire Loading	
• Essential Chilled Water Makeup Pump		Major Combustible (kJ (Btu))	• Cable insulation 1.43E7 (1.35E7)
		Floor Area (m^2(ft^2))	23 (252)
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.70E5 (5.90E4)
		Fire Severity (min)	44

Table 9.5A-2 (219 of 318)

<table>
<tr><td colspan="4">Z120-A18D : Lx Panel Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F120-AGAD : General Access Area D-120'-0"</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• Z120-A07D
• Z120-A10D
• F120-A08D</td><td>Fire Extinguish</td><td>• Dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F100-AGAD (Z100-A06D)</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F137-A31D</td><td>Access/Egress</td><td>• Doors
• Stair</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Lx Panel</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.33E7(1.26E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>27 (288)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>5.47E5 (4.82E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>36</td></tr>
</table>

Table 9.5A-2 (220 of 318)

Z137-A01D : Cable Spreading Area			
Zone Description		Protection Measures	
• F137-A01D : Cable Spreading Area		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A02D • F000-ADGD • F137-A30D • F137-A09D • F000-TB	Fire Extinguish	• CO_2 hose • Water hose • CO_2 chemical
Floor	• F000-ADGD	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F057-A01D	Access/Egress	• Doors • Stair
Major Equipment		Combustible & Fire Loading	
• Cable Trays and Conduits		Major Combustible (kJ (Btu))	• Cable insulation 2.30E7 (2.18E7)
		Floor Area (m^2(ft^2))	96 (1,035)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.63E5 (2.32E4)
		Fire Severity (min)	17

Table 9.5A-2 (221 of 318)

Z137-A02D : Electrical Equipment Room			
Zone Description		Protection Measures	
• F137-A02D : Electrical Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A01D • F137-ASTD • F137-A05D • F000-TB	Fire Extinguish	• Dry chemical • CO_2 hose • Water hose • CO_2 chemical
Floor	• F000-ADGD	Suppression System	• None
Ceiling	• F157-ACPX	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 480V N1E Loadcenter • 480V PNS Loadcenter • Cubicle Coolers[S] • RSP Room Supply Fans • RSP Room Exhaust Fans		Major Combustible (kJ (Btu))	• Cable insulation 7.93E7 (7.52E7)
		Floor Area (m^2(ft^2))	165 (1,771)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.30E5 (4.67E4)
		Fire Severity (min)	35

Table 9.5A-2 (222 of 318)

Z137-A05D : PCS Room			
Zone Description		Protection Measures	
• F137-A05D : PCS Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A09D • F137-ASTD • F137-A02D • F000-TB	Fire Extinguish	• Dry chemical • Water hose • CO_2 chemical
Floor	• F000-ADGD	Suppression System	• None
Ceiling	• F157-AMCR	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Digital Rod Control System Cabinet • Relay & Metering Pond PA21 • Relay & Metering Pond PA22		Major Combustible (kJ (Btu))	• Cable insulation 6.56E7 (6.22E7)
		Floor Area (m^2(ft^2))	123 (1,321)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.88E5 (5.18E4)
		Fire Severity (min)	39

Table 9.5A-2 (223 of 318)

Z137-A06D : Remote Shutdown Room				
Zone Description		Protection Measures		
• F137-A06D : Remote Shutdown Room		Detection	• Analog type photoelectric smoke detector	
Wall	• F137-A05D • F137-A02D	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical	
Floor	• F000-ADGD	Suppression System	• None	
Ceiling	• F157-AMCR	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• Remote Shutdown Panel[S] • Cubicle Cooler		Major Combustible (kJ (Btu))	• None	
		Floor Area (m^2(ft^2))	51 (551)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.24E4 (7.36E4)	
		Fire Severity (min)	1	

Table 9.5A-2 (224 of 318)

<table>
<tr><td colspan="4">Z137-A09D : General Access Area</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F137-AGAD : General Access Area D-137'-0"</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F137-A05D
• F137-A10D
• F137-A11D
• Z137-A12D</td><td>Fire Extinguish</td><td>• Water hose
• CO_2 chemical
• CO_2 hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F120-AGAD (Z120-A07D)</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F157-A16D
• F157-AMCR</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 4.63E7 (4.39E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>126 (1,358)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>4.04E5 (3.56E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>27</td></tr>
</table>

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Z137-A12D : MUX N2 Room			
Zone Description		Protection Measures	
• F137-AGAD : General Access Area D-137'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• Z137-A09D	Fire Extinguish	• Water hose • CO_2 chemical • CO_2 hose • Dry chemical
Floor	• F120-AGAD (Z120-A07D)	Suppression System	• None
Ceiling	• F157-AMCR	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.14E7 (1.08E7)
		Floor Area (m^2(ft^2))	30 (324)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.18E5 (3.68E4)
		Fire Severity (min)	28

Table 9.5A-2 (226 of 318)

Z137-A10D : 480V Class 1E MCC 03D Room				
Zone Description		Protection Measures		
• F137-A10D : 480V Class 1E MCC 03D Room		Detection	• Analog type photoelectric smoke detector	
Wall	• F137-A11D • F137-A09D • F137-A30D • F137-A31D	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical	
Floor	• F100-A07D	Suppression System	• None	
Ceiling	• F157-A16D	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• Class 1E 480V MCC[S] • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 1.15E7 (1.09E7)	
		Floor Area (m^2(ft^2))	79 (854)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.59E5 (1.40E4)	
		Fire Severity (min)	11	

Table 9.5A-2 (227 of 318)

<table>
<tr><td colspan="4">Z137-A11D : Electrical Penetration Room (D)</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F137-A11D : Electrical Penetration Room (D)</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F137-A09D
• F137-A10D
• F078-A09D
• F120-A06D
• F000-CNB</td><td>Fire Extinguish</td><td>• Water hose
• CO_2 hose
• CO_2 chemical
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F120-A09D</td><td>Suppression System</td><td>• Automatic preaction sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F157-A19D
• F157-A20D</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 480V Non 1E MCC
• Cubicle Cooler[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 8.96E7 (8.50E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>186 (2,005)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>5.29E5 (4.66E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>35</td></tr>
</table>

Table 9.5A-2 (228 of 318)

Z137-A13B : General Access Area B- 137'-6"			
Zone Description		Protection Measures	
• F137-A13B : General Access Area B- 137'-6"		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A24B • F137-A15B • F000-AFHU (Z137-AFHU)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F120-A11B • F120-A15B	Suppression System	• None
Ceiling	• F000-AFHU (Z156-AFHU)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.72E7(1.63E7)
		Floor Area (m^2(ft^2))	63 (682)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.98E5 (2.62E4)
		Fire Severity (min)	20

Table 9.5A-2 (229 of 318)

Z137-A14B : 480V N1E MCC 18N Room			
Zone Description		Protection Measures	
• F137-A14B : 480V N1E MCC 18N Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A24B • F137-A15B • F137-A31D • F137-AEPB (Z137-A17B)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F100-A07C	Suppression System	• None
Ceiling	• F156-AGAB	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 480V N1E MCC		Major Combustible (kJ (Btu))	• Cable insulation 3.83E6 (3.63E6)
		Floor Area (m^2(ft^2))	45 (488)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.57E4 (8.43E3)
		Fire Severity (min)	6

Table 9.5A-2 (230 of 318)

Z137-A15B : 480V Class 1E MCC 04B Room			
Zone Description		Protection Measures	
• F137-A15B : 480V Class 1E MCC 04B Room		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A14B • F137-A13B • F137-AEPB (Z137-A17B)	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F100-A07C	Suppression System	• None
Ceiling	• F156-AGAB	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Class 1E 480V MCC 04B[S] • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 4.39E6 (4.16E6)
		Floor Area (m^2(ft^2))	29 (316)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.67E5 (1.47E4)
		Fire Severity (min)	11

Table 9.5A-2 (231 of 318)

Z137-A24B : 480V N1E MCC 17N Room				
Zone Description		Protection Measures		
• F137-A24B : 480V N1E MCC 17N Room		Detection	• Analog type photoelectric smoke detector	
Wall	• F055-A14C • F055-AGAC • F050-A02C	Fire Extinguish	• Dry chemical	
Floor	• Basement	Suppression System	• None	
Ceiling	• F078-A11C	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• 480V N1E MCC		Major Combustible (kJ (Btu))	• Cable insulation 3.74E6 (3.54E6)	
		Floor Area (m^2(ft^2))	22 (233)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.96E5 (1.73E4)	
		Fire Severity (min)	13	

Table 9.5A-2 (232 of 318)

Z137-A30D : Main Steam Enclosure				
Zone Description		Protection Measures		
• F137-A30D : Main Steam Enclosure		Detection	• Analog type photoelectric smoke detector	
Wall	• F137-A01D • F137-A09D • F137-A10D • F137-A31D	Fire Extinguish	• Water hose • Dry chemical	
Floor	• F000-ADGD • F120-AGAD	Suppression System	• None	
Ceiling	• Exterior roof	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• Main Steam Enclosure Electrical Unit Heater.		Major Combustible (kJ (Btu))		• None
		Floor Area (m^2(ft^2))		253 (2,725)
		Fire Load (kJ/ m^2 (Btu/ft^2))		1.67E3 (1.47E2)
		Fire Severity (min)		Less than 1 min

Table 9.5A-2 (233 of 318)

Z137-A31D : MS Valve Room				
Zone Description		Protection Measures		
• F137-A31D : MS Valve Room		Detection	• Analog type photoelectric smoke detector	
Wall	• F000-CNB • F078-A23B • F137-A10D • F137-A30D	Fire Extinguish	• Water hose • Dry chemical	
Floor	• F100-A07D • F120-A06D • F120-AGAD	Suppression System	• None	
Ceiling	• Exterior roof	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• MSIVs^S • MSIVBVs^S • ADIVs^S • ADVs^S • AF Turbine Steam Supply Valve^S		Major Combustible (kJ (Btu))	• Fyrquel, EHC 8.39E4 (7.96E4)	
		Floor Area (m^2(ft^2))	299 (3,219)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.69E3 (1.49E2)	
		Fire Severity (min)	Less than 1 min	

Table 9.5A-2 (234 of 318)

Z137-A32B : Pipe Chase			
Zone Description		Protection Measures	
• F137-A32B : Pipe Chase		Detection	• None
Wall	• F000-CNB • F000-AFHU (Z137-AFHU) • F137-AEPB (Z137-A18B)	Fire Extinguish	• Dry chemical
Floor	• F000-AFHU (Z120-AFHU)	Suppression System	• None
Ceiling	• F156-A15B	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	25 (264)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.72E4 (1.52E3)
	Fire Severity (min)	1

Table 9.5A-2 (235 of 318)

Z137-A17B : Penetration MUX B Room			
Zone Description		Protection Measures	
• F137-AEPB : Electrical Penetration Room B		Detection	• Analog type photoelectric smoke detector
Wall	• Z137-A18B • F078-A23B • F137-A14B • F137-A15B • F137-A13B • F000-AFHU (Z137-AFHU)	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F120-AMPB	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F156-A04B	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 1.04E7 (9.84E6)
		Floor Area (m^2(ft^2))	125 (1,344)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.15E4 (8.05E3)
		Fire Severity (min)	6

Table 9.5A-2 (236 of 318)

Z137-A18B : Electrical Penetration Room B			
Zone Description		Protection Measures	
• F137-AEPB : Electrical Penetration Room B		Detection	• Analog type photoelectric smoke detector
Wall	• Z137-A17B • F078-A23B • F137-A32B • F000-AFHU (Z137-AFHU)	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F120-AMPB	Suppression System	• Automatic preaction sprinkler system
Ceiling	• F156-A04B	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 2.02E7 (1.92E7)
		Floor Area (m^2(ft^2))	81 (869)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.76E5 (2.43E4)
		Fire Severity (min)	18

Table 9.5A-2 (237 of 318)

Z137-ASTD : Stair				
Zone Description		Protection Measures		
• F137-ASTD : Stair		Detection	• Analog type photoelectric smoke detector	
Wall	• F137-A02D • F137-A05D • F137-A06D • F137-A09D	Fire Extinguish	• CO_2 chemical	
Floor	• F120-A01C • F000-ADGC	Suppression System	• None	
Ceiling	• F157-AMCR	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• None		Major Combustible (kJ (Btu))	• None	
		Floor Area (m^2(ft^2))	63 (674)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.74E3 (5.93E2)	
		Fire Severity (min)	Less than 1 min	

Table 9.5A-2 (238 of 318)

Z156-A04B: Containment Entrance Area			
Zone Description		Protection Measures	
• F156-A04B : Containment Entrance Area		Detection	• Analog type photoelectric smoke detector
Wall	• F156-A15B • F078-A23B • F156-AGAB • F000-AFHU (Z156-AFHU)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F137-AEPB	Suppression System	• None
Ceiling	• F174-A16B	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cabinets		Major Combustible (kJ (Btu))	• Cable insulation 5.40E6 (8.63E6)
		Floor Area (m^2(ft^2))	206 (2,218)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.88E4 (2.54E3)
		Fire Severity (min)	2 min

Table 9.5A-2 (239 of 318)

Z156-AGAB : SST Room			
Zone Description		Protection Measures	
• F156-AGAB : SST Room		Detection	• Analog type photoelectric smoke detector
Wall	• F156-A04B • F078-A23B • F137-A31D • F000-AFHU (Z156-AFHU)	Fire Extinguish	• Dry chemical • Water hose
Floor	• F137-A14B • F137-A15B • F137-A24B • F137-A13B	Suppression System	• None
Ceiling	• F174-A15B	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Single Stud Tensioner		Major Combustible (kJ (Btu))	• Cable insulation 2.35E7 (2.23E7)
		Floor Area (m^2(ft^2))	155 (1,673)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.66E5 (1.46E4)
		Fire Severity (min)	11

Table 9.5A-2 (240 of 318)

Z156-A15B : Pipe Chase			
Zone Description		Protection Measures	
• F156-A15B : Pipe Chase		Detection	• None
Wall	• F156-A04B • F000-CNB • F000-AFHU	Fire Extinguish	• Dry chemical • Water hose
Floor	• F137-A32B	Suppression System	• None
Ceiling	• F174-A22B	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	28 (298)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.52E4 (1.34E3)
		Fire Severity (min)	1

Table 9.5A-2 (241 of 318)

Z157-A01D : I&C Equipment Room			
Zone Description		Protection Measures	
• F157-A01D : I&C Equipment Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-ADGD • F137-A30D • F157-ACPX • F157-A16D	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F137-A10D	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-AGAD • F174-A01D	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cabinets[S]		Major Combustible (kJ (Btu))	• Cable insulation 1.88E7 (1.78E7)
		Floor Area (m^2(ft^2))	102 (1,100)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.03E5 (1.78E4)
		Fire Severity (min)	13

Table 9.5A-2 (242 of 318)

Z157-A16D : Corridor			
Zone Description		Protection Measures	
• F157-AGAD : General Access Area D-157'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F157-A28D • F157-A19D • F157-A20D • Z157-A13D	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A09D	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-A13D • F174-AGAD	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 6.66E5 (6.31E5)
		Floor Area (m^2(ft^2))	147 (1,583)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.98E4 (4.39E3)
		Fire Severity (min)	3

Table 9.5A-2 (243 of 318)

Z157-A13D : Vestibule			
Zone Description		Protection Measures	
• F157-AGAD : General Access Area D-157'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F157-ACPX • F157-A02C • F157-AMCR • Z157-A16D	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A09D	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-AGAD	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	30 (324)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.40E4 (1.23E3)
		Fire Severity (min)	1

Table 9.5A-2 (244 of 318)

Z157-A22D : Guest Room			
Zone Description		Protection Measures	
• F157-AGAD : General Access Area D-157'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F157-A19D • Z157-A16D	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A09D	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-AGAD	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	16 (173)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.63E4 (2.31E3)
		Fire Severity (min)	2

Table 9.5A-2 (245 of 318)

Z157-A27D : General Access Area			
Zone Description		Protection Measures	
• F157-AGAD : General Access Area D-157'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F137-A31C • Z157-A16D	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A30D	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	20 (216)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.10E4 (1.85E3)
		Fire Severity (min)	1

Table 9.5A-2 (246 of 318)

Z157-A19D : I&C Equipment Room			
Zone Description		Protection Measures	
• F157-A19C : I&C Equipment Room		Detection	• Analog type photoelectric smoke detector • Air Sampling smoke detector
Wall	• F157-A20D • F157-AGAD • F137-A31D • F078-A16D	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A11D	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-A14D	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cabinets • Cubicle Cooler[S]		Major Combustible (kJ (Btu))	• Cable insulation 1.78E7 (1.69E7)
		Floor Area (m^2(ft^2))	98 (1,055)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.00E5 (1.76E4)
		Fire Severity (min)	13

Table 9.5A-2 (247 of 318)

Z157-A20D : I&C Equipment Room			
Zone Description		Protection Measures	
• F157-A20D : I&C Equipment Room		Detection	• Analog type photoelectric smoke detector • Air Sampling smoke detector
Wall	• F157-A19D • F157-AGAD • F078-A09D	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F137-A11D	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-A14D • F174-A05D	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cabinets • Cubicle Cooler		Major Combustible (kJ (Btu))	• Cable insulation 1.44E7 (1.36E7)
		Floor Area (m^2(ft^2))	106 (1,136)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.50E5 (1.32E4)
		Fire Severity (min)	10

Table 9.5A-2 (248 of 318)

Z157-ACPX : Computer Room Area			
Zone Description		Protection Measures	
• F157-ACPX : Computer Room Area		Detection	• Analog type photoelectric smoke detector • Flame detector
Wall	• F000-TB • F157-A01D • F157-AMCR • F157-AGAD	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F137-A02D • F137-A06D	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-A24D	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Computers, Cabinets, Consoles • Computer Room PACU		Major Combustible (kJ (Btu))	• Cable insulation 2.77E7 (2.62E7) • Prefilter 2.03E5 (1.92E5)
		Floor Area (m^2(ft^2))	180 (1,938)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.70E5 (1.50E4)
		Fire Severity (min)	11

Table 9.5A-2 (249 of 318)

<table>
<tr><td colspan="4">Z157-AMCR : Control Room Area</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F157-AMCR : Control Room Area</td><td>Detection</td><td>• Analog type photoelectric smoke detector
• Flame detector
• Analog type heat detector</td></tr>
<tr><td>Wall</td><td>• F157-ACPX
• F157-A20D
• F000-TB
• Z157-AMAX</td><td>Fire Extinguish</td><td>• Water hose
• CO_2 hose
• CO_2 chemical
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F137-A03C
• F137-A04C
• F137-A05D
• F137-A35C ~ F137-A38C</td><td>Suppression System</td><td>• Automatic Actuated Clean Agent System</td></tr>
<tr><td>Ceiling</td><td>• F174-A23C
• F174-A23D
• F174-A24C
• F174-A24D
• F174-A25C
• F174-A25D</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Console
• LDP</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 4.76E7 (4.51E7)
• Paper/wood 8.44E5 (8.00E5)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>413 (4,442)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.29E5 (1.14E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>9</td></tr>
</table>

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Z157-AMAX : Meeting Room			
Zone Description		Protection Measures	
• F157-AMCR : Control Room Area		Detection	• Analog type photoelectric smoke detector • Flame detector • Analog type heat detector
Wall	• F157-A02C • F000-TB • Z157-AMCR	Fire Extinguish	• Water hose • CO_2 hose • CO_2 chemical • Dry chemical
Floor	• F137-A04C • F137-A35C ~ F137-A38C	Suppression System	• Automatic Actuated Clean Agent System
Ceiling	• F174-A24C	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Cabinets		Major Combustible (kJ (Btu))	• Cable insulation 4.74E7 (4.49E7) • Paper/wood 1.69E6 (1.60E6)
		Floor Area (m^2(ft^2))	126 (1,361)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.25E5 (3.75E4)
		Fire Severity (min)	28

Table 9.5A-2 (251 of 318)

Z157-A28D : Breaking Air Rack			
Zone Description		Protection Measures	
• F157-A28D : Breaking Air Rack		Detection	• Analog type photoelectric smoke detector
Wall	• F157-A19D • F137-A31D • F157-A16D	Fire Extinguish	• Water hose • CO_2 chemical • Dry chemical
Floor	• F137-A10D	Suppression System	• None
Ceiling	• F174-A13D	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	16 (173)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.63E4 (2.31E3)
		Fire Severity (min)	2

Table 9.5A-2 (252 of 318)

<table>
<tr><td colspan="4">Z174-A01D: EDG Room Normal Exhaust Fan Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F174-A01D : EDG Room Normal Exhaust Fan Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F174-A24D
• F000-ADGD
• F174-AGAD
• F000-TB</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F157-A01D
• F157-ACPX</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• EDG Room Normal Exhaust Fan[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 2.91E6 (2.76E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>42 (449)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>8.21E4 (7.23E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>5</td></tr>
</table>

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Z174-A05D: 480V N1E MCC Room			
Zone Description		Protection Measures	
• F174-A05D: 480V N1E MCC Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A09D • F000-CNB • F174-A14D • F174-AGAD	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-A20D	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 480V Non 1E MCC • 480V N1E Loadcenter		Major Combustible (kJ (Btu))	• Cable insulation 1.63E7 (1.55E7)
		Floor Area (m^2(ft^2))	66 (706)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.74E5 (2.41E4)
		Fire Severity (min)	18

Table 9.5A-2 (254 of 318)

<table>
<tr><td colspan="4">Z174-A13D: 480V N1E MCC Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F174-A13D: 480V N1E MCC Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F174-A14D
• F174-AGAD
• Exterior wall</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F157-AGAD
• F157-A28D</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 480V Non 1E MCC</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.60E7 (1.52E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>86 (931)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>2.04E5 (1.79E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>13</td></tr>
</table>

Table 9.5A-2 (255 of 318)

Z174-A14D: EDG Room Normal Supply AHU Room			
Zone Description		Protection Measures	
• F174-A14D: EDG Room Normal Supply AHU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A16D • F174-A13D • F174-AGAD • F000-CNB	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-A19D • F157-A20D	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• EDG Room Normal Supply AHU[S] • AB Clean Area Exhaust Fan[S] • AB smoke Removal Fan[S]		Major Combustible (kJ (Btu))	• Cable insulation 7.32E6 (6.94E6) • Prefilter 1.01E5 (9.60E4)
		Floor Area (m^2(ft^2))	145 (1,558)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.48E4 (4.82E3)
		Fire Severity (min)	4

Table 9.5A-2 (256 of 318)

Z174-A15B: CTMT High/Low Volume Purge ACU Room			
Zone Description		Protection Measures	
• F174-A15B: CTMT High/Low Volume Purge ACU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A16B • F000-AFHU • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• F156-AGAB • F000-AFHU	Suppression System	• Manually Actuated Deluge System
Ceiling	• Exterior roof	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• CTMT High Volume Purge ACU[R] • CTMT Low Volume Purge ACU[R] • CTMT Post-LOCA Purge Exhaust ACU[R] • CTMT High Volume Purge ACU Room Electric Unit Heater	Major Combustible (kJ (Btu))	• Prefilter 6.75E5 (6.40E5) • HEPA filters 6.41E5 (6.08E5) • Carbon adsorber 3.41E7 (3.23E7) • Cable insulation 1.80E7 (1.71E7)
	Floor Area (m^2(ft^2))	266 (2,863)
	Fire Load (kJ/ m^2 (Btu/ft^2))	3.29E5 (2.90E4)
	Fire Severity (min)	22

Table 9.5A-2 (257 of 318)

Z174-A16B : CTMT High Volume Purge AHU Room			
Zone Description		Protection Measures	
• F174-A16B : CTMT High Volume Purge AHU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A15B • F174-A22B • F000-AFHU • F000-CNB	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-A04B	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• CTMT High Volume Purge AHU • Low Volume Purge supply fan		Major Combustible (kJ (Btu))	• Prefilter 5.40E5 (5.12E5) • Cable insulation 6.05E6 (5.74E6)
		Floor Area (m^2(ft^2))	226 (2,428)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.19E4 (2.81E3)
		Fire Severity (min)	2

Table 9.5A-2 (258 of 318)

Z174-A22B : HVAC Chase			
Zone Description		Protection Measures	
• F174-A22B : HVAC Chase		Detection	• None
Wall	• F174-A16B • F000-AFHU • F000-CNB • Exterior wall	Fire Extinguish	• None
Floor	• F137-A23B	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	21 (226)
	Fire Load (kJ/ m^2 (Btu/ft^2))	2.01E4 (1.77E3)
	Fire Severity (min)	1

Table 9.5A-2 (259 of 318)

Z174-A23D : Control Room Area Supply AHUs Room			
Zone Description		Protection Measures	
• F174-A23D : Control Room Area Supply AHUs Room		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A23C • F174-A24D • F174-A25D • F174-AGAD	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-AMCR	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Control Room Area Supply AHU[S]		Major Combustible (kJ (Btu))	• Prefilter 2.53E5 (2.40E5)
		Floor Area (m^2(ft^2))	74 (797)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.12E3 (8.03E2)
		Fire Severity (min)	1

Table 9.5A-2 (260 of 318)

Z174-A24D : Control Room Area Supply AHU/ACU Room			
Zone Description		Protection Measures	
• F174-A24D : Control Room Area Supply AHU/ACU Room		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A23D • F174-A25D • F174-AGAD • F000-TB	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-AMCR • F157-ACPX	Suppression System	• Manually Actuated Deluge System
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Control Room Area Supply AHUs • Control Room Emergency Makeup ACU[R]		Major Combustible (kJ (Btu))	• Prefilter 4.56E5 (4.32E5) • HEPA filters 1.01E5 (9.60E4) • Carbon adsorber 4.83E7 (4.58E7)
		Floor Area (m^2(ft^2))	232 (2,500)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.19E5 (3.69E4)
		Fire Severity (min)	28

Table 9.5A-2 (261 of 318)

Z174-A25D : HVAC Area			
Zone Description		Protection Measures	
• F174-A25D : HVAC Area		Detection	• None
Wall	• F174-A23D • F174-A24D • F174-A25C • F000-TB	Fire Extinguish	• None
Floor	• F157-AMCR	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• None	Major Combustible (kJ (Btu))	• None
	Floor Area (m^2(ft^2))	46 (499)
	Fire Load (kJ/ m^2 (Btu/ft^2))	9.11E3 (8.02E2)
	Fire Severity (min)	1

Table 9.5A-2 (262 of 318)

Z174-A02D : ECW Compression Tank Room			
Zone Description		Protection Measures	
• F174-AGAD : General Access Area D-174'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A01D • F174-A24D • Z174-A03D • Z174-A12D	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-A01D	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• Essential Chilled Water Compression Tank	Major Combustible (kJ (Btu))	• Cable insulation 1.71E7 (1.62E7)
	Floor Area (m^2(ft^2))	35 (374)
	Fire Load (kJ/ m^2 (Btu/ft^2))	5.40E5 (4.76E4)
	Fire Severity (min)	36

Table 9.5A-2 (263 of 318)

Z174-A03D : CCW Surge Tank Room			
Zone Description		Protection Measures	
• F174-AGAD : General Access Area D-174'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A24D • Z174-A02D • Z174-A12D	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-A01D	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• CCW Surge Tank[S]		Major Combustible (kJ (Btu))	• None
		Floor Area ($m^2(ft^2)$)	35 (374)
		Fire Load (kJ/m^2 (Btu/ft^2))	1.28E4 (1.13E3)
		Fire Severity (min)	1

Table 9.5A-2 (264 of 318)

Z174-A12D : General Access Area			
Zone Description		Protection Measures	
• F174-AGAD : General Access Area D-174'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F174-A24D • F174-A23D • F174-A05D • F174-A14D • F174-A13D • Z174-A02C • Z174-A03D	Fire Extinguish	• Water hose • Dry chemical
Floor	• F157-AMCR • F157-AGAD	Suppression System	• None
Ceiling	• F195-A02D	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 6.47E6 (6.13E6)
		Floor Area (m^2(ft^2))	180 (1,940)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.95E4 (3.47E3)
		Fire Severity (min)	3

Table 9.5A-2 (265 of 318)

Z175-A01D : MSIV Room Supply AHU Room				
Zone Description		Protection Measures		
• F175-A01D : MSIV Room Supply AHU Room		Detection	• Analog type photoelectric smoke detector	
Wall	• F137-A31D • Exterior wall	Fire Extinguish	• Dry chemical	
Floor	• F137-A31D	Suppression System	• None	
Ceiling	• Exterior roof	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• MSIV Room Supply AHU		Major Combustible (kJ (Btu))	• Prefilter 1.35E5 (1.28E5)	
		Floor Area (m^2(ft^2))	42 (448)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.34E4 (1.18E3)	
		Fire Severity (min)	1	

Table 9.5A-2 (266 of 318)

Z195-A02D : AB Clean Area Supply AHUs Room			
Zone Description		Protection Measures	
• F195-A02D : AB Clean Area Supply AHUs Room		Detection	• Analog type photoelectric smoke detector
Wall	• F078-A14D • F195-A05D	Fire Extinguish	• Water hose • Dry chemical
Floor	• F174-AGAD	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• AB Clean Area Supply AHUs	Major Combustible (kJ (Btu))	• Prefilter 2.70E5 (2.56E5)
	Floor Area (m^2(ft^2))	137 (1,480)
	Fire Load (kJ/ m^2 (Btu/ft^2))	5.03E3 (4.43E2)
	Fire Severity (min)	Less than 1 min

Table 9.5A-2 (267 of 318)

Z195-A05D : 480V N1E Loadcenter Room				
Zone Description		Protection Measures		
• F195-A05D : 480V N1E Loadcenter Room		Detection	• Analog type photoelectric smoke detector	
Wall	• F195-A02D • Exterior wall	Fire Extinguish	• Water hose • Dry chemical	
Floor	• F174-A13D • F174-A14D	Suppression System	• None	
Ceiling	• Exterior roof	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• 480V Non 1E Loadcenter		Major Combustible (kJ (Btu))	• Cable insulation 9.03E6 (8.56E6)	
		Floor Area (m^2(ft^2))	105 (1,128)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.48E4 (8.35E3)	
		Fire Severity (min)	6	

Table 9.5A-2 (268 of 318)

Z195-A08B : AB Controlled Area (II) Normal Exhaust ACU Room			
Zone Description		Protection Measures	
• F195-A08B : AB Controlled Area (II) Normal Exhaust ACU Room		Detection	• Analog type photoelectric smoke detector
Wall	• Exterior wall	Fire Extinguish	• Dry chemical
Floor	• F174-A15B • F174-A16B	Suppression System	• Manually Actuated Deluge System
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• AB Controlled Area (II) Normal Exhaust ACUs[R]		Major Combustible (kJ (Btu))	• Prefilter 4.73E5 (4.48E5) • HEPA filters 9.45E5 (8.96E5) • Carbon adsorber 1.79E8 (1.69E8)
		Floor Area (m^2(ft^2))	544 (5,858)
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.60E5 (5.81E4)
		Fire Severity (min)	44

Table 9.5A-2 (269 of 318)

Z195-A10D : smoke Fan Room				
Zone Description		Protection Measures		
• F195-A10D : smoke Fan Room		Detection	• None	
Wall	• Exterior wall • F174-AGAD (Z174-A03D)	Fire Extinguish	• None	
Floor	• F174-A24D	Suppression System	• None	
Ceiling	• Exterior roof	Access/Egress	• Doors	
Major Equipment		Combustible & Fire Loading		
• Control Room Area smoke Removal Fan		Major Combustible (kJ (Btu))	• None	
		Floor Area ($m^2(ft^2)$)	11 (122)	
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.74E4 (3.29E3)	
		Fire Severity (min)	2	

Table 9.5A-2 (270 of 318)

Z055-AFHL : Fuel Handling Area – Lower Area El.55’			
Zone Description		Protection Measures	
• F000-AFHL : Fuel Handling Area – Lower Area		Detection	• Analog type photoelectric smoke detector
Wall	• F055-A54B • F055-A55B • F055-A30B • F055-A19B • F055-A21B • F055-A22B • F000-AHV • F000-ACVL (Z055-ACVL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• Z068-ACVL	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Floor Drain Sump Pump • Equipment Drain Sump Pump • RD Pump		Major Combustible (kJ (Btu))	• Grease 1.01E5 (9.61E4) • Cable insulation 4.15E6 (3.93E6)
		Floor Area (m^2(ft^2))	605 (6,509)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.88E3 (6.94E2)
		Fire Severity (min)	1

Table 9.5A-2 (271 of 318)

<table>
<tr><td colspan="4">Z078-AFHL : Fuel Handling Area – Lower Area El.78’</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-AFHL : Fuel Handling Area – Lower Area</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F078-AEEB
• F078-A21B
• F078-A47B
• F078-A51B
• F078-AGAB
• F000-AHV
• F000-ACVL (Z078-ACVL)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z068-ACVL</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Z100-AFHL</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Holdup Pump
• SG Wet Layup Recircu. Pump
• RMW Pump</td><td>Major Combustible (kJ (Btu))</td><td>• Lube oil 2.62E4 (2.48E4)
• Grease 1.12E4 (1.06E4)
• Cable insulation 4.68E7 (4.43E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>446 (4,796)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.16E5 (1.02E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>8</td></tr>
</table>

Table 9.5A-2 (272 of 318)

Z100-AFHU: Fuel Handling Area – Upper Area El.100’			
Zone Description		Protection Measures	
• F000-AFHU : Fuel Handling Area – Upper Area		Detection	• Analog type photoelectric smoke detector • Analog type heat detector • Flame Detector
Wall	• F100-A32B • F100-A36B • F100-A13B • F100-A11B • F100-A10B • F000-ACVU (Z100-ACVU)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F078-AGAB • Z078-AFHL	Suppression System	• Automatic Wet Pipe Sprinkler System
Ceiling	• Z120-AFHU	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.95E7 (1.85E7)
		Floor Area (m^2(ft^2))	690 (7,428)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.11E4 (2.74E3)
		Fire Severity (min)	2

Table 9.5A-2 (273 of 318)

<table>
<tr><td colspan="4">Z120-AFHU: Fuel Handling Area – Upper Area El.120’</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-AFHU : Fuel Handling Area – Upper Area</td><td>Detection</td><td>• Analog type photoelectric smoke detector
• Analog type heat detector
• Flame Detector</td></tr>
<tr><td>Wall</td><td>• F120-A29B
• F120-A30B
• F120-A35B
• F120-A11B</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z120-AFHU</td><td>Suppression System</td><td>• Automatic Wet Pipe Sprinkler System</td></tr>
<tr><td>Ceiling</td><td>• Z137-AFHU</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 3.05E7 (2.89E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>477 (5,138)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>7.02E4 (6.18E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>5</td></tr>
</table>

Table 9.5A-2 (274 of 318)

<table>
<tr><td colspan="4">Z137-AFHU: Fuel Handling Area – Upper Area El.137'-6"</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-AFHU : Fuel Handling Area – Upper Area</td><td>Detection</td><td>• Analog type photoelectric smoke detector
• Explosion proof type fixed temperature detector
• Flame Detector</td></tr>
<tr><td>Wall</td><td>• F137-A32B
• F137-AEPB
• F137-A13B
• F137-A15A
• F137-A25A
• F137-A20A</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z120-AFHU</td><td>Suppression System</td><td>• Automatic Wet Pipe Sprinkler System</td></tr>
<tr><td>Ceiling</td><td>• Z156-AFHU</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• AB Controlled Area II Supply AHU</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 2.51E7 (2.37E7)
• Prefilter 3.04E5 (2.88E5)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>880 (9,472)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.17E4 (2.79E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>2</td></tr>
</table>

Table 9.5A-2 (275 of 318)

Z156-AFHU: Fuel Handling Area – Upper Area El.156’			
Zone Description		Protection Measures	
• F000-AFHU : Fuel Handling Area – Upper Area		Detection	• Analog type photoelectric smoke detector • Explosion proof type fixed temperature detector • Flame Detector
Wall	• F156-AGAB • F156-A04B • F156-A15B	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z137-AFHU	Suppression System	• Automatic Wet Pipe Sprinkler System
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 2.05E7 (1.94E7)
		Floor Area ($m^2(ft^2)$)	733 (7,892)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.08E4 (2.71E3)
		Fire Severity (min)	2

Table 9.5A-2 (276 of 318)

Z055-A46B : Condensate Return Unit Room			
Zone Description		Protection Measures	
• F000-AHV : HELB Vent Area		Detection	• Analog type photoelectric smoke detector
Wall	• F000-AFHL • F000-ACVL	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• Z078-A40B	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Condensate Receiver Tank • Condensate Return Pumps		Major Combustible (kJ (Btu))	• Cable insulation 4.29E6 (4.06E76
		Floor Area (m^2(ft^2))	70 (755)
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.84E4 (6.02E3)
		Fire Severity (min)	5

Table 9.5A-2 (277 of 318)

Z068-A06A : Gas Stripper Room			
Zone Description		Protection Measures	
• F000-AHV : HELB Vent Area		Detection	• Analog type photoelectric smoke detector
Wall	• F000-ACVL (Z068-ACVL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F000-ACVL (Z055-ACVL)	Suppression System	• None
Ceiling	• Z078-AHV	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Gas Stripper		Major Combustible (kJ (Btu))	• Cable insulation 1.67E6 (1.59E6)
		Floor Area (m^2(ft^2))	102 (1,095)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.67E6 (1.59E6)
		Fire Severity (min)	1

Table 9.5A-2 (278 of 318)

Z078-A40B : Boric Acid Concentrator Room			
Zone Description		Protection Measures	
• F000-AHV : HELB Vent Area		Detection	• Analog type photoelectric smoke detector
Wall	• Z068-A06A • Z078-A43B • F100-A32B • F120-A24A • F000-AFHL (Z078-AFHL) • F000-AFHU • F000-ACVL	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z055-A46B	Suppression System	• None
Ceiling	• F000-AFHU (Z137-AFHU)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Boric Acid Concentrator • Cubicle Cooler		Major Combustible (kJ (Btu))	• Cable insulation 6.42E6 (6.08E6)
		Floor Area (m^2(ft^2))	94 (1,024)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.35E4 (6.48E3)
		Fire Severity (min)	5

Table 9.5A-2 (279 of 318)

Z078-A42B : HELB Area AHU Room			
Zone Description		Protection Measures	
• F000-AHV : HELB Vent Area		Detection	• Analog type photoelectric smoke detector
Wall	• Z078-A43B • F000-AFHL (Z078-AFHL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F000-ACVL (Z068-ACVL)	Suppression System	• None
Ceiling	• F000-AFHU (Z100-AFHU)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• HELB Area AHU		Major Combustible (kJ (Btu))	• Cable insulation 6.06E6 (5.74E6) • HEPA filters 1.01E5 (9.60E5) • Flexible 3.38E4 (2.20E4)
		Floor Area (m^2(ft^2))	42 (453)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.58E5 (1.39E4)
		Fire Severity (min)	10

Table 9.5A-2 (280 of 318)

Z078-A43B : HELB Area ACU Room			
Zone Description		Protection Measures	
• F000-AHV : HELB Vent Area		Detection	• Analog type photoelectric smoke detector
Wall	• Z078-A40B • Z078-A42B • F000-AFHL • F000-AFHU • F100-A32B • F120-A30B	Fire Extinguish	• Water hose • Dry chemical
Floor	• F000-AFHL (Z055-AFHL)	Suppression System	• Manually deluge system
Ceiling	• F100-A32B • F000-AFHU (Z156-AFHU)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• HELB Area ACU		Major Combustible (kJ (Btu))	• Cable insulation 6.08E5 (5.76E5) • HEPA filters 6.01E5 (5.76E5) • Carbon adsorber 1.50E8 (1.42E8)
		Floor Area (m^2(ft^2))	146 (1,568)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.12E6 (9.82E4)
		Fire Severity (hr)	1.2

Table 9.5A-2 (281 of 318)

Z120-A14A : SG Blowdown Regen. Hx Room			
Zone Description		Protection Measures	
• F000-AHV : HELB Vent Area		Detection	• Analog type photoelectric smoke detector
Wall	• F120-A16A • F100-A07C • F078-A23A • F137-A31C • F137-A20A • F137-AEPA • F000-ACVU (Z120-ACVL)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F100-A13A • F100-AEEA	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• SG Blowdown Regen. Heat Exchanger • SG Blowdown Flash Tank	Major Combustible (kJ (Btu))	• Cable insulation 2.76E7 (2.62E7)
	Floor Area (m^2(ft^2))	152 (1,631)
	Fire Load (kJ/ m^2 (Btu/ft^2))	1.86E5 (1.63E4)
	Fire Severity (min)	12

Table 9.5A-2 (282 of 318)

<table>
<tr><td colspan="4">Z000-HFSA : Diesel Fuel Oil Storage Tank Room A</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-HFSA : Diesel Fuel Oil Storage Tank Room A</td><td>Detection</td><td>• Analog type photoelectric smoke detector
• Explosion proof type fixed temperature detector
• Flame Detector</td></tr>
<tr><td>Wall</td><td>• F000-HFSB
• Exterior wall</td><td>Fire Extinguish</td><td>• Dry chemical
• Wheeled dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• Automatic preaction sprinkler system for
• Diesel Fuel Oil, Cables</td></tr>
<tr><td>Ceiling</td><td>• Exterior slab</td><td>Access/Egress</td><td>• Ladder</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Diesel Fuel Oil Transfer Pumps^S
• Diesel Fuel Oil Storage Tank^S
• Supply Fan^S
• Exhaust Fan^S
• DO Storage Tank Room Electrical Duct Heater</td><td>Major Combustible (kJ (Btu))</td><td>• Fuel oil 1.73E10 (1.64E10)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>171 (1,836)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.01E8 (8.92E6)</td></tr>
<tr><td>Fire Severity (hr)</td><td>111.5</td></tr>
</table>

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<table>
<tr><td colspan="4">Z000-HFSB: Diesel Fuel Oil Storage Tank Room B</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000- HFSB: Diesel Fuel Oil Storage Tank Room B</td><td>Detection</td><td>• Analog type photoelectric smoke detector
• Explosion proof type fixed temperature detector
• Flame Detector</td></tr>
<tr><td>Wall</td><td>• F000-HFSA
• Exterior wall</td><td>Fire Extinguish</td><td>• Dry chemical
• Wheeled dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• Automatic preaction sprinkler system for
• Diesel Fuel Oil, Cables</td></tr>
<tr><td>Ceiling</td><td>• Exterior slab</td><td>Access/Egress</td><td>• Ladder</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Diesel Fuel Oil Transfer Pumps[S]
• Diesel Fuel Oil Storage Tank[S]
• Supply Fan[S]
• Exhaust Fan[S]
• DO Storage Tank Room Electrical Duct Heater</td><td>Major Combustible (kJ (Btu))</td><td>• Fuel oil 1.73E10 (1.64E10)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>171 (1,836)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.01E8 (8.92E6)</td></tr>
<tr><td>Fire Severity (min)</td><td>111.5</td></tr>
</table>

Table 9.5A-2 (284 of 318)

<table>
<tr><td colspan="4">Z000- HDGA: Diesel Generator Area - Div. A</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000- HDGA : Diesel Generator Area - Div. A</td><td>Detection</td><td>• Analog type photoelectric smoke detector
• Explosion proof type fixed temperature detector
• Flame Detector</td></tr>
<tr><td>Wall</td><td>• F000-HDGB
• Exterior wall</td><td>Fire Extinguish</td><td>• Dry chemical
• Wheeled dry chemical
• Water hose
• CO_2 hose
• CO_2 chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• Automatic preaction sprinkler system for
• Diesel Fuel Oil, Cables</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Class 1E DG^S
• EDG Room Normal Supply AHU^S
• EDG Room Exhaust Fan^S
• DG Control Room Electrical Duct Heater
• Class 1E 480V MCC^S
• DG CCW Inlet Iso. Valve</td><td>Major Combustible (kJ (Btu))</td><td>• Lube oil 2.41E8 (2.29E8)
• Prefilter 1.01E5 (9.60E4)
• Cable insulation 4.85E7 (4.59E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>302 (3,248)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>9.89E5 (8.71E4)</td></tr>
<tr><td>Fire Severity (hr)</td><td>1.1</td></tr>
</table>

Table 9.5A-2 (285 of 318)

Z000- HDGB: Diesel Generator Area - Div. B			
Zone Description		Protection Measures	
• F000- HDGB : Diesel Generator Area - Div. B		Detection	• Analog type photoelectric smoke detector • Explosion proof type fixed temperature detector • Flame Detector
Wall	• F000-HDGA • Exterior wall	Fire Extinguish	• Dry chemical • Wheeled dry chemical • Water hose • CO_2 hose • CO_2 chemical
Floor	• Basement	Suppression System	• Automatic preaction sprinkler system for • Diesel Fuel Oil, Cables
Ceiling	• Exterior roof	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Class 1E DG[S] • EDG Room Normal Supply AHU[S] • EDG Room Exhaust Fan[S] • DG Control Room Electrical Duct Heater • Class 1E 480V MCC[S] • DG CCW Inlet Iso. Valve		Major Combustible (kJ (Btu))	• Lube oil 2.41E8 (2.29E8) • Prefilter 1.01E5 (9.60E4) • Cable insulation 4.00E7 (3.79E7)
		Floor Area (m^2(ft^2))	302 (3,248)
		Fire Load (kJ/ m^2 (Btu/ft^2))	9.60E5 (8.46E4)
		Fire Severity (min)	1.1

Table 9.5A-2 (286 of 318)

<table>
<tr><td colspan="4">Z121-H01A : Lube oil Makeup Tank Room - Div. A</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F121-H01A : Lube oil Makeup Tank Room - Div. A</td><td>Detection</td><td>• Explosion proof type fixed temperature detector</td></tr>
<tr><td>Wall</td><td>• F000-HDGA
• F121-H02A
• Exterior wall</td><td>Fire Extinguish</td><td>• Dry chemical
• Wheeled dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F000-HDGA</td><td>Suppression System</td><td>• Automatic preaction sprinkler system for
• Diesel Fuel Oil, Cables</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Lube oil Makeup Tank[S]</td><td>Major Combustible (kJ (Btu))</td><td>• Lube oil 1.70E8 (1.01E8)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>14 (147)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>7.86E6 (6.92E5)</td></tr>
<tr><td>Fire Severity (hr)</td><td>8.7</td></tr>
</table>

Table 9.5A-2 (287 of 318)

Z121- H01B : Lube oil Makeup Tank Room - Div. B			
Zone Description		Protection Measures	
• F121- H01B : Lube oil Makeup Tank Room - Div. B		Detection	• Explosion proof type fixed temperature detector
Wall	• F000-HDGB • F121-H02B • Exterior wall	Fire Extinguish	• Dry chemical • Wheeled dry chemical • Water hose
Floor	• F000-HDGB	Suppression System	• Automatic preaction sprinkler system for • Diesel Fuel Oil, Cables
Ceiling	• Exterior roof	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Lube oil Makeup Tank[S]		Major Combustible (kJ (Btu))	• Lube oil 1.70E8 (1.01E8)
		Floor Area (m^2(ft^2))	14 (147)
		Fire Load (kJ/ m^2 (Btu/ft^2))	7.86E6 (6.92E5)
		Fire Severity (hr)	8.7

Table 9.5A-2 (288 of 318)

Z121- H02A : Diesel Fuel Oil Day Tank Room - Div. A			
Zone Description		Protection Measures	
• F121- H02A : Diesel Fuel Oil Day Tank Room - Div. A		Detection	• Explosion proof type fixed temperature detector
Wall	• F000-HDGA • F121-H01A • Exterior wall	Fire Extinguish	• Dry chemical • Wheeled dry chemical • Water hose
Floor	• F000-HDGA	Suppression System	• Automatic preaction sprinkler system for • Diesel Fuel Oil, Cables
Ceiling	• Exterior roof	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Diesel Fuel Oil DayTank[S]		Major Combustible (kJ (Btu))	• Fuel oil 1.46E8 (1.38E8)
		Floor Area (m^2(ft^2))	14 (147)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.46E8 (1.38E8)
		Fire Severity (hr)	11.8

Table 9.5A-2 (289 of 318)

<table>
<tr><td colspan="4">Z121- H02B : Diesel Fuel Oil Day Tank Room - Div. B</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F121- H02B : Diesel Fuel Oil Day Tank Room - Div. B</td><td>Detection</td><td>• Explosion proof type fixed temperature detector</td></tr>
<tr><td>Wall</td><td>• F000-HDGB
• F121-H01B
• Exterior wall</td><td>Fire Extinguish</td><td>• Dry chemical
• Wheeled dry chemical
• Water hose</td></tr>
<tr><td>Floor</td><td>• F000-HDGB</td><td>Suppression System</td><td>• Automatic preaction sprinkler system for
• Diesel Fuel Oil, Cables</td></tr>
<tr><td>Ceiling</td><td>• Exterior roof</td><td>Access/Egress</td><td>• Door</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Diesel Fuel Oil DayTank[S]</td><td>Major Combustible
(kJ (Btu))</td><td>• Fuel oil
1.46E8 (1.38E8)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>14 (147)</td></tr>
<tr><td>Fire Load
(kJ/ m^2 (Btu/ft^2))</td><td>1.46E8 (1.38E8)</td></tr>
<tr><td>Fire Severity (hr)</td><td>11.8</td></tr>
</table>

Table 9.5A-2 (290 of 318)

Z000-HG : EDG Building - General			
Zone Description		Protection Measures	
• F000-HG : EDG Building - General		Detection	• Analog type photoelectric smoke detector
Wall	• F000-HFSA • F000-HFSB • Exterior wall	Fire Extinguish	• CO_2 chemical
Floor	• F000-HFSB • Exterior slab	Suppression System	• None
Ceiling	• Exterior roof	Access/Egress	• Door
Major Equipment		Combustible & Fire Loading	
• Electrical Room Exhaust Fan • Electrical Room PACU		Major Combustible (kJ (Btu))	• Cable insulation 4.98E7 (4.72E7)
		Floor Area (m^2(ft^2))	24 (254)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.32E6 (2.04E5)
		Fire Severity (hr)	2.6

Table 9.5A-2 (291 of 318)

Z067-T02 : Underground Common Tunnel			
Zone Description		Protection Measures	
• F067- T02 : Underground Common Tunnel		Detection	• Analog type photoelectric smoke detector
Wall	• F073-T11 • F000-TB (073-T02)	Fire Extinguish	• None
Floor	• Basement	Suppression System	• None
Ceiling	• F000-TB (100-T01)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	None
		Floor Area (m^2(ft^2))	498 (5,356)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.48E2 (74.7)
		Fire Severity (min)	Less than 1 min

Table 9.5A-2 (292 of 318)

<table>
<tr><td colspan="4">Z072-T01 : Chemical Handling Room</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F072-T01: Chemical Handling Room</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-TB (073-T02, T03)
• F073-T06</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• F000-TB (100-T01)</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Ethanolamine Metering Pump
• Hydrazine Metering Pump
• Ethanolamine Day Tank
• Hydrazine Day Tank
• Drum pump</td><td>Major Combustible (kJ (Btu))</td><td>• None</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>97(1,047)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>4.34E3 (382)</td></tr>
<tr><td>Fire Severity (min)</td><td>Less than 1 min</td></tr>
</table>

Table 9.5A-2 (293 of 318)

Z072-T02 : Lube oil Storage Room			
Zone Description		Protection Measures	
• F072-T02: Lube oil Storage Room		Detection	• Explosion Proof Type fixed temperature detector
Wall	• F000-TB (073-T02)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• Automatic Actuated Water Spray System
Ceiling	• F000-TB (100-T01)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Feedwater Pump TBN Dirty Lube oil Transfer Pump • Feedwater PP TBN Lube oil Conditioner		Major Combustible (kJ (Btu))	• Lube oil 6.08E7 (5.76E7)
		Floor Area (m^2(ft^2))	28(298)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.80E6 (2.46E5)
		Fire Severity (hr)	3

Table 9.5A-2 (294 of 318)

Z072-T03 : Main Turbine Lube oil Conditioner Room			
Zone Description		Protection Measures	
• F072-T03: Main Turbine Lube oil Conditioner Room		Detection	• Explosion Proof Type fixed temperature detector
Wall	• F000-TB (073-T02)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• Automatic Actuated Water Spray System
Ceiling	• F100-T11 • F000-TB (100-T01)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Main TBN Dirty Lube oil Transfer Pump • Main TBN Lube oil Conditioner		Major Combustible (kJ (Btu))	• Lube oil 4.79E7 (4.54E7)
		Floor Area (m^2(ft^2))	28 (305)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.28E6 (2.01E5)
		Fire Severity (hr)	2.5

Table 9.5A-2 (295 of 318)

Z073-T06 : Caustic/Acid Day Tank & Pump Room			
Zone Description		Protection Measures	
• F073-T06: Caustic/Acid Day Tank & Pump Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-TB (073-T03) • F072-T01	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F000-TB (100-T01)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Acid Day Tank		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	15 (163)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.79E4 (2.45E3)
		Fire Severity (min)	2

Table 9.5A-2 (296 of 318)

Z100-T11 : Turbine Lube oil Reservoir Room			
Zone Description		Protection Measures	
• F100-T11: Turbine Lube oil Reservoir Room		Detection	• Analog type photoelectric smoke detector
Wall	• F000-TB (100-T01)	Fire Extinguish	• Water hose • Dry chemical
Floor	• F000-TB (073-T02) • F072-T03	Suppression System	• Automatic Actuated Water Spray System
Ceiling	• F000-TB (136-T01)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• TBN Lube oil Reservoir • TBN Lube oil Coolers		Major Combustible (kJ (Btu))	• Lube oil 1.69E9 (1.61E9)
		Floor Area (m^2(ft^2))	70 (752)
		Fire Load (kJ/ m^2 (Btu/ft^2))	2.48E7 (2.19E6)
		Fire Severity (hr)	27.3

Table 9.5A-2 (297 of 318)

Z055-T01 : Condenser Pit Area			
Zone Description		Protection Measures	
• F000-TB: Turbine Generator Building - General		Detection	• Analog type photoelectric smoke detector
Wall	• F000-TB (100-T01)	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F000-TB (136-T01)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Condenser Pit •		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	371 (3,995)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.14E3 (100)
		Fire Severity (hr)	Less than 1 min

Table 9.5A-2 (298 of 318)

Z060-T01 : Condensate Overflow Storage Sump Pit Area			
Zone Description		Protection Measures	
• F000-TB: Turbine Generator Building - General		Detection	• Analog type photoelectric smoke detector
Wall	• Z073-T02 • Z100-T01	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z073-T02 • F072-T03	Suppression System	• None
Ceiling	• Z136-T01	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Condensate Overflow Storage Sump Pit		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	136 (1,459)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.11E3 (274)
		Fire Severity (hr)	Less than 1 min

Table 9.5A-2 (299 of 318)

Z073-T02 : TGB Basement Floor			
Zone Description		Protection Measures	
• F000-TB: Turbine Generator Building - General		Detection	• Analog type photoelectric smoke detector
Wall	• F072-T01 • F072-T02 • F072-T03 • F073-T11 • Aux. building • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• Automatic Wet Pipe Sprinkler System
Ceiling	• Z100-T01	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• FW Booster Pump • Startup FW Pump	Major Combustible (kJ (Btu))	• Lube oil 8.20E7 (7.77E7) • Cable Insulation 8.55E8 (8.10E8)
	Floor Area (m^2(ft^2))	2,702 (29,080)
	Fire Load (kJ/ m^2 (Btu/ft^2))	3.78E5 (3.33E4)
	Fire Severity (min)	25

Table 9.5A-2 (300 of 318)

Z100-T01 : TGB Bldg. Ground Floor			
Zone Description		Protection Measures	
• F000-TB: Turbine Generator Building - General		Detection	• Analog type photoelectric smoke detector
Wall	• F100-T11 • F100-T15 • Aux. building • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z073-T02 • F072-T03	Suppression System	• Automatic Wet Pipe Sprinkler System
Ceiling	• F000-TB (136-T01)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Turbine-driven Feedwater Pumps • Feedwater Pumps Turbines • LP Feedwater Heaters		Major Combustible (kJ (Btu))	• Lube oil 7.41E8 (7.03E8) • Cable Insulation 1.24E9 (1.18E9)
		Floor Area ($m^2(ft^2)$)	3,089 (33,251)
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.83E5 (6.01E4)
		Fire Severity (min)	45

Table 9.5A-2 (301 of 318)

Z136-T01 : TGB Operating Floor			
Zone Description		Protection Measures	
• F000-TB: Turbine Generator Building - General		Detection	• Analog type photoelectric smoke detector • Flame detector • Explosion proof type fixed temperature detector
Wall	• F122-T01 • Aux. building • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z100-T01	Suppression System	• Automatic Wet Pipe Sprinkler System • Automatic Preaction System
Ceiling	• Z170-T01	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Generator • LP Turbines • HP Turbines		Major Combustible (kJ (Btu))	• Cable Insulation 7.42E7 (7.03E7)
		Floor Area (m^2(ft^2))	2,662 (28,656)
		Fire Load (kJ/ m^2 (Btu/ft^2))	3.06E4 (2.70E3)
		Fire Severity (min)	2

Table 9.5A-2 (302 of 318)

<table>
<tr><td colspan="4">Z170-T01 : TB Deaerator Floor</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-TB: Turbine Generator Building - General</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• Aux. building
• Exterior wall</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F136-T01</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Exterior wall</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Deaerator
• Deaerator Storage Tank
• TGBCCW Surge Tank</td><td>Major Combustible (kJ (Btu))</td><td>• Cable Insulation 2.56E6 (2.42E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>1,221 (13,147)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>2.51E3 (221)</td></tr>
<tr><td>Fire Severity (min)</td><td>Less than 1 min</td></tr>
</table>

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Z073-T11 : Switchgear Area – 73’-0”			
Zone Description		Protection Measures	
• F073-T11: Switchgear Area – 73’-0”		Detection	• Analog type photoelectric smoke detector
Wall	• F000-TB (073-T02) • F067-T02	Fire Extinguish	• Water hose • Dry chemical • CO_2 chemical
Floor	• Basement	Suppression System	• None
Ceiling	• F100-T15	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 480V PNS Loadcenters • 480V N1E Loadcenters • 480V PNS MCCs • 480V N1E MCCs • Cubicle Cooler • 4.16kV N1E SWGR 02M		Major Combustible (kJ (Btu))	• Cable insulation 3.08E8 (2.92E8)
		Floor Area (m^2(ft^2))	505(5,435)
		Fire Load (kJ/ m^2 (Btu/ft^2))	6.70E5 (5.90E4)
		Fire Severity (min)	44

Table 9.5A-2 (304 of 318)

Z100-T15 : Switchgear Area – 100'-0"			
Zone Description		Protection Measures	
• F100-T15: Switchgear Area – 100'-0"		Detection	• Analog type photoelectric smoke detector
Wall	• F000-TB (100-T01)	Fire Extinguish	• Water hose • Dry chemical • CO_2 chemical
Floor	• F073-T11	Suppression System	• None
Ceiling	• F122-T01	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• 13.8 kV N1E SWGR 02M • Battery Room Exhaust Fan • SWGR Area Exhaust Fan • Battery Room Supply Fan		Major Combustible (kJ (Btu))	• Cable insulation 1.94E8 (1.84E8) • Battery 2.17E7 (2.06E7)
		Floor Area (m^2(ft^2))	505(5,435)
		Fire Load (kJ/ m^2 (Btu/ft^2))	4.66E5 (4.11E4)
		Fire Severity (hr)	31

Table 9.5A-2 (305 of 318)

<table>
<tr><td colspan="4">Z122-T01 : Switchgear Area – 122'-0"</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F122-T01: Switchgear Area – 122'-0"</td><td>Detection</td><td>• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-TB (122-T18, 136-T01)</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical
• CO_2 chemical</td></tr>
<tr><td>Floor</td><td>• F100-T15</td><td>Suppression System</td><td>• None</td></tr>
<tr><td>Ceiling</td><td>• Roof</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 13.8 kV N1E SWGR 02N
• 4.16 kV N1E SWGR 01N
• 480V N1E Loadcenter
• Cubicle Cooler</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 1.79E8 (1.70E8)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>505(5,435)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.90E5 (3.44E4)</td></tr>
<tr><td>Fire Severity (hr)</td><td>26</td></tr>
</table>

Table 9.5A-2 (306 of 318)

<table>
<tr><td colspan="4">Z000-P17 : Flammable Gas Storage</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">F000-P17: Flammable Gas Storage</td><td>Detection</td><td>• Explosion proof type fixed temperature detector</td></tr>
<tr><td>Wall</td><td>• F000-RW (096-P01, 100-P06)
• F100-P18</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F000-RW (063-P05)</td><td>Suppression System</td><td>• Automatic wet pipe sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F000-RW</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Flammable Gas Storage</td><td>Major Combustible (kJ (Btu))</td><td>• Propane 3.90E4 (3.70E4)
• Hydrogen 1.12E5 (1.06E5)
• Acetylene 1.12E5 (1.06E5)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>6 (68)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.08E5 (9.55E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>7</td></tr>
</table>

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<table>
<tr><td colspan="5">Z100-P18: Unflammable Gas Storage</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="3">Protection Measures</td></tr>
<tr><td colspan="2">• F100-P18: Unflammable Gas Storage</td><td>Detection</td><td colspan="2">• Explosion proof type fixed temperature detector</td></tr>
<tr><td>Wall</td><td>• F000-RW (096-P01, 100-P06)
• F100-P18</td><td>Fire Extinguish</td><td colspan="2">• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• F000-RW (063-P05)</td><td>Suppression System</td><td colspan="2">• Automatic wet pipe sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F000-RW</td><td>Access/Egress</td><td colspan="2">• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="3">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Unflammable Gas Storage</td><td colspan="2">Major Combustible (kJ (Btu))</td><td>• None</td></tr>
<tr><td colspan="2">Floor Area (m^2(ft^2))</td><td>7 (70)</td></tr>
<tr><td colspan="2">Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>6.49E4 (5.71E3)</td></tr>
<tr><td colspan="2">Fire Severity (min)</td><td>4</td></tr>
</table>

Table 9.5A-2 (308 of 318)

Z063-AC : Compound Building – Access Control Area El.63’			
Zone Description		Protection Measures	
• F000-AC: Compound Building – Access Control Area		Detection	• Explosion proof type fixed temperature detector • Analog type photoelectric smoke detector
Wall	• F000-RW (Z063-RW) • Aux. building • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• Basement	Suppression System	• Automatic wet pipe sprinkler system
Ceiling	• Z085-AC • F000-RW (Z077-RW)	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• PACUs		Major Combustible (kJ (Btu))	• Paper 1.69E4 (1.60E4) • Cable insulation 5.04E7 (4.78E7)
		Floor Area (m^2(ft^2))	1,049 (11,291)
		Fire Load (kJ/ m^2 (Btu/ft^2))	5.37E4 (4.73E3)
		Fire Severity (min)	4

Table 9.5A-2 (309 of 318)

Z085-AC : Compound Building – Access Control Area El.85’			
Zone Description		Protection Measures	
• F000-AC: Compound Building – Access Control Area		Detection	• Explosion proof type fixed temperature detector • Analog type photoelectric smoke detector
Wall	• F000-RW (Z085-RW) • Aux. building • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z063-AC	Suppression System	• Automatic wet pipe sprinkler system
Ceiling	• Z100-AC	Access/Egress	• Doors

Major Equipment	Combustible & Fire Loading	
• Compound building Sump Pumps	Major Combustible (kJ (Btu))	• Cable insulation 5.48E7 (5.20E7)
	Floor Area (m^2(ft^2))	684 (7,366)
	Fire Load (kJ/ m^2 (Btu/ft^2))	8.68E4 (7.64E3)
	Fire Severity (min)	6

Table 9.5A-2 (310 of 318)

Z100-AC : Compound Building – Access Control Area El.100’			
Zone Description		Protection Measures	
• F000-AC: Compound Building – Access Control Area		Detection	• Explosion proof type fixed temperature detector • Analog type photoelectric smoke detector
Wall	• F000-RW (Z100-RW) • Aux. building • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z085-AC	Suppression System	• Automatic wet pipe sprinkler system
Ceiling	• Z120-AC	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• None		Major Combustible (kJ (Btu))	• Cable insulation 1.57E8 (1.49E8)
		Floor Area (m^2(ft^2))	1,987 (21,384)
		Fire Load (kJ/ m^2 (Btu/ft^2))	8.56E4 (7.54E3)
		Fire Severity (min)	6

Table 9.5A-2 (311 of 318)

<table>
<tr><td colspan="4">Z120-AC : Compound Building – Access Control Area El.120’</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-AC: Compound Building – Access Control Area</td><td>Detection</td><td>• Explosion proof type fixed temperature detector
• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-RW (Z120-RW)
• Aux. building
• Exterior wall</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z100-AC</td><td>Suppression System</td><td>• Automatic wet pipe sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• Z139-AC</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• 480V N1E Loadcenters
• 480V N1E MCCs
• CCS Cabinet Room PACU</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 2.20E8 (2.08E8)
• Prefilter 6.08E5 (5.76E5)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>1,987 (21,384)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.22E5 (1.07E4)</td></tr>
<tr><td>Fire Severity (min)</td><td>8</td></tr>
</table>

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<table>
<tr><td colspan="4">Z139-AC : Compound Building – Access Control Area El.139’</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-AC: Compound Building – Access Control Area</td><td>Detection</td><td>• Explosion proof type fixed temperature detector
• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-RW (Z139-RW)
• Aux. building
• Exterior wall</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z120-AC</td><td>Suppression System</td><td>• Automatic wet pipe sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• Z157-AC</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Clean Area Supply AHUs</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 4.13E7 (3.91E7)
• Prefilter 7.76E5 (7.36E5)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>1,236 (13,306)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>3.68E4 (3.23E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>2</td></tr>
</table>

Table 9.5A-2 (313 of 318)

Z157-AC : Compound Building – Access Control Area El.157'-9" & El. 163'-8"			
Zone Description		Protection Measures	
• F000-AC: Compound Building – Access Control Area		Detection	• Explosion proof type fixed temperature detector • Analog type photoelectric smoke detector
Wall	• Aux. building • Exterior wall	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z139-AC	Suppression System	• Automatic wet pipe sprinkler system
Ceiling	• Exterior roof	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• Clean Area Exhaust Fan • Clean Area Return Fan		Major Combustible (kJ (Btu))	• None
		Floor Area (m^2(ft^2))	*1,236 (13,306)*
		Fire Load (kJ/ m^2 (Btu/ft^2))	*3.68E4 (3.23E3)*
		Fire Severity (min)	*2*

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<table>
<tr><td colspan="4">Z063-RW : Compound Building – Radwaste Area El.63'</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-RW: Compound Building – Radwaste Area</td><td>Detection</td><td>• Explosion proof type fixed temperature detector
• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-AC
• Exterior wall
• Aux. building</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Basement</td><td>Suppression System</td><td>• Automatic wet pipe sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F000-AC (Z077-AC)</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• RLS Drain Tanks
• RLS Drain Tank Pumps
• Filters
• Chemical Waste Tanks
• Chemical Waste Pumps</td><td>Major Combustible (kJ (Btu))</td><td>• Lube oil 1.37E6 (1.30E6)
• Grease 4.43E6 (4.20E6)
• Cable insulation 2.57E7 (2.43E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>1,978 (21,287)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.72E4 (1.52E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>1</td></tr>
</table>

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<table>
<tr><td colspan="4">Z085-RW : Compound Building – Radwaste Area El.85’</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-RW: Compound Building – Radwaste Area</td><td>Detection</td><td>• Explosion proof type fixed temperature detector
• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-AC (Z085-AC)
• Exterior wall
• Aux. building</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z063-RW
• F000-AC (Z077-AC)</td><td>Suppression System</td><td>• Automatic wet pipe sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F000-AC (Z100-AC)
• Z100-RW</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Charcoal Beds
• Ion Exchangers</td><td>Major Combustible (kJ (Btu))</td><td>• Lube oil 9.07E6 (8.60E6)
• Charcoal 8.86E6 (8.40E6)
• Cable insulation 3.77E7 (3.58E7)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>2,530 (27,238)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>2.35E4 (2.07E3)</td></tr>
<tr><td>Fire Severity (min)</td><td>2</td></tr>
</table>

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Z100-RW : Compound Building – Radwaste Area El.100’			
Zone Description		Protection Measures	
• F000-RW: Compound Building – Radwaste Area		Detection	• Explosion proof type fixed temperature detector • Analog type photoelectric smoke detector
Wall	• F000-AC (Z100-AC) • Exterior wall • Aux. building	Fire Extinguish	• Water hose • Dry chemical
Floor	• Z085-RW • F000-AC (Z085-AC)	Suppression System	• Automatic wet pipe sprinkler system
Ceiling	• F000-AC (Z120-AC) • Z120-RW	Access/Egress	• Doors
Major Equipment		Combustible & Fire Loading	
• HEPA Filters • Chemical Addition Tank • Acid Batch Tank • Caustic Batch Tank		Major Combustible (kJ (Btu))	• Prefilter 5.06E4 (4.80E4) • HEPA filter 5.06E4 (4.80E4) • Charcoal 6.20E6 (5.88E6) • Cable insulation 2.72E7 (2.58E7)
		Floor Area (m^2(ft^2))	1,228 (12,219)
		Fire Load (kJ/ m^2 (Btu/ft^2))	1.03E6 (9.09E4)
		Fire Severity (hr)	1.1

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<table>
<tr><td colspan="4">Z120-RW : Compound Building – Radwaste Area El.120’</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-RW: Compound Building – Radwaste Area</td><td>Detection</td><td>• Explosion proof type fixed temperature detector
• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-AC (Z120-AC)
• Exterior wall
• Aux. building</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z100-RW</td><td>Suppression System</td><td>• Automatic wet pipe sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• Z139-RW
• Exterior roof</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• None</td><td>Major Combustible (kJ (Btu))</td><td>• Cable insulation 9.03E5 (8.56E5)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>1,228 (13,219)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.15E3 (101)</td></tr>
<tr><td>Fire Severity (min)</td><td>Less than 1 min</td></tr>
</table>

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<table>
<tr><td colspan="4">Z139-RW : Compound Building – Radwaste Area El.139’</td></tr>
<tr><td colspan="2">Zone Description</td><td colspan="2">Protection Measures</td></tr>
<tr><td colspan="2">• F000-RW: Compound Building – Radwaste Area</td><td>Detection</td><td>• Explosion proof type fixed temperature detector
• Analog type photoelectric smoke detector</td></tr>
<tr><td>Wall</td><td>• F000-AC (Z139-AC)
• Exterior wall
• Aux. building</td><td>Fire Extinguish</td><td>• Water hose
• Dry chemical</td></tr>
<tr><td>Floor</td><td>• Z120-RW
• F000-AC (Z120-AC)</td><td>Suppression System</td><td>• Automatic wet pipe sprinkler system</td></tr>
<tr><td>Ceiling</td><td>• F000-AC (Z157-AC)
• Exterior roof</td><td>Access/Egress</td><td>• Doors</td></tr>
<tr><td colspan="2">Major Equipment</td><td colspan="2">Combustible & Fire Loading</td></tr>
<tr><td colspan="2" rowspan="4">• Emergency Exhaust ACUs
• Normal Exhaust ACUs</td><td>Major Combustible (kJ (Btu))</td><td>• Prefilter 2.43E6 (2.30E6)
• HEPA filter 1.62E6 (1.54E6)
• Charcoal 4.68E8 (4.44E8)
• Cable insulation 3.51E6 (3.33E6)</td></tr>
<tr><td>Floor Area (m^2(ft^2))</td><td>682 (7,344)</td></tr>
<tr><td>Fire Load (kJ/ m^2 (Btu/ft^2))</td><td>1.38E6 (1.22E5)</td></tr>
<tr><td>Fire Severity (hr)</td><td>1.5</td></tr>
</table>

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Fire Areas and Fire Zones

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
RCB	I(A,C) & II(B,D)	F000-CNB	Containment Building	Z069-C01	ICI Cavity
				Z100-C02A	SG Cavity 1
				Z100-C02B	SG Cavity 2
				Z100-C03	Reactor Drain Tank Room
				Z100-C04	Letdown Heat Exchanger Room
				Z128-C01	Regenerative Heat Exchanger Room
				Z136-C02	Pressurizer Cavity
				Z156-C01	Containment Upper Area
				Z000-CAN	Containment Annulus Area
				Z000-CRP	Refueling Pool Area
AB	I (C)	F050-A01C	CS Pump & Mini Flow Heat Exchanger Room A	Z050-A01C	CS Pump & Mini Flow Heat Exchanger Room A
AB	II (D)	F050-A01D	CS Pump & Mini Flow Heat Exchanger Room B	Z050-A01D	CS Pump & Mini Flow Heat Exchanger Room B
AB	I (C)	F050-A02C	Safety Injection Pump Room C	Z050-A02C	Safety Injection Pump Room C
AB	II (D)	F050-A02C	Safety Injection Pump Room D	Z050-A02D	Safety Injection Pump Room D
AB	I (A)	F050-A03A	Safety Injection Pump Room A	Z050-A03A	Safety Injection Pump Room A
AB	II (B)	F050-A03B	Safety Injection Pump Room B	Z050-A03B	Safety Injection Pump Room B

Table 9.5A-3 (2 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	I (A)	F050-A04A	SC Pump & Mini Flow Heat Exchanger Room A	Z050-A04A	SC Pump & Mini Flow Heat Exchanger Room A
AB	II (B)	F050-A04B	SC Pump & Mini Flow Heat Exchanger Room B	Z050-A04B	SC Pump & Mini Flow Heat Exchanger Room B
AB	I (C)	F055-A01C	Containment Spray Heat Exchanger Room A	Z055-A01C	Containment Spray Heat Exchanger Room A
AB	II (D)	F055-A01D	Containment Spray Heat Exchanger Room B	Z055-A01D	Containment Spray Heat Exchanger Room B
AB	I (A)	F055-A02A	CCW Pump Room A	Z055-A02A	CCW Pump Room A
AB	II (B)	F055-A02B	CCW Pump Room B	Z055-A02B	CCW Pump Room B
AB	I (C)	F055-A02C	CCW Pump Room C	Z055-A02C	CCW Pump Room C
AB	II (D)	F055-A02D	CCW Pump Room D	Z055-A02D	CCW Pump Room D
AB	I	F055-A04C	Seismic CAT-I Fire Water Tank Room A	Z055-A04C	Seismic CAT-I Fire Water Tank Room
AB	II	F055-A04D	Seismic CAT-I Fire Water Tank Room B	Z055-A04D	Seismic CAT-I Fire Water Tank Room
AB	N	F055-A10C	Tendon Gallery Entrance Area	Z055-A10C	Tendon Gallery Entrance Area
AB	N	F055-A14C	Pipe Chase & Valve Room	Z055-A14C	Pipe Chase & Valve Room
AB	N	F055-A14D	Pipe Chase & Valve Room	Z055-A14D	Pipe Chase & Valve Room
AB	N	F055-A18A	Pipe Chase & Valve Room	Z055-A18A	Pipe Chase & Valve Room
AB	N	F055-A18B	Pipe Chase & Valve Room	Z055-A18B	Pipe Chase & Valve Room
AB	I (A)	F055-A19A	General Access Area A- 55’-0”	Z055-A19A	General Access Area
AB	II (B)	F055-A19B	General Access Area B- 55’-0”	Z055-A19B	General Access Area
AB	N	F055-A21A	Pipe Chase & Valve Room	Z055-A21A	Pipe Chase & Valve Room
AB	N	F055-A21B	Pipe Chase & Valve Room	Z055-A21B	Pipe Chase & Valve Room
AB	N	F055-A22A	Pipe Chase	Z055-A22A	Pipe Chase
AB	N	F055-A22B	Pipe Chase	Z055-A22B	Pipe Chase

Table 9.5A-3 (3 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	I (A)	F055-A30A	Shutdown Cooling Hx Room	Z055-A30A	Shutdown Cooling Hx Room
AB	II (B)	F055-A30B	Shutdown Cooling Hx Room	Z055-A30B	Shutdown Cooling Hx Room
AB	I (A)	F055-A42A	Charging Pump Room	Z055-A42A	Charging Pump Room
AB	II (B)	F055-A55B	Charging Pump Room	Z055-A55B	Charging Pump Room
AB	I (A), II(B)	F055-A54B	Aux. Charging Pump Room	Z055-A54B	Aux. Charging Pump Room
AB	N	F055-AGAC	General Access Area C-55’-0”	Z055-A03C	Central Water Chiller Room
AB	I (C)			Z055-A07C	General Access Area
AB	N			Z055-A08C	Floor Drain Sump Pump Room
AB	I (C)			Z055-A57C	Piping & Cable Area
AB	N	F055-AGAD	General Access Area D-55’-0”	Z055-A03D	Central Water Chiller Room
AB	II (D)	F055-AGAD	General Access Area D-55’-0”	Z055-A07D	General Access Area
AB	N			Z055-A08D	Floor Drain Sump Pump Room
AB	N			Z055-A11D	Storage Room
AB	II (D)			Z055-A57D	Piping & Cable Area
AB	I (C)	F065-A01C	Diesel Fuel Oil Storage Tank Room C	Z065-A01C	Diesel Fuel Oil Storage Tank Room C
AB	II (D)	F065-A01D	Diesel Fuel Oil Storage Tank Room D	Z065-A01D	Diesel Fuel Oil Storage Tank Room D
AB	N	F068-A05A	HVAC Chase	Z068-A05A	HVAC Chase
AB	N	F078-A01C	PNG SWGR Room	Z078-A01C	PNG SWGR Room
AB	N	F078-A01D	PNG SWGR Room	Z078-A01D	PNG SWGR Room

Table 9.5A-3 (4 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	I (C)	F078-A02C	Class 1E SWGR 01C Room	Z078-A02C	Class 1E SWGR 01C Room
AB	II (D)	F078-A02D	Class 1E SWGR 01D Room	Z078-A02D	Class 1E SWGR 01D Room
AB	I (C)	F078-A03C	Class 1E Load Center 01C Room	Z078-A03C	Class 1E Load Center 01C Room
AB	II (D)	F078-A03D	Class 1E Load Center 01D Room	Z078-A03D	Class 1E Load Center 01D Room
AB	N	F078-A04C	MISC. Electrical Equip Room	Z078-A04C	MISC. Electrical Equip Room
AB	N	F078-A04D	MISC. Electrical Equip Room	Z078-A04D	MISC. Electrical Equip Room
AB	I (C)	F078-A05C	Train C DC & IP Equip. Room	Z078-A05C	Train C DC & IP Equip. Room
AB	II (D)	F078-A05D	Train D DC & IP Equip. Room	Z078-A05D	Train D DC & IP Equip. Room
AB	N	F078-A06C	N1E Battery Room	Z078-A06C	N1E Battery Room
AB	N	F078-A06D	N1E Battery Room	Z078-A06D	N1E Battery Room
AB	I (C)	F078-A07C	Train C Battery Room	Z078-A07C	Train C Battery Room
AB	II (D)	F078-A07D	Train D Battery Room	Z078-A07D	Train D Battery Room
AB	N	F078-A09C	HVAC Chase	Z078-A09C	HVAC Chase
AB	N	F078-A09D	HVAC Chase	Z078-A09D	HVAC Chase
AB	I (A)	F078-A11C	Essential Chiller Room	Z078-A11C	Essential Chiller Room
AB	II (B)	F078-A11D	Essential Chiller Room	Z078-A11D	Essential Chiller Room
AB	I (C)	F078-A12C	Essential Water Chiller Room	Z078-A12C	Essential Water Chiller Room
AB	II (D)	F078-A12D	Essential Water Chiller Room	Z078-A12D	Essential Water Chiller Room
AB	N	F078-A13D	Duct Room	Z078-A13D	Duct Room
AB	N	F078-A14C	Buttress Opening	Z078-A14C	Buttress Opening
AB	N	F078-A16C	HVAC Chase	Z078-A16C	HVAC Chase
AB	N	F078-A16D	HVAC Chase	Z078-A16D	HVAC Chase

Table 9.5A-3 (5 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	I (A)	F078-AGAA	General Access Area A- 78’-0”	Z078-A19A	Corridor
				Z078-A29B	CCW Makeup Pump Room
AB	II (B)	F078-A19B	General Access Area B- 78’-0”	Z078-A19B	Corridor
AB	I (A)	F078-A20A	MD AFW Pump Room A	Z078-A20A	MD AFW Pump Room A
AB	II (B)	F078-A20B	MD AFW Pump Room B	Z078-A20B	MD AFW Pump Room B
AB	N	F078-A21A	Pipe Chase	Z078-A21A	Pipe Chase
AB	N	F078-A21B	Pipe Chase	Z078-A21B	Pipe Chase
AB	N	F078-A23A	Buttress Opening	Z078-A23A	Buttress Opening
AB	N	F078-A23B	Buttress Opening	Z078-A23B	Buttress Opening
AB	I (A)	F078-A25A	Class 1E SWGR 01A Room	Z078-A25A	Class 1E SWGR 01A Room
AB	N	F078-A47B	Electrical Equipment Room	Z078-A47B	Electrical Equipment Room
AB	N	F078-A51B	Boric Acid Makeup Pump Room	Z078-A51B	Boric Acid Makeup Pump Room
AB	N	F078-A52C	480V N1E MCC Room	Z078-A52C	480V N1E MCC Room
AB	N	F078-A52D	480V N1E MCC Room	Z078-A52D	480V N1E MCC Room
AB	N	F078-A53C	480V N1E Loadcenter Room	Z078-A53C	480V N1E Loadcenter Room
AB	N	F078-A53D	480V N1E Loadcenter Room	Z078-A53D	480V N1E Loadcenter Room
AB	I (A)	F078-A56A	Train A DC & IP Equip. Room	Z078-A56A	Train A DC & IP Equip. Room
AB	II (B)	F078-A56B	Train B DC & IP Equip. Room	Z078-A56A	Train B DC & IP Equip. Room
AB	I (C)	F078-AAFC	TD AFW Pump Room	Z078-AAFC	TD AFW Pump Room
AB	II (D)	F078- AAFD	TD AFW Pump Room	Z078- AAFD	TD AFW Pump Room
AB	II (B)	F078-AEEB	Class 1E SWGR 01B Room	Z078-A25B	Class 1E SWGR 01B Room
AB	I & II			Z078-A58B	Swing Loadcenter Room

Table 9.5A-3 (6 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	I (C)	F078-AGAC	General Access Area C- 78'-0"	Z078-A10C	General Access Area
AB	N			Z078-A29C	CCW Makeup Pump Room
AB	I (C)			Z078-A57C	Piping & Cable Area
AB	II (D)	F078-AGAD	General Access Area D- 78'-0"	Z078-A10D	General Access Area
AB	II (D)			Z078-A57D	Piping & Cable Area
AB	I (C)	F000-ADGC	Diesel Generator Room C	Z000-ADGC	Diesel Generator Room
AB	II (D)	F000-ADGD	Diesel Generator Room D	Z000-ADGD	Diesel Generator Room
AB	I (C)	F100-A04C	Cable Access Area	Z100-A04C	Cable Access Area
AB	II (D)	F100-A04D	Cable Access Area	Z100-A04D	Cable Access Area
AB	N	F100-A05C	Electrical Equipment Room	Z100-A05C	Electrical Equipment Room
AB	N	F100-A05D	Electrical Equipment Room	Z100-A05D	Electrical Equipment Room
AB	II (D)	F100-A06D	General Access Area D- 100'-0"	Z100-A06D	General Access Area
AB	I	F100-A07C	Aux. Feedwater Tank Room A	Z100-A07C	Aux. Feedwater Tank Room A
AB	II	F100-A07D	Aux. Feedwater Tank Room B	Z100-A07D	Aux. Feedwater Tank Room B
AB	N	F100-A08C	N1E DC&IP Equip. Room	Z100-A08C	N1E DC&IP Equip. Room
AB	N	F100-A08D	N1E DC&IP Equip. Room	Z100-A08D	N1E DC&IP Equip. Room
AB	I (A)	F100-A10A	General Access Area A- 100'-0"	Z100-A10A	General Access Area
AB	II (B)	F100-A10B	General Access Area B - 100'-0"	Z100-A10B	General Access Area
AB	I (A)	F100-A11A	Train A Battery Room	Z100-A11A	Train A Battery Room
AB	II (B)	F100-A11B	Train B Battery Room	Z100-A11B	Train B Battery Room
AB	I (A)	F100-A13A	Mechanical Penetration Room	Z100-A13A	Mechanical Penetration Room
AB	II (B)	F100-A13B	Mechanical Penetration Room	Z100-A13B	Mechanical Penetration Room

Table 9.5A-3 (7 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	N	F100-A16C	Pipe Chase	Z100-A16C	Pipe Chase
AB	N	F100-A16D	Pipe Chase	Z100-A16D	Pipe Chase
AB	I	F100-A23A	AB Controlled Area (I) Supply AHU Room	Z100-A23A	AB Controlled Area (I) Supply AHU Room
AB	I	F100-A24A	SFP Cooling Heat Exchanger Room	Z100-A24A	SFP Cooling Heat Exchanger Room
AB	II	F100-A32B	SFP Cooling Heat Exchanger Room	Z100-A32B	SFP Cooling Heat Exchanger Room
AB	II	F100-A36B	FH Area Supply AHU Room	Z100-A36B	FH Area Supply AHU Room
AB	I	F100-A38A	FH Area Normal Exhaust ACU Room	Z100-A38A	FH Area Normal Exhaust ACU Room
AB	I (A)	F100-AEEA	480V Class 1E MCC Room	Z100-A12A	480V Class 1E MCC 01A Room
AB	N			Z100-A18A	MUX N1 Room
AB	II (B)	F100-AEEB	480V Class 1E MCC Room	Z100-A12B	480V Class 1E MCC 01B Room
AB	N			Z100-A18B	MUX N2 Room
AB	I (C)	F100-AGAC	General Access Area C- 100’-0”	Z100-A06C	General Access Area
AB	N			Z100-A09C	Tendon Access Room
AB	I (C)	F120-A01C	Piping Cable Area	Z120-A01C	Piping Cable Area
AB	II (D)	F120-A01D	Piping Cable Area	Z120-A01D	Piping Cable Area
AB	I (C)	F120-A02C	Lube Oil Makeup Tank Room C	Z120-A02C	Lube Oil Makeup Tank Room
AB	II (D)	F120-A02D	Lube Oil Makeup Tank Room D	Z120-A02D	Lube Oil Makeup Tank Room
AB	I (C)	F120-A03C	Diesel Fuel Oil Day Tank Room C	Z120-A03C	Diesel Fuel Oil Day Tank Room
AB	II (D)	F120-A03D	Diesel Fuel Oil Day Tank Room D	Z120-A03D	Diesel Fuel Oil Day Tank Room
AB	N	F120-A05C	Electrical Equipment Room	Z120-A05C	Electrical Equipment Room
AB	N	F120-A05D	Electrical Equipment Room	Z120-A05D	Electrical Equipment Room
AB	N	F120-A08C	480V N1E MCC Room	Z120-A08C	480V N1E MCC Room
AB	N	F120-A08D	480V N1E MCC Room	Z120-A08D	480V N1E MCC Room

Table 9.5A-3 (8 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	I (C)	F120-A09C	Electrical Penetration Room C	Z120-A09C	Electrical Penetration Room C
AB	II (D)	F120-A09D	Electrical Penetration Room D	Z120-A09D	Electrical Penetration Room D
AB	N	F120-A11B	General Access Area B- 120’-0”	Z120-A11B	General Access Area
AB	II (B)	F120-A15B	480V Class 1E MCC 03B Room	Z120-A15B	480V Class 1E MCC 03B Room
AB	N	F120-A16A	Mechanical Penetration Room	Z120-A16A	Mechanical Penetration Room
AB	I	F120-A21A	AB Controlled Area (I) ECCS Equip. Rm Exhaust ACU Room 1	Z120-A21A	AB Controlled Area (I) ECCS Equip. Rm Exhaust ACU Room 1
AB	I	F120-A24A	FH Area Emergency Exhaust ACU Room	Z120-A24A	FH Area Emergency Exhaust ACU Room
AB	N	F120-A25A	HVAC Chase	Z120-A25A	HVAC Chase
AB	II	F120-A29B	AB Controlled Area (II) ECCS Equip. Rm Exhaust ACU Room 1 Room Exhaust ACU Room	Z120-A29B	AB Controlled Area (II) ECCS Equip. Rm Exhaust ACU Room 1 Room Exhaust ACU Room
AB	II	F120-A30B	AB Controlled Area (II) ECCS Equip. Rm Exhaust ACU Room 2	Z120-A30B	AB Controlled Area (II) ECCS Equip. Rm Exhaust ACU A Room 2
AB	I	F120-A32A	AB Controlled Area (I) ECCS Equip. Rm Exhaust ACU Room 2	Z120-A32A	AB Controlled Area (I) ECCS Equip. Rm Exhaust ACU Room 2
AB	N	F120-A35B	Battery Room	Z120-A35B	Battery Room
AB	N	F120-AGAA	General Access Area A - 120’-0”	Z120-A11A	General Access Area
AB	N			Z120-A18A	Lx Panel Room
AB	N	F120-AGAC	General Access Area C - 120’-0”	Z120-A07C	General Access Area
AB	N			Z120-A10C	ECW Makeup Pump Room
AB	N			Z120-A18C	Lx Panel Room
AB	N	F120-AGAD	General Access Area D - 120’-0”	Z120-A07D	General Access Area
AB	N			Z120-A10D	ECW Make-up Pump Room
AB	N			Z120-A18D	Lx Panel Room

Table 9.5A-3 (9 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	N	F120-AMPB	Mech. Penetration Room	Z120-A16B	Mech. Penetration Room
AB	N			Z120-A36B	Hydrogen Analyzer Room
AB	N			Z120-A37B	Access Area
AB	I	F137-A01C	Cable Spreading Area	Z137-A01C	Cable Spreading Area
AB	II	F137-A01D	Cable Spreading Area	Z137-A01D	Cable Spreading Area
AB	N	F137-A02C	Electrical Equip. Room	Z137-A02C	Electrical Equip. Room
AB	N	F137-A02D	Electrical Equip. Room	Z137-A02D	Electrical Equip. Room
AB	N	F137-A03C	CEDM M/G Set Room	Z137-A03C	CEDM M/G Set Room
AB	N	F137-A04C	CEDM Power Control Cabinet Room	Z137-A04C	CEDM Power Control Cabinet Room
AB	N	F137-A05D	PCS Room	Z137-A05D	PCS Room
AB	I & II	F137-A06D	Remote Shutdown Room	Z137-A06D	Remote Shutdown Room
AB	N	F137-A09C	General Access Area C- 137'-6"	Z137-A09C	General Access Area
AB	I (C)	F137-A10C	480V Class 1E MCC 03C Room	Z137-A10C	480V Class 1E MCC 03C Room
AB	II (D)	F137-A10D	480V Class 1E MCC 03D Room	Z137-A10D	480V Class 1E MCC 03D Room
AB	I (C)	F137-A11C	Electrical Penetration Room C	Z137-A11C	Electrical Penetration Room C
AB	II (D)	F137-A11D	Electrical Penetration Room D	Z137-A11D	Electrical Penetration Room D
AB	N	F137-A14B	480V N1E MCC 18N Room	Z137-A14B	480V N1E MCC 18N Room
AB	I (A)	F137-A15A	480V Class 1E MCC 04A Room	Z137-A15A	480V Class 1E MCC 04A Room
AB	II (B)	F137-A15B	480V Class 1E MCC 04B Room	Z137-A15B	480V Class 1E MCC 04B Room
AB	N	F137-A20A	General Access Area A- 137'-6"	Z137-A20A	General Access Area
AB	I (A)	F137-A23A	480V Class 1E MCC 03A Room	Z137-A23A	480V Class 1E MCC 03A Room
AB	N	F137-A24B	480V N1E MCC 17N Room	Z137-A24B	480V N1E MCC 17N Room
AB	A	F137-A25A	Fuel Handling Area Emergency Exhaust ACU Room	Z137-A25A	Fuel Handling Area Emergency Exhaust ACU Room

Table 9.5A-3 (10 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	N	F137-A30C	Main Steam Enclosure	Z137-A30C	Main Steam Enclosure
AB	N	F137-A30D	Main Steam Enclosure	Z137-A30D	Main Steam Enclosure
AB	I & II	F137-A31C	MS Valve Room	Z137-A31C	MS Valve Room
AB	I & II	F137-A31D	MS Valve Room	Z137-A31D	MS Valve Room
AB	N	F137-A32B	Pipe Chase	Z137-A32B	Pipe Chase
AB	II (D)	F137-A35C	Reactor Trip Switchgear Room	Z137-A35C	Reactor Trip Switchgear Room
AB	I (C)	F137-A36C	Reactor Trip Switchgear Room	Z137-A36C	Reactor Trip Switchgear Room
AB	II (B)	F137-A37C	Reactor Trip Switchgear Room	Z137-A37C	Reactor Trip Switchgear Room
AB	I (A)	F137-A38C	Reactor Trip Switchgear Room	Z137-A38C	Reactor Trip Switchgear Room
AB	I & II	F137-A41A	Remote Control Console Room	Z137-A41A	Remote Control Console Room
AB	I (A)	F137-AEPA	Electrical Penetration Room A	Z137-A17A	Penetration MUX A Room
AB	I (A)			Z137-A18A	Electrical Penetration Room A
AB	II (B)	F137-AEPB	Electrical Penetration Room B	Z137-A17B	Penetration MUX B Room
AB	II (B)			Z137-A18B	Electrical Penetration Room B
AB	N	F137-A13B	General Access Area B- 137’-6”	Z137-A13B	General Access Area
AB	N	F137-AGAD	General Access Area D- 137’-6”	Z137-A09D	General Access Area
AB	N			Z137-A12D	MUX N2 Room
AB	N	F137-ANEA	Electrical Equip. Room	Z137-A21A	Electrical Equipment Room
AB	N			Z137-A22A	Electrical Equipment Room
AB	N	F137-ASTD	Stair	Z137-ASTD	Vestibule
AB	N	F156-A04B	Containment Entrance Area	Z156-A04B	Containment Entrance Area
AB	I	F156-A14A	AB Controlled Area (I) Normal Exhaust ACU Room Normal/Emergency Exhaust ACU Room	Z156-A14A	AB Controlled Area (I) Normal Exhaust ACU Room Normal/Emergency Exhaust ACU Room

Table 9.5A-3 (11 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	N	F156-A15B	Pipe Chase	Z156-A15B	Pipe Chase
AB	N	F156-A16A	SIS Filling Tank Room	Z156-A16A	SIS Filling Tank Room
AB	N	F156-AGAB	SST Room	Z156-AGAB	SST Room
AB	II (B)	F157-A01D	I&C Equipment Room B	Z157-A01D	I&C Equipment Room
AB	I (C)	F157-A16C	General Access Area C- 157'-0"	Z157-A16C	Corridor
AB	II (D)	F157-AGAD	General Access Area D- 157'-0"	Z157-A16D	Corridor
AB	N	F157-AGAD	General Access Area	Z157-A22D	Guest Room
AB	N			Z157-A27D	General Access Area
AB	N	F157-A18C	Clean Agent Room	Z157-A18C	Clean Agent Room
AB	I (C)	F157-A19C	I&C Equipment Room C	Z157-A19C	I&C Equipment Room
AB	II (D)	F157-A19D	I&C Equipment Room D	Z157-A19D	I&C Equipment Room
AB	N	F157-A20C	I&C Equipment Room	Z157-A20C	I&C Equipment Room
AB	N	F157-A20D	I&C Equipment Room	Z157-A20D	I&C Equipment Room
AB	I (A)	F157-A25C	I&C Equipment Room A	Z157-A25C	I&C Equipment Room
AB	N	F157-A28D	Breathing Air Rack	Z157-A28D	Breathing Air Rack
AB	N	F157-ACPX	Computer Room Area	Z157-ACPX	Computer Room Area
AB	I & II	F157-AMCR	Control Room Complex	Z157-AMCR	Control Rom Complex
AB	N	F157-ATOC	TSC Office Area	Z157-ATOC	TSC Office Area
AB	I	F174-A01C	EDG Room Normal Exhaust Fan Room	Z174-A01C	EDG Room Normal Exhaust Fan Room
AB	II	F174-A01D	EDG Room Normal Exhaust Fan Room	Z174-A01D	EDG Room Normal Exhaust Fan Room
AB	N	F174-A05C	480V N1E MCC Room	Z174-A05C	480V N1E MCC Room
AB	N	F174-A05D	Electrical Equipment Room	Z174-A05D	Electrical Equipment Room
AB	N	F174-A13C	480V N1E MCC Room	Z174-A13C	480V N1E MCC Room
AB	N	F174-A13D	480V N1E MCC Room	Z174-A13D	480V N1E MCC Room

Table 9.5A-3 (12 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	I	F174-A14C	EDG Room Normal Supply AHU Room	Z174-A14C	EDG Room Normal Supply AHU Room
AB	II	F174-A14D	EDG Room Normal Supply AHU Room	Z174-A14D	EDG Room Normal Supply AHU Room
AB	N	F174-A15B	CTMT High /Low Volume Purge ACU Room	Z174-A15B	CTMT High /Low Volume Purge ACU Room
AB	II	F174-A16B	CTMT High Volume Purge AHU Room	Z174-A16B	CTMT High Volume Purge AHU Room
AB	N	F174-A22B	HVAC Chase	Z174-A22B	HVAC Chase
AB	I	F174-A23C	Control Room Area Supply AHU Room	Z174-A23C	Control Room Area Supply AHUs Room
AB	II	F174-A23D	Control Room Area Supply AHU Room	Z174-A23D	Control Room Area Supply AHUs Room
AB	I	F174-A24C	Control Room Area Supply AHU/ACU Room	Z174-A24C	Control Room Area Supply AHU/ACU Room
AB	II	F174-A24D	Control Room Area Supply AHU/ACU Room	Z174-A24D	Control Room Area Supply AHU/ACU Room
AB	I	F174-A25C	HVAC Area	Z174-A25C	HVAC Area
AB	II	F174-A25D	HVAC Area	Z174-A25D	HVAC Area
AB	N	F174-AGAC	General Access Area C- 174’-0”	Z174-A02C	ECW Compression Tank Room
AB	N			Z174-A03C	CCW Surge Tank Room
AB	N			Z174-A12C	General Access Area
AB	N	F174-AGAD	General Access Area D- 174’-0”	Z174-A02D	ECW Compression Tank Room
AB	N			Z174-A03D	CCW Surge Tank Room
AB	N			Z174-A12D	General Access Area
AB	I	F175-A01C	MSIV Room Supply AHU Room	Z175-A01C	MSIV Room Supply AHU Room
AB	II	F175-A01D	MSIV Room Supply AHU Room	Z175-A01D	MSIV Room Supply AHU Room
AB	I	F195-A02C	AB Clean Area Supply AHUs Room	Z195-A02C	AB Clean Area Supply AHUs Room
AB	II	F195-A02D	AB Clean Area Supply AHUs Room	Z195-A02D	AB Clean Area Supply AHUs Room
AB	N	F195-A05C	480V N1E Loadcenter Room	Z195-A05C	480V N1E Loadcenter Room

Table 9.5A-3 (13 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
AB	N	F195-A05D	480V N1E Loadcenter Room	Z195-A05D	480V N1E Loadcenter Room
AB	II	F195-A08B	AB Controlled Area (II) Normal Exhaust ACU Room	Z195-A08B	AB Controlled Area (II) Normal Exhaust ACU Room
AB	N	F195-A09C	HVAC Exhaust Penthouse	Z195-A09C	HVAC Exhaust Penthouse
AB	N	F195-A10D	Smoke Fan Room	Z195-A10D	Smoke Fan Room
AB	N	F000-ACVL	CVCS Area – Lower Area	Z055-ACVL	CVCS Area – Lower Area El.55’-0”
AB	N			Z068-ACVL	CVCS Area – Lower Area El.68’-0”
AB	N			Z078-ACVL	CVCS Area – Lower Area El.78’-0”
AB	N	F000-AFHL	Fuel Handling Area – Lower Area	Z055-AFHL	Fuel Handling Area – Lower Area El.55’-0”
AB	N			Z078-AFHL	Fuel Handling Area – Lower Area El.78’-0”
AB	N	F000-AHV	HELB Vent Area	Z055-A46B	Condensate Return Unit Room
AB	N			Z068-A06A	Gas Stripper Room
AB	N	F000-AHV	HELB Vent Area	Z078-A40B	Boric Acid Conc. Room
AB	N			Z078-A42B	HELB Area AHU Room
AB	N			Z078-A43B	HELB Area ACU Room
AB	N			Z120-A14A	SGBD Regen. Hx. Room
AB	I & II	F000-ACVU	CVCS Area –Upper Area	Z100-ACVU	CVCS Area - Upper Area El.100’
AB	N			Z120- ACVU	CVCS Area - Upper Area El.120’
AB	II	F000-AFHU	Fuel Handling Area – Upper Area	Z100-AFHU	Fuel Handling Area – Upper Area El.100’-0”
AB	N			Z120-AFHU	Fuel Handling Area – Upper Area El.120’-0”
AB	II			Z137-AFHU	Fuel Handling Area – Upper Area El.137’-6”
AB	N			Z156-AFHU	Fuel Handling Area – Upper Area El.156’-0”

Table 9.5A-3 (14 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
EDGB	I (A)	F000-HFSA	Diesel Fuel Oil Storage Tank Room A	Z000-HFSA	Diesel Fuel Oil Storage Tank Room A
EDGB	II (B)	F000-HFSB	Diesel Fuel Oil Storage Tank Room B	Z000-HFSB	Diesel Fuel Oil Storage Tank Room B
EDGB	I (A)	F000-HDGA	Diesel Generator Area A	Z000-HDGA	Diesel Generator Area A
EDGB	II (B)	F000-HDGB	Diesel Generator Area B	Z000-HDGB	Diesel Generator Area B
EDGB	I (A)	F121-H01A	Lube Oil Makeup Tank Room A	Z121-H01A	Lube Oil Makeup Tank Room A
EDGB	II (B)	F121-H01B	Lube Oil Makeup Tank Room B	Z121-H01B	Lube Oil Makeup Tank Room B
EDGB	I (A)	F121-H02A	Diesel Fuel Oil Day Tank Room A	Z121-H02A	Diesel Fuel Oil Day Tank Room A
EDGB	II (B)	F121-H02B	Diesel Fuel Oil Day Tank Room B	Z121-H02B	Diesel Fuel Oil Day Tank Room B
EDGB	N	F000-HG	EDG Building- General	Z000-HG	EDG Building- General
TB	N	F067-T02	Underground Common Tunnel	Z067-T02	Underground Common Tunnel
TB	N	F072-T01	Chemical Handling Room	Z072-T01	Chemical Handling Room
TB	N	F072-T02	Lube Oil Storage Room	Z072-T02	Lube Oil Storage Room
TB	N	F072-T03	Main TB Lube Oil Conditioner Room	Z072-T03	Main TB Lube Oil Conditioner Room
TB	N	F073-T06	Caustic/Acid Day Tank & Pump Room	Z073-T06	Caustic/Acid Day Tank & Pump Room
TB	N	F073-T11	SWGR Area – 73’-0”	Z073-T11	SWGR Area – 73’-0”
TB	N	F100-T11	TB Lube Oil Reservoir Room	Z100-T11	TB Lube Oil Reservoir Room
TB	N	F100-T15	SWGR Area – 100’-0”	Z100-T15	SWGR Area – 100’-0”
TB	N	F100-T17	Battery Room	Z100-T17	Battery Room
TB	N	F122-T01	SWGR Area – 122’-0”	Z122-T01	SWGR Area– 122’-0”
TB	N	F000-TB	Turbine Building - General	Z055-T01	Condenser Pit Area
TB	N			Z060-T01	Condensate Overflow Storage Sump Pit Area
TB	N			Z073-T02	TGB Basement Floor
TB	N			Z100-T01	TBG Bldg. Ground Floor

Table 9.5A-3 (15 of 15)

Building	Division	Fire Area	Fire Area Description	Fire Zone	Fire Zone Description
TB	N	F000-TB	Turbine Building - General	Z136-T01	TGB Operating Floor
TB	N			Z170-T01	TB Deaerator Floor
CPB	N	F100-P17	Flammable Gas Storage Room	Z100-P17	Flammable Gas Storage Room
CPB	N	F100-P18	Non-Flammable Gas Storage Room	Z100-P18	Non-Flammable Gas Storage Room
CPB	N	F000-AC	Compound Building – Access Control Area	Z063-AC	Compound Building – Access Control Area El. 63’
CPB	N			Z085-AC	Compound Building – Access Control Area El. 85’
CPB	N			Z100-AC	Compound Building – Access Control Area El.100’
CPB	N			Z120-AC	C100pound Building – Access Control Area El.120’
CPB	N			Z139-AC	Compound Building – Access Control Area El.139’
CPB	N			Z157-AC	Compound Building – Access Control Area El.157’
CPB	N	F000-RW	Compound Building – Radwaste Area	Z063-RW	Compound Building – Radwaste Area El.63’
CPB	N			Z085-RW	Compound Building – Radwaste Area El.85’
CPB	N	F000-RW	Compound Building – Radwaste Area	Z100-RW	Compound Building – Radwaste Area El.100’
CPB	N			Z120-RW	Compound Building – Radwaste Area El.120’
CPB	N			Z139-RW	Compound Building – Radwaste Area El.139’

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-1   Fire Barrier DBD – RCB/AB El.55’-0”

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-2 Fire Barrier DBD – RCB/AB El.68'-0" & 77'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-3 Fire Barrier DBD – RCB/AB El.78'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-4 Fire Barrier DBD – RCB/AB El.1-100’-0”

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-5 Fire Barrier DBD – RCB/AB El.120’-0”

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-6   Fire Barrier DBD – RCB/AB El.137'-6"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-7 Fire Barrier DBD – RCB/AB El.156'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-8 Fire Barrier DBD – RCB/AB El.174'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-9 Fire Barrier DBD – RCB/AB El.195'-0" & Roof

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-10 Fire Barrier DBD – EDGB El.63’-0” & 100’-0”

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-11 Fire Barrier DBD – EDGB El.121'-6" & 135'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-12 Fire Barrier DBD – TGB El.73'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-13 Fire Barrier DBD – TGB Intermediate El.73’-0”

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-14 Fire Barrier DBD – TGB El.100'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-15   Fire Barrier DBD – TGB Intermediate El.100’-0”

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-16 Fire Barrier DBD – TGB El.136'-6"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-17 Fire Barrier DBD – TGB El.170’-0”

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-18   Fire Barrier DBD – CPB El.63’-0”

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-19 Fire Barrier DBD – CPB El.77'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-20 Fire Barrier DBD – CPB El.85'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-21   Fire Barrier DBD – CPB El.100'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-22 Fire Barrier DBD – CPB El.120'-0"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-23 Fire Barrier DBD – CPB El.139'-6"

Security-Related Information – Withheld Under 10 CFR 2.390

Figure 9.5A-24   Fire Barrier DBD – CPB El.157'-9" & El.163'-8"