9.4 AIR CONDITIONING, HEATING, COOLING, AND VENTILATION SYSTEMS

9.4.1 Control Center Air Conditioning System

9.4.1.1 Design Bases

The control center air conditioning system (CCACS) is designed to provide ventilation, heating, and cooling, and to limit the relative humidity in the control center envelope (as described in Subsection 9.4.1.2) during normal operation and following a design-basis accident (DBA).

The CCACS is designed as follows:

a. The system is designed to limit the maximum relative humidity* to 60 percent and the nominal ambient temperature to 75°F dry bulb, except for the mechanical equipment room (MER) and SGTS room, to ensure comfort of the operators as well as to obtain an optimum environment for controls and instrumentation. The system is designed to limit the nominal ambient temperature in the MER to 95°F during normal operation and following a design-basis accident, and in the SGTS room to 104°F during normal operation. The system is designed to maintain the above temperatures, assuming an ambient temperature of 95°F dry bulb and 75°F wet bulb during the summer and -10°F dry bulb during the winter

b. The system is designed to detect and limit the introduction of radioactive material into the main control room and to remove airborne radioactivity from the environment therein such that the dose to main control room personnel following a DBA does not exceed the requirements of General Design Criterion 19

c. The system is designed to limit the introduction of chlorine gas into the main control room

d. Redundant components are powered by their corresponding redundant Division I and Division II engineered safety feature (ESF) buses

e. The system is designed to accomplish its design objectives assuming a single active component failure. A single active failure in the Halon fire protection system will cause loss of cooling to the relay room, cable spreading room, or computer room. Redundant smoke/Halon dampers are not provided. Adequate time exists to take manual actions to restore airflow

f. The CCACS is designed to meet Category I requirements.

* The relative humidity in the control room and the computer room is controlled between a minimum of 40 percent and a maximum of 60 percent.

g. The system is designed for accessibility in making adjustments and periodic inspections and for testing principal system components to ensure continuous functional reliability

h. The control center emergency air filtration system design conforms to Regulatory Guide 1.52 except as stated in Subsection A.1.52. The system is redundant only at the active component level.

Environmental design considerations relating to main control room habitability following an accident are discussed in Subsection 6.4.1.

The CCACS is designed to maintain the control center under a positive pressure of approximately 1/4 ± 1/8-in. water gage in the "recirculation mode" in order to minimize inleakage of contaminated air. Such outside contamination could be the result of radioactivity leakage after a LOCA.

Isolation valves and isolation dampers are capable of remote manual operation so that failure of their control system will not render the system inoperable.

Surveillance of airborne radioactivity levels in the main control room is provided by the airborne radiation monitoring system (Subsection 12.2.4).

9.4.1.2 System Description

9.4.1.2.1 System Equipment

The control center envelope encloses a total air volume of approximately 275,960 ft^3 (during normal mode) and 252,731 ft^3 (during emergency modes). The following areas are air conditioned as separate zones as indicated:

Zone	Area Description
1	Relay room
2	Cable spreading room
3	Main control room
4	Computer room
6	Office
7	Conference room
8	Mechanical equipment room and standby gas treatment system (SGTS) rooms (during normal mode). However, the SGTS rooms are not part of the control center envelope during emergency modes (See Subsection 9.4.1.2.3)

The CCACS diagram is shown in Figures 9.4-1, 9.4-2, and 9.4-3, and principal system component design data are listed and described in Table 9.4-1. The CCACS consists of two

100 percent-capacity air-conditioning supply units, an air distribution system, and an emergency filtration system. The control center is heated, cooled, and pressurized by a recirculating air system.

There are four operating modes for the ventilating system, as follows:

a. Normal Mode: A minimum of 2769 cfm outside air mixes with recirculated ventilating air, bypassing the emergency makeup and recirculation filters

b. Purge Mode: 100 percent outside air is circulated through the control center and exhausted to the atmosphere to purge any smoke or fumes within the control center

c. Recirculation Mode: A maximum of 1800 cfm outside air is filtered and mixes with 1200 cfm recirculated air that is filtered again and mixed with recirculating ventilation air to prevent intrusion and to provide continuous removal of contaminants during a radiation-release emergency

d. Chlorine Mode: All outside intakes are closed to prevent ingress during a chlorine-release emergency. Ventilating air is recirculated with 1200 cfm passing through the emergency recirculation filter.

Each of the multizone air-conditioning supply units includes a fail-closed air-operated inlet damper, an electronic air cleaner, a roll filter, a centrifugal fan, and an electrically heated hot deck and a cold deck with a chilled water cooling coil. The supply air temperature for each zone is controlled by a pair of zone dampers that proportion the hot and cold air. Each of the air-conditioning supply units is served by a Category I chiller unit. During normal operation, the condenser section of the chiller is cooled by the reactor building closed cooling water system (RBCCWS). During emergency operation, the chiller condenser is cooled by the emergency equipment cooling water system (EECWS).

The emergency filtration system processes control center air and makeup air through charcoal filters if the control center is subjected to airborne contamination. This system consists of two separate emergency air intakes. Each has a dual set of "bubble tight" dampers in each of two parallel lines.

These dampers are valves with pneumatic piston actuators. The emergency makeup air filter train is sized for a flow rate of 3000 cfm, but is restricted to a maximum emergency intake flow of 1800 cfm. The filter train consists of the following components arranged in the direction of flow:

a. Mist eliminator (prefilter type)

b. Two electric heaters, one each for Division I and Division II

c. High-efficiency particulate air (HEPA) filter with a design filtration efficiency of 99.97 percent for 0.3 μm particles or larger. The filters are installed and field tested such that a 95 percent decontamination efficiency can be assumed for removal of particulate iodine

d. 2-inch deep charcoal adsorber. The carbon is purchased, lab tested, and tested for bypass leakage after installation such that a 95 percent decontamination efficiency can be assumed for removal of all forms of gaseous iodine

e. HEPA filter with a design filtration efficiency of 99.97 percent for 0.3 μm particles or larger.

The emergency intake flow is then combined with 1200 cfm of control center recirculation airflow. This airflow is then processed through the recirculation air filter train.

The emergency recirculation filter train is sized for a flow rate of 3000 cfm and consists of the following filters in the direction of flow:

a. Prefilter

b. HEPA filter with a design filtration efficiency of 99.97 percent for 0.3 μm particles or larger. The filters are installed and field tested such that a 95 percent decontamination efficiency can be assumed for removal of particulate iodine.

c. 4-inch deep charcoal adsorber. The carbon is purchased, lab tested, and tested for bypass leakage after installation such that a 95 percent decontamination efficiency can be assumed for removal of all forms of gaseous iodine.

d. HEPA filter with a design filtration efficiency of 99.97 percent for 0.3 μm particles or larger.

The air is drawn through these emergency filters by one of two redundant emergency recirculation air fans. Redundant air-operated dampers are installed on the intake, upstream of make-up air filter unit, and exhaust side of each of the fans. The fans receive electrical power from ESF buses.

In order to provide adequate makeup air to the control center during normal operation, the intake air damper is provided with a minimum stop to ensure a minimum airflow at all times except while the control center is isolated. The design minimum airflow is 2769 cfm. This minimum airflow is based on the normal airflow to the main control room exhaust vent, the exfiltration from the building, and the ventilation air supplied to the standby gas treatment room, kitchen, and washrooms. A modulating damper in the system exhaust restricts exhaust flow relative to supply airflow rate to maintain approximately $1/4 \pm 1/8$ in. of water difference between the lower of the outside ambient pressure or the turbine building pressure and control center pressure when the system is in the normal mode.

The two fan-coil cooling units are located in the mechanical equipment room. Each of these units is sized to dissipate the total heat load generated in the mechanical equipment room during an emergency. The units are of the factory-assembled, integral-fan-type with a chilled water cooling coil. One fan-coil unit is for Division I and the other for Division II. Chilled water is supplied to these units from the control center chillers.

The air conditioning system is equipped with alarms annunciated in the main control room for detection of equipment malfunction. Each division has similar alarms. A malfunction in the operating division will annunciate an alarm; if necessary, the entire division will be shut down manually and the standby division will be manually started. Shutoff dampers on the outlet of each unit are interlocked with the fan starter. Chiller starter contacts are held open until verification of chilled water, condenser water flow, supply air, and return airflow. The chiller starter contacts are tripped if oil pressure is not verified after a time delay.

For heat and smoke removal from the control center complex in the event of a fire in either the relay room or the cable spreading room, the fire detection system automatically switches the air conditioning system to a purge mode. Smoke and fire detection systems for the control center are covered in Subsection 9.5.1.

All electrical power for motor operation is supplied by the reactor building ESF buses and the division concept of separation and redundancy is maintained. Power to these buses is supplied from the emergency diesel generator (EDG) system if offsite electrical power is lost. Refer to Subsection 7.3.5 for a discussion of the CCACS instrumentation and controls.

9.4.1.2.2 Normal Operation

During normal operation, the master selector switches in the main control room activate all components in the Division I or Division II system. A mixture of return and outside air is filtered, then cooled, heated, and dehumidified, as required by a multizone air-conditioning supply unit. Each zone thermostat modulates zone mixing dampers to obtain the supply air temperature necessary to satisfy the zone cooling or heating requirements.

Heating is supplied by an electric heating coil and is provided on demand from any one of the zone thermostats. The air temperature leaving the heating coil is maintained at approximately 95°F and reset to lower temperatures on rising outside air temperature. Steam is supplied by the auxiliary boiler and controlled by humidistats located in the control room and computer room. Positive pressure is maintained in the control center by throttling the exhaust air modulating damper. This damper modulates only in the normal mode. It has no essential function and opens upon loss of power to allow "purge" mode operation if required. Exhaust fans are provided in the kitchen and washrooms.

9.4.1.2.3 Emergency Operation

During an emergency, the control center is isolated from all other areas of the plant. All air supplies to the standby gas treatment rooms and the normal operation of air intake and exhaust ducts are dampered closed.

The multizone air-handling unit, the chiller, chilled water pump and the return air fan continue to operate as during normal operation. The return air damper assumes a full open position. Condenser water is supplied from the EECWS. The fan in the mechanical equipment room fan-coil cooling unit is also energized under room thermostat control. Chilled-water flow through the cooling coil of the unit continues unimpeded as during normal operation.

The emergency recirculation air fan is energized and the isolation dampers on the emergency intake air duct are opened. Pressure control dampers, which regulate the proportion of recirculated air to emergency makeup air, modulate to maintain approximately 1/4 ± 1/8-in. water gage positive pressure in the control room. The dampers in the kitchen and washroom exhaust air ducts are closed. In the event that chlorine gas is detected in the control center by control room personnel, manual operator action will place the CCHVAC system in chlorine mode which will cause all system isolation dampers to automatically close. Damper position indications in the main control room allow continuous monitoring of system performance and confirm all remote manual control actions taken.

9.4.1.3 Safety Evaluation

Continued operation of the CCACS during both normal and emergency conditions is ensured by the following:

a. Design of system components to meet Category I requirements

b. Redundancy of components to meet single active failure. Smoke/Halon dampers are not single active failure proof. A system single-failure analysis is presented in Table 9.4-2

c. During loss of offsite power, all active components, such as valve and damper operators, fan motors, controls, and instrumentation, are served by their respective emergency power sources.

d. The unfiltered inleakage into the main control room is limited to a maximum of 173 cfm as evaluated in accordance with the AST methodology in Regulatory Guide 1.183.

Alarms in the control center will alert the operator to any malfunction in the CCACS so that, if necessary, he can manually actuate the standby division. The instrumentation in the main control room is designed to operate without degradation of performance in an ambient temperature of 120°F.

Detection of radioactivity in the main control room environment is provided by radiation monitors, as described in Subsection 12.2.4. Signals generated by high radioactivity in the control center makeup air, the reactor building exhaust, and fuel pool exhaust; low reactor water level; and high drywell pressure will initiate automatic isolation of the control center.

Protection of main control room personnel against an offsite chlorine release can be provided by manual isolation of the main control room and the use of breathing apparatus by the main control room operators as discussed in Section 6.4.

A discussion and analysis of the chlorine accidents considered in the design of the plant and an evaluation of the habitability of the main control room after a chlorine accident are presented in Subsection 6.4.3.4.

An evaluation of the buildup of carbon dioxide in the main control room, with the CCACS isolated, is given in Subsection 6.4.1.2.

A fire outside the plant will not affect control room habitability because the control center will be isolated. The operator will receive an indication of an onsite fire through the control center air inlet smoke detector.

The sources of smoke closest to the control center outside air intake are the system service and main unit transformers approximately 80 to 240 ft from the air intake. Smoke from a fire outside the plant should be detected within 1 minute after the smoke begins to enter the control center. The control center can then be manually isolated in less than 10 sec. The operators will have immediate access to self-contained breathing apparatus for respiratory protection as discussed in Section 6.4.

9.4.1.4 Inspection and Testing Requirements

The CCACS equipment was subjected to a dynamic system test to directly verify the acceptability of the supplied equipment in accordance with the design specifications. At the conclusion of the work, all of the heating, cooling, hydronic, and ventilating systems were tested and balanced to meet the design conditions.

Routine procedures require checking for proper mode of operation, proper positioning of dampers, and proper operation of the system equipment. All those dampers which are required to provide tight shutoff were checked in the closed position by the vendor to verify proper operation of the seals, and those dampers are periodically observed in service to confirm proper functioning of the operating air connections. Design provisions are made so that active components of the air conditioning system can be periodically inspected for operability and required functional performance.

Initial system flow distribution, valve operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Test program as discussed in Chapter 14.

The control center emergency filtration system has been subjected to shop test, acceptance test, and inservice inspection in accordance with Regulatory Guide 1.52 as delineated in Appendix A. Laboratory testing was also in accordance with Regulatory Guide 1.52. The control center emergency filtration system was given a preoperational test as discussed in Chapter 14.

An inservice surveillance program has been implemented in accordance with the Technical Specifications to ensure that the main control room emergency filtration system can perform its design functions.

9.4.2 Reactor/Auxiliary Building Ventilation System

9.4.2.1 Design Bases

The reactor/auxiliary building ventilation system is designed to provide normal ventilation for the reactor and auxiliary build-ings and to maintain the temperature in general access areas between 65°F and 104°F. The temperature in potentially contam-inated areas is maintained between 65°F and 125°F. To maintain these temperatures, additional room coolers have been added to selected areas. Equipment in the emergency core cooling system (ECCS) pump rooms was originally designed to operate at temperatures below 148°F during emergency conditions. The actual conditions to which this equipment is environmentally qualified under the Fermi 2 EQ program are documented in EQ0-EF2-018. Also see Section 3.11 for discussion of original Fermi 2 design and environmental qualification activities performed for Fermi 2. During normal operation, when the emergency core cooling equipment is not in service, the temperature in these rooms is maintained below 104°F.

The HVAC System for battery rooms controls the temperature at an approximate value of 75°F. The ventilation system is designed to maintain these temperatures when the outside ambient dry bulb temperature is between -10°F and 95°F.

The ventilation system provides a means of purging the drywell of the nitrogen inerting atmosphere, prior to entry by personnel.

The system is designed to maintain airflow from areas of low potential radioactivity to areas of progressively higher potential radioactivity. In addition, the system will maintain the reactor and auxiliary buildings at a negative pressure with respect to the ambient pressure, assuming a maximum wind velocity of 32 mph.

All components, piping, valves, and dampers are designed to meet the criteria of appropriate system quality group classification as listed in Subsection 3.2.2. The reactor/auxiliary building ventilation system is nonseismic, with the exception of ventilation penetrations of the reactor building secondary containment and the engineered safeguard equipment space coolers, which are Category I. The reactor building secondary containment ventilation penetrations consist of the ventilation ductwork and associated isolation valves and actuators. The isolation valves and space coolers receive control and operating power from buses that are connected to the EDGs. The essential battery room ventilation fans are also Category I. The power supplies to these fans are from motor control centers (MCCs) that were installed non-1E, but are automatically restorable from essential power. The MCCs were purchased to the same specifications (except for documentation requirements) as Class 1E, and their installation is seismically qualified. The MCCs will be maintained as 1E equipment.

9.4.2.2 System Description

The reactor/auxiliary building ventilation system is shown in Figure 9.4-4, Sheets 1 and 2. The nominal size and type of principal system components are listed in Table 9.4-3.

Areas in the reactor and auxiliary buildings that have separate ventilation and air conditioning and/or cooling systems are not covered in this subsection. These areas, given in the following listing, are covered in the indicated subsections:

a. Steam tunnel (Subsection 9.4.6)

b. Control center and standby gas treatment system (SGTS) room (Subsection 9.4.1)

c. Drywell cooling (Subsection 9.4.5).

Normal ventilation of the SGTS equipment rooms is handled by the CCACS and is discussed in Subsection 9.4.1. However, ventilation of these rooms is isolated during a DBA. The emergency fan-coil coolers, which are included as part of the reactor/auxiliary building ventilation system, will then handle the cooling requirements for this room.

Air conditioning of the motor-generator set is discussed in Subsection 9.4.11.

The reactor/auxiliary building ventilation system supplies filtered outside air to accessible areas of the reactor and auxiliary buildings through a central fan system consisting of an outside air intake, filters, heating coils, and three 50 percent-capacity fans. The air intake is located midway down the south side of the auxiliary building. The ventilation air is supplied to accessible areas of the buildings through ductwork and is exhausted from areas of high potential contamination through a common vent located on top of the auxiliary building. Three 50 percent-capacity exhaust fans are provided.

Normally, one exhaust and one supply fan are on standby. Gravity backdraft dampers with counterbalancing weights are provided to prevent backflow of contaminated air and permit control of the required differential pressure (approximately 1/4 in. of H_2O) between general access areas and potentially contaminated areas. Backdraft dampers are fitted on the inlets of exhaust ducts that run between general access areas and potentially contaminated areas.

Each of the two battery rooms that are located in the auxiliary building has two 100 percent-capacity exhaust fans. One air-conditioning unit serves both battery rooms. However, safety- related space coolers provide essential cooling at the battery charger location next to each battery room. The exhaust fans draw air into and through the battery room from general access areas and exhaust the air to other general access areas when the air conditioner is off. The main function of the battery exhaust fans is to prevent the buildup of hydrogen from reaching an explosive concentration in the battery room. The fan units are seismically qualified and powered from an automatically restorable ac bus on loss of offsite power. The air-conditioning unit is not considered part of the ESFs in that it is provided only to prolong the life of the batteries. However, battery charger area coolers are capable of maintaining area temperature under 120°F independent of the air-conditioning unit, with or without a loss of offsite power.

The design of the refueling floor area ventilation is sized for a minimum of 7 air changes per hour based on the volume in the lower 15 ft of the refueling area. The supply air outlets are located 15 ft above the refueling floor level. The airflow is directed across the refueling floor toward the pools. The building ventilation system exhaust takes suction from the following refueling areas:

a. Dryer-separator storage pool - 25 percent, 8250 cfm

b. Fuel storage pool - 50 percent, 16,500 cfm

c. The reactor well - 25 percent, 8250 cfm.

During non-refueling periods, the reactor well will not be ventilated; however, the excess air will be exhausted along the wall above the refueling floor.

The ventilation system also serves to purge the primary containment to permit personnel access. This is accomplished through the cross tie between the primary containment purge piping and the building ventilation system. Sufficient airflow (8500 cfm) is provided to purge the drywell and suppression chamber a minimum of three air changes per hour. The purge air is normally processed through the building exhaust system. However, when the drywell atmosphere is contaminated, initiating a reactor building heating, ventilation, and air conditioning (HVAC) shutdown and isolation, the purge air is processed through the SGTS, which is described in Subsection 6.2.3.

The only areas not ventilated in the reactor and auxiliary buildings are stairwells that are fire rated.

Two reactor building isolation dampers are provided in each supply and exhaust duct that penetrates the reactor building. These dampers are closed when there is high radioactivity in the reactor building, high drywell pressure, low reactor water level, or loss of offsite power. When the reactor building is isolated, the ventilation supply and exhaust fans are tripped off and the reactor building is maintained under negative pressure by the SGTS. The same

signal that isolates the reactor building ventilation also signals the isolation valve between the reactor building ventilation duct and the SGTS to open. A reactor building isolation pushbutton is provided in the main control room. The fan-coil cooling units are intended primarily to function while the reactor building is isolated, at which time the ventilation system is shut down. The fan-coil cooling units are either automatically controlled by a thermostat located in the room they serve or they are operated in a manual mode where they operate continuously. Thus, the fan-coil units will also aid to cool their respective areas whenever the ventilation system is unable to maintain the designed room temperatures.

During normal plant operation and outages, it sometimes becomes necessary to take a fan-coil unit out-of-service for preventive or corrective maintenance. When this happens, the plant determines the operability of the safety-related equipment that relies on the fan-coil unit for local cooling and then follows the plant's Technical Specifications.

The following fan-coil cooling units are required to operate following a DBA and, as such, are part of the plant ESFs:

a. One unit of 100 percent capacity furnished for each division of residual heat removal (RHR) pumps

b. One unit of 100 percent capacity furnished for each division of core spray pumps. The Division I unit also cools the reactor core isolation cooling (RCIC) pump

c. One unit of 100 percent capacity furnished for the high pressure coolant injection (HPCI) pump room

d. One unit of 100 percent capacity furnished for each division of SGTS filter unit room

e. One unit of 100 percent capacity furnished for each division of EECW pumps

f. One unit of 100 percent capacity furnished for each division of hydrogen recombiners

   The NRC amended 10 CFR 50.44, "Standards for combustible gas control system in light-water-cooled power reactors" on October 16, 2003 to eliminate the requirements for hydrogen recombiners. The hydrogen recombiner Technical Specification Requirements were subsequently removed by License Amendment 159, dated March 15, 2004. The wording in this UFSAR section associated with these changes will remain unaltered until after the hydrogen recombiner system has been abandoned in place or removed from the plant.

g. Two units, each of 50 percent capacity, furnished for each division of the switchgear room

h. This item is not used

i. One unit of 100 percent capacity furnished for each division of the control air compressors

j. One unit of 100 percent capacity furnished for each division of the battery charging area.

The fan-coil cooling units recirculate room air to remove heat generated by process equipment. Cooling water is normally supplied to the fan-coil units by the RBCCWS. During malfunction of the RBCCWS or on loss of offsite power, cooling water is supplied by the EECWS. All of the above fan-coil cooling units are physically separated by virtue of their location.

Radiation monitors are provided in the building exhaust to monitor the release of airborne activity. Upon detection of high radioactivity in the exhaust vent, an alarm is sounded in the main control room. Simultaneously, the building ventilation system fans are automatically tripped off and the isolation dampers are closed automatically. A description of the monitoring system is presented in Subsection 12.2.4.

9.4.2.3 Safety Evaluation

The reactor/auxiliary building ventilation system is required to operate only during normal plant operations except the fan-coil cooling units, the battery room exhaust fans, and the reactor building supply and exhaust isolation dampers, which are required to operate after a DBA. To ensure the reliable and safe operation of the ventilation system over the full range of normal plant operations, the portion of the system that is not required to operate after a DBA incorporates the following design features:

a. The ventilation system maintains the building at a negative pressure with respect to the ambient pressure to preclude exfiltration of potentially contaminated air. (The reactor building is maintained at a negative pressure by the SGTS following the isolation of the reactor building)

b. Backdraft dampers are used in the ventilation system to prevent backflow between general access areas and contaminated areas

c. Standby exhaust and supply fans are provided to increase the availability of the ventilation system

d. The ventilation system in the area of the refueling pool is designed to exhaust more air than is supplied. In addition, the supply air is directed across the refueling pool. This method of ventilating the refueling pool area limits the spread of radioactivity from the refueling pool to other parts of the reactor building

e. Potentially contaminated effluent rising from the surface of the refueling pool and the dryer-separator pool is entrained in the normal ventilation air and is drawn into the exhaust openings located above the pool water level. A radiation monitor is provided on the exhaust ducts from the pool areas. The monitors will alarm in the main control room if a high radiation level is detected and will automatically start the SGTS, isolate the reactor building normal air intake and exhaust, and place the CCACS into recirculation mode.

The fan-coil cooling units, the battery room exhaust fans, and the reactor building supply and exhaust isolation dampers, all of which are required to operate after a DBA, incorporate the following design features to ensure their reliable and safe operation following a DBA:

a. Battery room exhaust fans and fan-coil units receive power from the same division as the equipment they protect. The diesel generators are the source of electrical power in the event of a loss of normal offsite power

b. The loss of any of the fan-coil units has the same effect on the safety of the plant as the loss of the equipment being cooled. Therefore, a single failure of the ventilation system affecting the safety-related equipment rooms will not prevent safe shutdown of the plant. Each ECCS subsystem (Division 1 RHR pump room, Division 2 pump room, Division 1 core spray and RCIC pump room, Division 2 core spray pump room, and HPCI pump room) has its own integral area cooling subsystem and fan-coil unit which is supplied from the same essential bus as the ECCS subsystem being cooled and which is an ESF. The loss of a particular ECCS subsystem, its room, or its equipment area cooling subsystem would result in automatic initiation of the redundant ECCS subsystem

c. Each battery room has two 100 percent-capacity exhaust fans. The loss of one of these fans has no effect on plant availability.

9.4.2.4 Inspection and Testing

All equipment is factory inspected and tested in accordance with applicable equipment specifications, quality assurance requirements, and codes. The system ductwork and erection of equipment were inspected during various construction stages, and construction tests were performed on all components of the system. The system was balanced for the design airflow and system operating pressures in accordance with Sheet Metal and Air Conditioning Contractors National Association procedures. Controls, interlocks, and safety devices on each system were adjusted and tested to ensure proper sequence of operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Test program as discussed in Chapter 14. Periodic tests of all system functions will be performed in accordance with normal operating procedures.

9.4.2.5 Instrumentation and Controls

Each exhaust and supply fan is manually controlled from the main control room. In order to ensure that a negative pressure is maintained in the reactor building while starting a fan combination, a time delay is provided so that the exhaust fan will start first. In addition, the motor starters are interlocked after starting to ensure that the associated fan shuts down when either an exhaust or supply fan is tripped.

The outside barometric pressure is detected on each of the four sides of the building and compared with the pressure being detected on the inside of the building. The difference between the lowest outside pressure and the inside pressure then is used as the control signal for modulating the inlet vanes of the ventilation system exhaust fan in order to maintain the building pressure lower than the outside pressure. Should the pressure in the building become excessively high or low (2.50 in. H_2O above or below the setpoint), the fans are automatically tripped.

The fan-coil cooling units located in a harsh environment are operated in a manual mode where they run continuously. The remainder of the fan-coil cooling units are operated in an automatic mode where the units start when the thermostat in the room being cooled reaches its setpoint.

Tripping of the supply and/or exhaust fans and dampers is indicated by audible and visible alarms in the main control room and audible and visible alarms on the refueling floor.

9.4.3 Radwaste Building Ventilation System

9.4.3.1 Design Bases

The radwaste building ventilation system is designed to maintain a suitable environment that conforms to the equipment and personnel ambient requirements in that area. The specific temperature design criteria used in sizing the system components are as follows:

a. Outside air design temperatures

   1. Dry bulb temperature, -10°F to 95°F
   2. Wet bulb temperature, 75°F maximum.

b. Inside air design temperatures

   1. Radwaste office, control room, and Health Physics laboratory, 75°F ±5°F
   2. Other general access areas, below 105°F
   3. All other areas, below 125°F.

In order to maintain the general access areas as free from potential radioactivity as possible, the system is designed to direct airflow from general access areas to areas of higher potential radioactivity. Exfiltration of potentially contaminated air to the environment is prevented by maintaining the building at a lower pressure than the ambient pressure.

Filters are provided in both the intake and exhaust systems. The intake filters reduce the amount of dust particles that are induced into the radwaste building. The exhaust filters are provided to remove particulate activity from the ventilation exhausts of the radwaste building.

Local hoods are provided to exhaust fumes from selected equipment handling radioactive wastes. Each fume hood exhaust system is designed to maintain a minimum face velocity of 100 fpm across the door opening of the hood.

This system is required to function under normal operating conditions only and therefore is not specifically designed to operate after a DBA. This system is nonseismic.

9.4.3.2 System Description

The radwaste building ventilation system diagram is presented in Figures 9.4-5 and 9.4-6. The nominal size and type of principal system components are presented in Table 9.4-4.

The radwaste building ventilation system consists of two 100 percent supply fans, two 100 percent exhaust fans, one fume hood exhaust fan, and a radwaste control room and laboratory

air conditioning system. System fans, including booster fans, take suction through modulating dampers, a prefilter, and either a HEPA or a high-efficiency filter. The intake, exhaust, and fume hood fans all discharge through shutoff dampers. The supply fans take suction through louvers that are located above the radwaste building and supply a total of approximately 22,567 cfm to principal areas of various floor levels of the building. These fans also supply approximately 1650 cfm to the pipe tunnel between the radwaste and turbine buildings. Normally, air is supplied to general access areas and is exhausted from potentially contaminated areas. Wherever an exhaust duct is located between a general access area and an area of higher potential radio-activity, the inlet to the duct is fitted with a backdraft damper. This prevents exfiltration of air from a higher to a lower potential radioactive area.

Each of the radwaste building exhaust fans discharges approximately 31,818 cfm from the radwaste building. The exhaust fans take suction from all principal areas on the various floor levels of the building and from the vents of the following tanks and equipment:

a. Waste collector tank
b. Waste surge tank
c. Waste sample tanks
d. Floor drain sample tank
e. Floor drain collector tank
f. Waste sludge tank
g. Spent resin tank
h. Centrifuges
i. Condensate phase separators
j. Chemical waste tank
k. Radwaste evaporators.
l. Side Stream Liquid Radwaste Processing System (SSLRPS) Distillation Inlet Batch Tank
m. SSLRPS Post Treatment System Inlet Batch Tank
n. SSLRPS High and Low Rad Side Stream Evaporator Condenser Air Exhausts
o. SSLRPS Sample Batch Tank
p. SSLRPS Granular Activated Carbon Filter Tanks
q. SSLRPS Mixed Bed Filter Tanks

In addition, the hood exhaust fan in the Health Physics area exhausts approximately 6600 cfm from the radwaste laboratory fume hoods. The radwaste exhaust fans and the fume hood exhaust fan discharge air through a common exhaust vent located on top of the radwaste building. A radiation monitor is connected to the common exhaust header.

The radwaste office, radwaste control room, and Health Physics laboratory air conditioning subsystem consists of a double-duct air-handling unit, fan, steam heating coil, evaporator-type cooling coil, and remote water-cooled chiller unit which is cooled by the turbine

building closed cooling water system (TBCCWS). Steam to the heating coils is supplied by the auxiliary boilers. The system supply ductwork consists of three decks: hot, cold, and auxiliary. The hot and cold ducts go to mixing boxes that mix the air to the temperature required by each room. The auxiliary air is ducted to the low-level laboratory fume hood through a pressure reducing valve. Return air is ducted to the air-conditioning unit, where it is mixed with fresh air to make up for the air exhausted by the fume hood exhaust fan. The air-conditioning unit consists of a filter, preheat coil, fan, cooling coil, and heating coils with face and bypass dampers.

In addition to the normal ventilation systems, a Dedicated Shutdown Air Conditioning Unit is installed on the second floor of the Radwaste building to support post-fire dedicated shutdown as described in section 7.5.2.5 and Appendix 9A. It is a split system with the air-handling unit (AHU) located inside the room and outside condensing unit located on the adjacent roof. The AHU consists of an inlet filter, fan, evaporator-type cooling coil, condensate collection tank and condensate pump. The discharge ductwork and dampers cool the area in the vicinity of the dedicated shutdown panel. The condensing unit is a split system cooling condenser consisting of two refrigerant circuits that reject heat to the ambient outdoor air. Each circuit consists of a compressor/motor, coil and fan/motor.

Radiation monitors are provided in the building exhaust vent to monitor the release of airborne radioactivity. Upon detection of high radioactivity in the exhaust vent, an alarm is sounded in the main control room. Simultaneously, the building ventilation system fans are tripped off and the isolation dampers are closed automatically. A description of the monitoring systems is presented in Subsection 12.2.4.

9.4.3.3 Safety Evaluation

The radwaste building ventilation system is required to operate only during normal plant operation. However, the system does incorporate features to ensure its reliable and safe operation over the full range of normal plant operation. These features include the installation of standby exhaust and intake fans, and the use of backdraft dampers between general access areas and areas of potentially high radioactivity to prevent general access areas from becoming contaminated. In addition, the system is designed to prevent exfiltration of potentially contaminated air to the environment by maintaining the internal pressure of the radwaste building negative with respect to the ambient pressure.

The Dedicated Shutdown Air Conditioning Unit supports a post-fire shutdown from outside the Main Control Room as described in Section 7.5.2.5.

9.4.3.4 Inspection and Testing

All equipment has been factory inspected and tested in accordance with applicable equipment specifications, quality assurance requirements, and codes. The system ductwork and erection of equipment were inspected during various construction stages. Construction tests were performed on all components of the system. The system has been balanced for the design airflow and system operating pressures. Controls, interlocks, and safety devices on each system were adjusted and tested to ensure proper sequence of operation. Initial system flow distribution, valve operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Test program as discussed in Chapter 14.

The Dedicated Shutdown Air conditioning Unit is also balanced for its operating conditions. This system and its components will be tested and maintained periodically, as appropriate for the system safety classification.

9.4.3.5 Instrumentation and Controls

Each exhaust and supply fan is manually controlled from the main control room. In order to ensure that a negative pressure is maintained in the radwaste building while starting a fan combination, a time delay is provided to make the exhaust fan start first. In addition, the motor starters are interlocked after starting to make the associated fan shut down when either an exhaust or supply fan is tripped.

The outside barometric pressure is detected on each of three sides of the building and compared with the pressure being detected on the inside of the building. The difference between the lowest outside pressure and the inside pressure then is used as the control signal for modulating the inlet vanes of the ventilation system exhaust fan in order to maintain the building pressure lower than the outside pressure. Should the pressure in the building exceed the alarm setpoints, the fans will be manually tripped.

The balance-of-plant battery room cooling equipment is controlled by a thermostat.

The exhaust air radiation monitoring system will alarm in the main control room in the event of high radioactivity in the exhaust header. A radwaste building isolation pushbutton is provided in the main control room to isolate the exhaust and shut down the supply and exhaust fans.

The instrumentation and controls for the Dedicated Shutdown Air Conditioning System are discussed in Section 7.5.2.5.

9.4.4 Turbine Building Ventilation System

9.4.4.1 Design Bases

The turbine building ventilation system is designed to provide a suitable environment for personnel and to ensure the integrity of equipment and controls located in the turbine building.

The turbine building ventilation system was designed to maintain the temperature in general access areas below 105°F and to ensure that the temperature in all other areas within the turbine building was below 125°F, with the following exceptions:

a. The lube oil room, feedwater heater room, turbine building overhead crane bay and the second floor steam tunnel exceed the 105°F and 125°F design temperatures originally established. The maximum nominal temperature for the steam tunnel is 180°F (measured at the ceiling). The maximum nominal temperature for the other specified rooms is less than 150°F.

b. The offgas system charcoal adsorber room, which has its own air conditioning system to ensure that the temperature within the room is 70°F (Nominal), and the excitation equipment area, which has its own air cooling system to ensure

that the nominal temperature within the area does not exceed approximately 104°F.

The turbine building ventilation system is designed based on the following outside air temperatures:

a. Dry bulb temperature, -10°F to 95°F

b. Wet bulb temperature, 75°F maximum.

To maintain areas within the turbine building as free from potential radioactive contamination as possible, the system is designed to direct the airflow from areas of low potential radioactivity to areas of progressively higher potential radio-activity. The exhaust from the turbine building is monitored to detect and annunciate high radiation levels.

Exfiltration of potentially contaminated air to the environment is prevented by maintaining the building at a negative pressure with respect to the plant environment.

This system is required to function under normal plant operating conditions only and therefore is not specifically designed to operate after a DBA. The system components are designed to nonseismic requirements, with the exception of a few PAS system components located in the Auxiliary Building which are designed to seismic class II/I requirements.

9.4.4.2 System Description

The turbine building ventilation system is shown schematically in Figure 9.4-7. The nominal size and type of principal system components are presented in Table 9.4-5.

The turbine building is heated, cooled, and ventilated during normal and shutdown operation by a circulating air system. The building is heated by the ventilation air intake heating coils, and unit space heaters which are serviced by the auxiliary boiler of the plant. Cooling of the building is accomplished by circulating outside air throughout the ventilation system. All outside air enters the building through an intake located on top of the building and then passes through an evaporative air cooler cooling unit, the fresh air intake dampers, a filter bank, heating coils, a shutoff damper, and two of the three 50 percent-capacity intake fans. The air from these fans is generally distributed to areas of low potential radioactivity through distribution ducts. If the air is discharged into an area of high potential radioactivity, it is exhausted from that area by exhaust ducts and is discharged through the building exhaust enclosure. The air that is discharged into areas of low potential radioactivity is circulated through areas of higher potential radioactivity by the use of propeller fans. The air is then induced into the exhaust ductwork and discharged through the exhaust enclosure by two of the three 50 percent-capacity fans.

A radiation monitor is provided in the building exhaust vent to monitor the release of airborne radioactivity. Upon detection of high radioactivity in the exhaust vent, an alarm is sounded in the main control room. Simultaneously, the building ventilation system fans are automatically tripped off. A description of the monitoring systems is presented in Subsection 12.2.4.

The ventilation system also provides ventilation to the switchgear and exhaust fan rooms of the radwaste building and to the RBCCWS equipment area in the auxiliary building.

The offgas system charcoal adsorber room is provided with one air change per hour. Three cooling coil units are provided in the adsorber room, complete with fan, direct expansion cooling coil, and expansion valve. The compressor/condenser units are located outside the adsorber room. Cooling water is supplied to the condenser by the TBCCWS. The three cooling units are sized to maintain the adsorber room at 70°F during normal operation.

Gravity-type backdraft dampers having adjustable counterbalancing weights are provided on the discharge of propeller fans functioning to exhaust air from general access areas to potentially contaminated areas. This prevents backflow of contaminated air.

The excitation equipment area is provided with a separate air cooling system located on the second floor of the turbine building. Two 100% capacity, water cooled air coolers are provided to maintain the excitation equipment area at a nominal ambient temperature of 104°F during normal operation. Cooling water is supplied by the TBCCW System.

9.4.4.3 Safety Evaluation

The turbine building ventilation system is required to operate only during normal plant operation. However, the system incorporates features to ensure its reliable and safe operation over the full range of normal plant operation. These features include the installation of standby exhaust and intake fans, and the use of backdraft dampers between general access areas and areas of potentially high radioactivity to prevent general access areas from becoming contaminated. With respect to the higher temperature areas in the turbine building (i.e. areas above 105°F/125°F), an evaluation of the impact to equipment and personnel was performed. Results of the review show that the components are fully capable of functioning at the higher temperatures. Plant personnel are not required to access any of the high temperature areas during plant operation or following an accident condition in order to safely shut down and/or maintain the plant in a safe shutdown condition.

The system is designed to prevent exfiltration of potentially contaminated air to the environment by maintaining the internal pressure of the turbine building negative with respect to the ambient pressure.

A radiation monitor in the exhaust vent automatically trips the turbine building ventilating system in the event of a high radiation level.

9.4.4.4 Inspection and Testing

All equipment has been factory inspected and tested in accordance with applicable equipment specifications, quality assurance requirements, and codes. The system ductwork and erection of equipment were inspected during various construction stages. Construction tests were performed on all components of the system. The system has been balanced for the design airflow and system operating pressures. Controls, interlocks, and safety devices on each system were adjusted and tested to ensure proper sequence of operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Test program as discussed in Chapter 14.

9.4.4.5 Instrumentation and Controls

Each exhaust and supply fan is manually controlled from the main control room and, to ensure that a negative pressure is maintained in the turbine building while starting a fan combination, a time delay is provided to ensure that the exhaust fan starts first. In addition, the motor starters are interlocked after starting to ensure that the associated fan shuts down when either an exhaust or supply fan is tripped.

The outside barometric pressure is detected on each of the four sides of the building and compared with the pressure being detected on the inside of the building. Should the pressure in the building become excessively high or low, both the supply and exhaust fans are automatically tripped.

The adsorber room cooling equipment is controlled by a thermostat.

9.4.5 Drywell Cooling System

9.4.5.1 Design Bases

The cooling system is designed to maintain the average ambient temperature at 135°F. The drywell volumetric average temperature may increase over 135°F and up to 145°F. The area around the primary coolant recirculating pump motors is limited to 128°F during normal operation. During a scram, the system is designed to limit the temperature in the area below the reactor pressure vessel (RPV) to 185°F. The system is not required to operate following a LOCA and is isolated.

The design of the system permits periodic inspection and testing of the principal system components where they are accessible.

The power supply to the drywell cooling unit fans is designed to allow operation from the EDG-fed buses if normal ac power is not available.

The system components, excluding single-speed fan and fan motors but including fan-coil units and ducts, are Category I.

The cooling water supply piping to the fan-coil units in the drywell is provided with a check valve inside containment and one remote, manually actuated isolation valve outside containment. The supply line outboard isolation valves will automatically close on high drywell pressure initiation of EECWS. The cooling water return piping has two remote, manually actuated isolation valves, one on each side of the drywell wall for containment isolation.

Pressure relief valves are provided to relieve hydrostatic pressure caused by water expansion in the cooling water header subsequent to system isolation during and after a LOCA. The system will be operated during nitrogen purging of the containment in order to provide proper mixing of the containment atmosphere.

9.4.5.2 System Description

The system design for drywell cooling is presented in Figure 9.4-8. The nominal size and type of principal system components are listed in Table 9.4-6.

The system design is based on recirculating drywell air and cooling water through fan-coil units to limit the maximum drywell temperature. Cooling water is supplied by the RBCCWS under normal conditions and EECWS during abnormal operating conditions. However, high drywell pressure in conjunction with EECW operation will automatically close the EECW supply line outboard isolation valves.

The cooling system consists of 14 fan-coil coolers. Each unit is furnished with cooling coils, supply air fan, distribution ductwork, air-diffusing devices, and controls. Drywell temperature is maintained by mixing the cool air with the heated air at the heat source.

The fourteen drywell coolers are physically separated into two divisions, each consisting of five single-speed and two two-speed coolers. During normal plant operation, six of seven drywell cooler fans in each division are continuously operating in order to maintain the drywell atmosphere temperatures below the prescribed limits. All of the two-speed fans operate at high speed during normal operation.

All of the fan motors are provided with temperature detectors for the motor windings, a bearing vibration detector, and an integral space heater to maintain motor temperature above ambient during motor shutdown.

All ductwork is fabricated from carbon steel. Each section is galvanized after fabrication.

Electrical power for operation of the Category I cooling units is supplied from ESF buses, maintaining the divisional concept of separation and redundancy. Electrical power for operation of the single-speed fans is supplied from EDG restorable BOP buses. One-half of the fans are supplied from the Division I bus, the other half from the Division II bus. These buses are supplied from the EDG system if offsite electrical power is lost.

Cooling water is supplied to the coolers from two redundant EECWS piping loops during abnormal operation of the system. The loops are designated as Division I loop and Division II loop. Each loop is designed to supply cooling water to one-half of the coolers. Both loops are supplied by cooling water from a single header of the RBCCWS during normal operation.

9.4.5.3 Safety Evaluation

The drywell cooling system is not required for the safe shutdown of the plant. The system incorporates features that ensure its reliable operation over the full range of normal plant operations. These features include the separation of the system into two cooling divisions.

In the event of a postulated design basis accident (LOCA), all of the single-speed drywell cooler fans in AUTO are automatically tripped, and the four two-speed drywell cooler fans then automatically shift to slow speed. Plant procedures provide the necessary guidance for returning any of the drywell coolers to service.

This is done to preclude the possibility of two phase flow phenomenon accompanied by potential water hammer damage due to the initial formation of steam bubbles and their subsequent collapse by the introduction of colder supply water to the drywell cooling system.

Instrumentation is provided to monitor the temperature in various zones in the drywell and to annunciate high temperatures in the main control room.

The equipment and ducts inside the drywell are designed to Category I requirements. Relief valves on the EECWS preclude the possibility of coil rupture inside the drywell as a result of a rise in cooling water temperature and pressure after closure of the isolation valves.

All equipment meets the criteria of the appropriate system quality group classification and codes listed in Subsection 3.2.2.

Upon the loss of offsite power, all fans will trip off. All previously operating units will be restarted automatically using power supplied to the essential and BOP buses from the diesel generators, unless a LOCA signal is also present concurrent with the loss of offsite power.

9.4.5.4 Inspection and Testing

The system will not be accessible during reactor operation. Routine testing and inspection of the system will be accomplished during scheduled reactor shutdowns. However, monitoring devices are provided to determine that the fan-coil units are functioning properly during normal operation.

All equipment has been factory inspected and tested in accordance with the applicable equipment specifications, quality assurance requirements, and codes. System ductwork and the erection of equipment has been inspected for quality assurance during various construction stages. Construction tests were performed on all mechanical components. The system was balanced for the design airflow and system operating pressures. Controls, interlocks, and safety devices on each system were cold checked, adjusted, and tested to ensure proper sequence of operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Test program as discussed in Chapter 14.

9.4.5.5 Instrumentation and Controls

The drywell cooling system is a "full-on" system in that no modulating controls are installed to automatically reduce or maintain set temperatures. The cooling water flow through the cooling coils and the airflow are constant. Manual balance valves are provided at each air discharge diffuser to adjust the airflow. Cooling capacity can be reduced by shutting down individual unit coolers.

Controls required for remote operation of the system are located in the main control room.

Restart of the cooling units after a loss of offsite power is accomplished automatically on a permissive signal. Restart of the cooling units is initiated within 90 sec after a loss of offsite power, and all cooling units will be in operation within 120 sec after a loss of offsite power.

Thermocouples are provided in various areas in the drywell to monitor the temperature, with alarms and temperature indication provided in the main control room.

9.4.6 Steam Tunnel Cooling System

9.4.6.1 Design Bases

The system is designed to maintain the temperature in the steam pipe tunnel below 130°F and is nonseismic.

9.4.6.2 System Description

A diagram of the steam tunnel cooling system is shown in Figure 9.4-9. Nominal sizes and types of principal system components are listed in Table 9.4-7.

The system consists of two 100 percent-capacity cooling coils and fans that are connected to a common supply plenum. The supply ducts from the plenum deliver the cooled air to various areas within the tunnel. The air is returned to the cooling coils by the induced draft of the fan. Cooling water is supplied to the cooling coils by the RBCCWS.

Balancing dampers are provided in each supply duct downstream of the common supply plenum, and shutoff dampers are provided for each fan.

A pressure equalizing line between the steam tunnel and the reactor building functions primarily to maintain secondary containment negative atmospheric pressure within the steam tunnel in the event of a DBA.

9.4.6.3 Safety Evaluation

The steam tunnel cooling system is required to operate only during normal plant operation. To ensure high reliability of the system and safe operation over the full range of normal plant operation, two 100 percent fan-coil units are provided.

9.4.6.4 Inspection and Testing

All equipment has been factory inspected and tested in accordance with the applicable equipment specifications, quality assurance requirements, and codes. Controls and safety devices on each system have been cold checked, adjusted, and tested to ensure the proper sequence of operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Acceptance Test program as discussed in Chapter 14.

Routine maintenance and tests, based on the manufacturer's recommendations and/or operating/maintenance experience, are scheduled in accordance with the plant preventive maintenance program.

9.4.6.5 Instrumentation and Controls

The steam tunnel cooling system is manually controlled from the main control room.

A temperature-sensing element is located inside the steam tunnel and displays the temperature in the main control room. This same element sounds an alarm in the main control room when the steam tunnel air temperature exceeds 160°F.

9.4.7 Residual Heat Removal Complex Ventilation Systems

The RHR complex is composed of two identical divisions. The safety-related equipment in one division is 100 percent redundant to that in the other division. Each RHR division is composed of two diesel generator rooms, two diesel oil storage rooms, two switchgear rooms, and a pump room. The diesel-fuel-oil storage room ventilation system is used to purge the diesel generator room, diesel generator oil storage room, and air receiver room. This system operates continuously for all modes of plant operation. Each division of the RHR complex includes ventilation systems, as described in the following subsection. Failure analysis of the ventilation system for the RHR complex is provided in Table 9.4-8.

A typical ventilation system flow diagram for the RHR complex is presented in Figure 9.4-10. Nominal sizes and types of principal system components are listed in Tables 9.4-9 through 9.4-12.

9.4.7.1 Residual Heat Removal Diesel Generator Room Ventilation System

9.4.7.1.1 Design Bases

The diesel generator room ventilation systems are not required to operate during plant operation unless the ventilation equipment itself is in the manual mode, the diesel generators are running, or the room temperature rises above the room temperature controller setpoint.

The diesel generator room ventilation systems limit the temperature of each diesel room to a maximum of 122°F in conformance with the equipment requirements. The systems are available under all plant operating conditions.

Outside air with a maximum design temperature of 95°F is used to dissipate heat produced by the operation of the equipment in the diesel room.

The systems are designed to Category I requirements.

The fans are powered from ESF buses corresponding to the diesel generators they are serving.

The air intake and exhaust openings are located a sufficient distance apart to preclude reintroduction of exhaust air into the room. The outside air intakes and exhaust openings are protected by missile walls or slabs.

9.4.7.1.2 System Description

Each diesel room is provided with two 50 percent-capacity supply air fans. The operation of the fans induces outside air through a control damper and mixes the recirculation air from the diesel room in order to maintain the minimum air temperature above 65°F during diesel generator operation. The recirculation air path is provided with a control damper.

The mixed air is discharged into the diesel room by the supply fans. A part of the exhaust air is recirculated, depending upon the temperature of the return air. The balance of the exhaust air is forced through gravity dampers provided at the exhaust outlet.

Each division of the RHR complex is redundant to the other, thereby satisfying the need to make the respective equipment redundant.

9.4.7.1.3 Safety Evaluation

The loss of any ventilating fan or damper does not affect the safe-shutdown capability of the plant, since separate ventilation systems are provided for each redundant diesel generator.

To ensure maximum automatic fire-fighting capability, and to minimize potential cold-weather damage to equipment, the outside air damper fails closed upon loss of control power.

9.4.7.1.4 Inspection and Testing

All equipment has been factory inspected and tested in accordance with the applicable equipment specifications, quality assurance requirements, and codes. System ductwork and erection of equipment has been inspected for quality assurance requirements during various construction stages. Construction tests were performed on all mechanical components and the system was balanced for design airflow rates and system operating pressures. Controls, interlocks, and safety devices on each system were cold checked, adjusted, and tested to ensure proper sequence of operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Test program as discussed in Chapter 14.

Routine maintenance and tests, based on the manufacturer's recommendations and/or operating/maintenance experience, are scheduled in accordance with the plant preventive maintenance program.

9.4.7.1.5 Instrumentation

Each diesel generator room ventilation fan is interlocked to start with the operation of the respective diesel generator set. The ventilation fan will start automatically on high room temperature and can also be manually started by the switches provided in the main control room.

Temperature controllers sense temperature in each diesel generator room to modulate the intake and recirculation air dampers to maintain the room temperature within the design limits.

Indication of room temperature is provided locally. Damper position is indicated locally and in the main control room. An alarm is provided in the main control room for high and low room temperature. Supply fan "no airflow" indication is provided locally and is indicated and alarmed in the main control room.

9.4.7.2 Residual Heat Removal Switchgear Room Ventilation System

9.4.7.2.1 Design Bases

The switchgear room ventilation system is not required to operate during plant operation unless the ventilating equipment is in the manual mode, corresponding essential equipment is running, or the room temperature rises above the room temperature setpoint.

The system dissipates the heat produced by the switchgear room equipment, and limits the inside ambient temperature to 104°F under all plant operating conditions.

The outside air, with a design ambient temperature of 95°F, is used for cooling if necessary.

The system is designed to Category I requirements. Electrical power is furnished from the same ESF buses that supply power to equipment in the room being cooled.

The air intake and exhaust openings are located a sufficient distance apart to preclude reintroduction of exhaust air into the system. The outside air intakes and exhaust openings are protected by missile barriers.

9.4.7.2.2 System Description

Each switchgear room system consists of an intake air duct, high efficiency filter, and two 50 percent-capacity fans in parallel, arranged in the order given. The fan outlets are connected to a common supply air duct that distributes air to the switchgear room.

An outside air control damper is provided on the outside air duct, and a recirculation damper is provided on the mixing box upstream of the supply air filter. The operation of fans induces outside air and recirculated air into the mixing box to maintain the minimum air temperature above 65°F.

The mixed air is discharged in the switchgear room through the supply air duct system. A part of the exhaust air is recirculated, depending upon room temperature, and the balance of the air is forced through gravity dampers provided at the exhaust outlet.

9.4.7.2.3 Safety Evaluation

The loss of any ventilating fan does not affect the safe-shutdown capability of the plant, since a separate ventilation system is provided for each switchgear room.

To ensure maximum automatic fire-fighting capability, and to minimize potential cold-weather damage to equipment, the outside air damper fails closed upon loss of control power.

9.4.7.2.4 Inspection and Testing

All equipment was factory inspected and tested in accordance with the applicable equipment specifications, quality assurance requirements, and codes. System ductwork and the erection of equipment were inspected during various construction stages. Construction tests were performed on all mechanical components, and the system was balanced for the design airflow rates and system operating pressures. Controls, interlocks, and safety devices on each system were cold checked, adjusted, and tested to ensure the proper sequence of operation. Initial system flow distribution, valve operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Test program as discussed in Chapter 14.

Routine maintenance and tests, based on the manufacturer's recommendations and/or operating/maintenance experience, are scheduled in accordance with the plant preventive maintenance program.

9.4.7.2.5 Instrumentation and Controls

Each switchgear room ventilation system is started automatically on high room temperature or when its corresponding diesel generator sets are started. In addition, manual switches are provided in the main control room. A temperature controller located in the switchgear room modulates the intake and recirculation air dampers to maintain the room temperature within the design limits.

Room temperature and filter high differential pressure are indicated locally. An alarm is provided in the main control room for high and low room temperature. Supply fan "no airflow" indication is provided locally and is indicated and alarmed in the main control room.

9.4.7.3 Pump Room Ventilation System

9.4.7.3.1 Design Bases

The pump room ventilation system is not required to operate during normal plant operation unless the ventilating equipment itself is in the test mode, the corresponding essential pump is running, or the room temperature rises above the room temperature controller setpoint.

The system provides ventilation and limits the temperature of the pump room to 104°F.

The system dissipates the heat produced by the pumps and associated equipment, limiting the inside ambient temperature to 104°F under all plant operating conditions. The outside air, with a design ambient temperature of 95°F, is used for cooling.

The system is designed for Category I requirements. Electrical power is furnished from the same ESF buses that supply power to the equipment in the room being cooled.

The air intake and exhaust openings are located a sufficient distance apart to preclude reintroduction of exhaust air to the system. The outside air intakes and exhaust openings are protected by missile barriers.

9.4.7.3.2 System Description

The pump room ventilation system consists of an intake air duct, high efficiency filter, and two 50 percent-capacity fans in parallel, arranged in the order given. The fan outlets are connected to a common supply air duct that distributes air in the pump room.

An outside air control damper is provided on the outside air duct and a recirculation damper is provided on the mixing box upstream of the supply air filter. The operation of fans induces outside air and recirculated air into the mixing box to maintain a mixed air temperature above 65°F.

The mixed air is discharged to the pump room through the supply air duct system. A part of the exhaust air is recirculated, depending upon the room temperature, and the balance of the air is forced through the gravity dampers provided at the exhaust outlet. The intake and exhaust air openings are protected from missiles.

9.4.7.3.3 Safety Evaluation

The loss of the ventilating system does not affect the safe shutdown capability of the plant, since separate ventilation systems are provided for each redundant pump room.

To ensure maximum automatic fire-fighting capability and to minimize potential cold-weather damage to equipment, the outside air damper fails closed upon loss of control power.

9.4.7.3.4 Inspection and Testing

All equipment was factory inspected and tested in accordance with the applicable equipment specifications, quality assurance requirements, and codes. System ductwork and the erection of the equipment were inspected for quality assurance requirements during various construction stages. Construction tests were performed on all mechanical components, and the system was balanced for the design airflow rates and system operating pressures. Controls, interlocks, and safety devices on each system were cold checked, adjusted, and tested to ensure the proper sequence of operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Test program as discussed in Chapter 14.

Routine maintenance and tests, based on the manufacturer's recommendations and/or operating/maintenance experience, are scheduled in accordance with the plant preventive maintenance program.

9.4.7.3.5 Instrumentation and Controls

The pump room ventilation system is started automatically on high temperature or when the corresponding EDGs are running. Manual switches are provided in the main control room.

Room temperature and filter high differential pressure are indicated locally. An alarm is provided in the main control room for abnormal high or low room temperature. Supply fan "no airflow" indication is provided locally and is indicated and alarmed in the main control room.

9.4.7.4 Diesel-Fuel-Oil Storage Room Ventilation System

9.4.7.4.1 Design Bases

The diesel-fuel-oil storage room ventilation system is used to pull an adequate quantity of ventilation air through the diesel generator room, CO_2 storage room, fuel-oil storage room, and ventilation equipment room to maintain the temperature in these rooms below 104°F while the diesel is not operating and below 125°F when the diesel is operating. This system is designed to operate continuously for all modes of plant operation.

The outside air, with a design ambient temperature of 95°F, is used for cooling.

The system is designed to Category I requirements. The system is powered from ESF buses corresponding to the respective diesel generator.

9.4.7.4.2 System Description

The system exhausts air through exhaust ducts from the diesel generator room, CO_2 storage room, fuel-oil storage room, and ventilation equipment room. Air is induced through exhaust ducts by an exhaust fan. The exhaust air is discharged to the atmosphere through a missile-protected exhaust opening.

Nominal sizes and types of principal system components are listed in Table 9.4-12. Fire dampers are provided between rooms.

9.4.7.4.3 Safety Evaluation

The loss of any ventilating fan does not affect the safe-shutdown capability of the plant, since a ventilation system for each set of redundant rooms is provided.

9.4.7.4.4 Inspection and Testing

All equipment was factory inspected and tested in accordance with the applicable equipment specifications, quality assurance requirements, and codes. System ductwork and the erection of equipment were inspected for conformance with drawing and specification requirements during various construction stages. Construction tests were performed on all mechanical components, and the system was balanced for the design air and system operating pressures. Controls, interlocks, and safety devices on each system were cold checked, adjusted, and tested to ensure the proper sequence of operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Test program as discussed in Chapter 14.

Routine maintenance and tests, based on the manufacturer's recommendations and/or operating/maintenance experience, are scheduled in accordance with the plant preventive maintenance program.

9.4.7.4.5 Instrumentation and Controls

Manual switches are provided in the main control room. An indication of the temperature in each room except for the CO_2 storage room, fuel-oil storage room, and diesel generator ventilation equipment room is provided, along with an alarm in the main control room for high room temperature.

9.4.7.5 RHR Complex Heating System

9.4.7.5.1 Design Basis

Electric unit heaters are provided for the following areas:

a. RHR pump room
b. Diesel generator room
c. CO_2 storage room
d. Switchgear room

e. Switchgear ventilation equipment room

f. Diesel generator ventilation equipment room.

The electric unit heaters will maintain the RHR complex equipment rooms at an ambient temperature of 65°F during normal operation and shutdown. The electric unit heaters can be powered from an essential bus. The operation of the heaters inside the diesel generator rooms is required to support the standby readiness of each diesel by ensuring the temperature inside the diesel generator rooms remains above a design minimum value of 40°F. This ensures the initial combustion air inside the EDG intake manifolds remains above the 40°F minimum value necessary to support fast, cold-starting.

9.4.7.5.2 System Description

The electric unit heaters are self-contained with their own fan, heating coil, and thermostat. The heaters recirculate room air to maintain area air temperatures above 65°F. A Control Room Process Computer point alarms if the EDG room temperature begins to approach the 40°F design minimum value so that appropriate corrective action may be taken to restore the room environment.

9.4.7.5.3 Safety Evaluation

The RHR Complex Heating System has no safety design bases. However, the system is relied upon to maintain the temperature of the initial combustion air above the 40°F design minimum required for reliable fast, cold-weather starting. Thus, while the loss of the unit heaters during normal operation does not directly affect the safe-shutdown capability of the plant, EDG operability is compromised if the room is not maintained above the required 40°F.

9.4.7.5.4 Inspection and Testing

All unit heaters were factory inspected and tested in accordance with the applicable equipment specifications. Erection of the heaters was in conformance with drawing and specification requirements. Construction tests were performed on the unit heater system to ensure that the heaters will provide the desired flow distribution. Controls and safety devices for each unit heater were checked and adjusted to ensure proper operation. During the heating season, the heating units are periodically inspected to verify continued proper operation. Operator rounds are performed to verify EDG room temperatures are within the design envelope daily.

9.4.7.5.5 Instrumentation and Controls

Control of the electrical unit heaters is by an individual thermostat built into each unit heater.

9.4.8 Plant Heating System

9.4.8.1 Design Bases

The plant heating system is designed to limit the minimum temperature inside the reactor building, auxiliary building, radwaste building, and other miscellaneous facilities to 65°F. The system is designed to preheat the ventilation air to 65°F and provide perimeter heating to these buildings during the winter. The turbine building heating system is similar. However, the supply air temperature may be controlled in a range of 55°F to 65°F during the heating season.

The system performs its function during normal plant operation and shutdown. The heating steam isolation valves and piping on either side of the secondary containment boundary are seismic I. The remainder of the plant heating system is nonseismic. The system is required to function under normal plant operating conditions. Safety related motor operated isolation valves in the heating steam piping at the secondary containment boundary have been provided to allow the operators to isolate the steam piping in the event of a postulated break in the heating steam piping.

9.4.8.2 System Description

A diagram of the plant heating system is shown in Figure 9.4-11. Nominal sizes and types of principal system components are listed in Table 9.4-13. Steam is used for plant heating in the reactor, auxiliary, turbine, and radwaste buildings. Electrical unit heaters are provided to heat all other buildings. Steam is supplied to heating coils, located in the building ventilation supply system, and to unit heaters from the auxiliary steam boilers via a 15 psig pressure reducing station. To ensure that the steam pressure in the heating system does not exceed 15 psig, the reducing station is equipped with a pressure relief valve. The unit heaters are provided to offset transmission heat loss through exposed walls and roofs. The condensate from the heating coils is returned to a deaerator located in the auxiliary boiler room.

Permanent fuel oil, feedwater, and steam line connections are provided so that a portable boiler can be connected to the existing system to supply steam in a timely manner in the event of failure of the auxiliary boilers.

The system is designed to maintain the building temperature at 65°F, with an ambient temperature of -10°F.

9.4.8.3 Safety Evaluation

The operation of the plant heating system is not required to ensure the safe shutdown of the plant.

The system incorporates features that ensure its reliable operation over a full range of normal plant operations. These features include the installation of control valves on the coil inlet and multiple condensate return pumps.

Instrumentation is provided to monitor the temperature and pressure at various points.

Necessary safety features are provided for the operation of auxiliary boilers.

9.4.8.4 Inspection and Testing

All equipment was factory inspected and tested in accordance with the applicable equipment specifications, quality assurance requirements, and codes. System ductwork and the erection of equipment were inspected for quality assurance during various construction stages. Construction tests were performed on all mechanical components, and the system was balanced for the design water flows and system operating pressures.

Controls, interlocks, and safety devices were cold checked, adjusted, and tested to ensure their proper operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Acceptance Test program as discussed in Chapter 14.

Maintenance is performed on a scheduled basis in accordance with the recommendations of the equipment manufacturer and/or operating/maintenance experience.

9.4.8.5 Instrumentation and Controls

The plant heating system works in conjunction with various ventilation systems in the plant. The system is put in service by manually starting the auxiliary boiler. The steam temperature and pressure at various points are monitored and indicated. The capacity control of the coils is achieved by modulating the inlet steam and not by throttling the condensate quantity, thereby precluding the possibility of coil freezeup resulting from low steam flow conditions.

The unit heaters are controlled by locally mounted thermostats with integrated on-off-auto switches.

9.4.9 General Service Water Pump House Heating and Ventilation System

9.4.9.1 Design Bases

The system is designed to maintain the temperature in the pump and switchgear rooms between 50°F and 120°F during all normal modes of plant operation and during plant shutdown periods. The ambient design temperature is between -10°F and 95°F.

The system is nonseismic.

9.4.9.2 System Description

A diagram of the general service water pump house heating and ventilation system is shown in Figure 9.4-12. Nominal sizes and types of principal system components are listed in Table 9.4-14.

The pump room is provided with three propeller-type fans equipped with gravity backdraft dampers. The fans are mounted in the roof of the pump house. A centrifugal blower unit equipped with an air filter and an intake damper is mounted on an outside wall of the switchgear room.

The pump room fans draw outside air into the room through intake louvers located at either end of the pump house. The switchgear room fan supplies outside air to the room and forces the heated air into the pump room.

Five electrical heaters are provided in the pump room and one in the switchgear room. The heating units heat and recirculate room air.

9.4.9.3 Safety Evaluation

This system is not required for the safe shutdown of the plant. An indication of high and low room temperatures, along with an alarm, is provided in the main control room.

9.4.9.4 Inspection and Testing

All equipment was factory inspected and tested in accordance with the applicable equipment specifications, quality assurance requirements, and codes. Controls, interlocks, and safety devices on each system were cold checked, adjusted, and tested to ensure the proper sequence of operation. Initial system flow distribution, valve operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Acceptance Test program as discussed in Chapter 14.

Routine maintenance and tests, based on the manufacturer's recommendations and/or operating/maintenance experience, are scheduled in accordance with the plant preventive maintenance program.

9.4.9.5 Instrumentation and Controls

Heating and ventilating of each room are controlled by a thermostat located in that room. Each ventilating fan is equipped with a local on-off switch. High and low temperatures for the pump and switchgear rooms are alarmed in the main control room.

9.4.10 Circulating Water Pump House Ventilation System

9.4.10.1 Design Bases

The circulating water pump house ventilation system is designed to limit the temperature in the pump room, switchgear room, and chemical treatment room to a maximum of 104°F.

The ventilation system is nonseismic.

9.4.10.2 System Description

Nominal sizes and types of principal system components are listed in Table 9.4-15.

The circulating water pump house has three separate ventilation systems, one each for the pump room, switchgear room, and chemical treatment room.

9.4.10.2.1 Pump Room

At each circulating water pump location, there is one exhaust fan that draws room air through the pump motor shroud for motor cooling and provides ventilation of the pump area during pump operation. For operation during cold weather, warm air from the pump motor shroud is mixed with a mixture of recirculated room air and outside air to maintain room temperature. During warm-weather operation, outside air is drawn directly into the pump area, through the pump motor shroud, and discharged back to the outside, thereby providing pump area ventilation and adequate cooling for the pump motor. Supplemental electric heating is provided to maintain room temperature well above freezing during cold weather when the circulating water pump is out of service.

9.4.10.2.2 Switchgear Room

Operation of the switchgear room ventilation system is initiated when the switchgear room temperature reaches 80°F. The exhaust fan starts and the outside air damper opens automatically.

9.4.10.2.3 Chemical Treatment Room

The ventilation fan in the chemical treatment room draws in air from the adjacent pump room when the chemical treatment room temperature is below 80°F. Above 80°F, the pump room damper closes and the outside air damper opens. When the chemical treatment room temperature is below 50°F, a room thermostat regulates the electric duct heaters at the ventilating fan.

9.4.10.3 Safety Evaluation

The circulating water pump house ventilation systems are required to operate only during normal plant operation.

9.4.10.4 Tests and Inspections

All equipment was factory inspected and tested in accordance with applicable equipment specifications, quality assurance requirements, and codes. The system ductwork and erection of equipment were inspected during various construction stages. Construction tests were performed on all components of the system. The system was balanced for the design airflow and system operating pressures. Controls, interlocks, and safety devices on each system were adjusted and tested to ensure proper sequence of operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Acceptance Test program as discussed in Chapter 14.

9.4.10.5 Instrumentation

All rooms are provided with high and low temperature alarms in the main control room. Flow status lights are provided for all rooms and an alarm is provided for a loss of ventilation flow in the pump room.

9.4.11 Motor-Generator Set Cooling System

9.4.11.1 Design Bases

The motor-generator (M-G) set cooling system is designed to provide 104°F cooling air to the reactor recirculating pump M-G sets.

The system is nonseismic.

9.4.11.2 System Description

A diagram of the M-G set cooling system is shown in Figure 9.4-13. Nominal sizes and types of principal system components are listed in Table 9.4-16.

Three 50 percent fan-coil cooling units are provided to cool the two reactor recirculating pump M-G sets located on the fourth floor of the reactor building. The cooling unit fans induce room air to flow through each generator and motor. The air is then drawn through a common exhaust duct system to the fan-coil units. The fan-coil unit cools the air and discharges it back into the room. Two of the three fan-coil units are normally operating, with the third on standby. The standby unit is automatically started if the discharge air temperature in one of the two operating cooling units exceeds 125°F. The cooling coils are cooled by the RBCCWS.

9.4.11.3 Safety Evaluation

The M-G set cooling system is required to operate only during normal plant operation.

In order to ensure that the system has a high reliability during normal plant operation, three 50 percent fan-cooling coil units are provided.

9.4.11.4 Inspection and Testing

All equipment was factory inspected and tested in accordance with the applicable equipment specifications, quality assurance requirements, and codes. Controls, interlocks, and safety devices on each system were cold checked, adjusted, and tested to ensure the proper sequence of operation. Initial system flow distribution, valve and damper operability, instrumentation and control loop checks, and alarm setpoints were done in accordance with the Preoperational Acceptance Test program as discussed in Chapter 14.

Routine maintenance and tests, based on the manufacturer's recommendations and/or operating/maintenance experience, are scheduled in accordance with the plant preventive maintenance program.

9.4.11.5 Instrumentation and Controls

Two M-G set cooling units are selected to operate manually when the M-G sets need to be started. If after 30 sec the chosen fan does not provide airflow, it will be tripped and a standby fan started. Temperature switches are also provided in the discharge of the cooling units to trip above 125°F and automatically start a standby fan. Alarms are provided in the

main control room for "motor trip" and "M-G set vent air fan auto start" to alert the operator that the automatic trip has occurred.

TABLE 9.4-1 CONTROL CENTER HVAC SYSTEM MAJOR COMPONENTS DESCRIPTIONS

A.	Air Handling Equipment Trains	
	Type	Built-up
	Quantity	Two, 100 percent capacity
1.	Air Handling Units	
	Type	Blow-through
	Quantity	Two, 100 percent capacity
	Capacity: cooling, Btu/hr	12×10^5
	heating, Btu/hr	5.3×10^5
2.	Supply Air Fans	
	Type	Centrifugal
	Drive	Belt, variable speed
	Capacity, scfm	37,000
	Total static pressure, in. H_2O	3.6
	Motor, hp	40
3.	Supply Air Filters	
	Type	Fiberglass roll filter with electrostatic precipitator
	Quantity	Two, 100 percent capacity
	Efficiency (NBS Dust Spot Test)	90 percent
	Capacity, scfm	37,000
	Pressure Drop (Clean), in. H_2O	0.16
4.	Return Air Fans	
	Type	Centrifugal
	Drive	Belt
	Quantity	Two, 100 percent capacity
	Capacity, scfm	35,550
	Total static pressure, in. H_2O	2.5
	Motor, hp	25
B.	Refrigeration Units	
	Type	Centrifugal packaged chillers (water cooled)
	Quantity	Two, 100 percent capacity
	Capacity, tons	100
	Power, kW	85

TABLE 9.4-1 CONTROL CENTER HVAC SYSTEM MAJOR COMPONENTS DESCRIPTIONS

C. Chilled Water Pumps

Type	Centrifugal, vertically split casing
Total dynamic head capacity, gpm	300
Total dynamic head, ft H_2O	50
Motor, hp	7.5

D. Emergency Makeup Air Filter Trains

Type	Built-up
Quantity	One, 100 percent capacity

Components of emergency makeup air filter trains

1. Fans

Type	Centrifugal
Drive	Belt
Quantity	Two, 100 percent capacity
Capacity, scfm	3000
Static pressure, in. H_2O	11
Motor, hp	20

2. Makeup Air Filter

a. Prefilter-Moisture Separator

Type	Baffles & fiberglass
Medium	Fiberglass 5 1/2 in.
Efficiency (per NBS Dust Spot Test)	85 percent
Pressure Drop (Clean), in. H_2O	0.80 in. at 1800 cfm flow saturated air at 70 °F

b. Electric Heaters

Type	Resistance, single stage
Quantity	Two
Capacity, kW	12

c. HEPA Filters

Type	High-efficiency particulate dry
Medium	Glass fiber (fire retardant)
Efficiency	Design efficiency of 99.97 percent for 0.3μm particles or larger.

TABLE 9.4-1 CONTROL CENTER HVAC SYSTEM MAJOR COMPONENTS DESCRIPTIONS

c. HEPA Filters (cont.)	
	Installed and tested such that an overall decontamination efficiency of 95 percent is assumed for removal of particulate iodine
Pressure drop (Clean) in. H_2O	1.1
d. Charcoal Adsorber	
Type	2-in. gasketless
Quantity	One bank
Medium	Impregnated charcoal
Efficiency, percent	Lab tested to ensure a 99 percent removal efficiency for methyl iodide
	Installed and tested in the adsorber housing such that an overall decontamination efficiency of 95 percent is assumed for removal of all forms of gaseous iodine
Capacity, cfm	3000 by design, 1800 maximum during operation
3. Recirculation Air Filter	
a. HEPA Filters	
Type	High-efficiency particulate dry
Medium	Glass fiber (fire retardant)
Efficiency	Design efficiency of 99.97 percent for 0.3μm particles or larger.
	Installed and tested such that an overall decontamination efficiency of 95 percent is assumed for removal of particulate iodine.
Pressure Drop (Clean), in. H_2O	1.1
b. Charcoal Adsorber	
Type	4-in. gasketless
Quantity	One bank

TABLE 9.4-1 CONTROL CENTER HVAC SYSTEM MAJOR COMPONENTS DESCRIPTIONS

b. Charcoal Adsorber (cont.)

Medium	Impregnated charcoal
Efficiency	Lab tested to ensure a 99 percent removal efficiency for methyl iodide. Installed and tested in the adsorber housing such that an overall decontamination efficiency of 95 percent is assumed for removal of all forms of gaseous iodine.
Capacity, cfm	3000

E. Control Center Air Conditioning Equipment Room Fan-Coil Cooling Units

1. Type — Package

2. Quantity — Two

3. Components of each unit

a. Fan

Type	Centrifugal
Quantity	One
Drive	Belt
Capacity, scfm	1200
Static pressure, in. H_2O	1.03
Motor, hp	1.0

b. Heat Exchange Coil

Type	Finned tube
Face velocity, ft/minute	449
Capacity, Btu/hr	49,100

F. Control Center Computer Room Air Conditioning Units

1. Type — Horizontal package

2. Quantity — Two

3. Components of each unit

TABLE 9.4-1 CONTROL CENTER HVAC SYSTEM MAJOR COMPONENTS DESCRIPTIONS

a. Air Conditioning Unit

Fan type	Centrifugal
Quantity	One
Drive	Belt
Capacity, scfm	6200
Static pressure, in. H_2O	2
Motor, hp	7-1/2
Cooling coil type	6-row direct expansion
Face velocity, ft/minute	500
Capacity, Btu/hr - nominal	180,000

b. Refrigeration Compressors

Quantity	Two
Size, tons	15
Type	Semi-hermetic reciprocating 3-stage unloading
Motor amps (RLA)	29 @ 460 V
Refrigerant	R-22

c. Air-Cooled Condensers

Quantity	Two
Gross heat rejection each, Btu/hr	229,000
Motors per unit	Three
Motor, hp (each)	3/4

TABLE 9.4-2 MAIN CONTROL ROOM AIR CONDITIONING SYSTEM SINGLE-FAILURE ANALYSIS

System	Component Malfunction	Comments
1. Offsite power	Not available	Emergency diesels start and supply electrical load to systems
2. Emergency diesels	One not available	The operative diesel supplies necessary to power one of the System's redundant active components
3. Main control room air conditioning	Rupture of equipment casing and/or ducts	Consideration has been given in the detailed design to withstand the design- basis temperature, pressure, and seismic forces during a postaccident situation. The equipment and components are also inspectable and protected against credible missiles
	Rupture of chiller piping or loss of one of the chiller systems	Rupture is not considered credible since all piping is designed to withstand the design-basis temperature, pressure, and seismic forces during a post accident situation and is inspectable and protected from missiles. 100 percent redundant control center air conditioning systems are provided. The operating division will be shut down and the standby division manually started
	System fan fails	100 percent redundant fans are provided. Loss of a fan will be alarmed in the control room. The operating division must be shut down and the standby division manually started
	Normal intake or exhaust isolation damper fails to close	Two redundant dampers provided in series in each line. Each damper in series receives power from a separate ESF bus. This ensures that at least one damper in each line will close
	One of the emergency filtration intake isolation dampers fails to close during a chlorine accident	Four dampers provided, two per division in each line. The dampers are normally closed and fail closed
	One of the kitchen/washroom exhaust isolation dampers fails to close during a chlorine accident	Four dampers provided, two in each exhaust duct. Each damper in each exhaust duct receives power from a separate ESF bus. This ensures that at least one damper will close in each exhaust duct.
	One of the emergency filtration intake isolation dampers fails to open	Redundant intake lines provided. Two intake isolation dampers provided in each line. Both dampers in series receive power from the same ESF bus. This ensures that two dampers in series will open.
	Smoke/Halon dampers for relay room, cable spreading room or computer room close	Loss of cooling to the respective room. Manual action is required to reopen dampers.

TABLE 9.4-3 REACTOR/AUXILIARY BUILDING VENTILATION AND COOLING SYSTEM COMPONENTS DESCRIPTIONS

A.	Reactor Auxiliary Building Ventilation Supply	
1.	Type	Built-up
2.	Components	
a.	Fans	
	Type	Vaneaxial
	Quantity	Three, 50 percent capacity
	Drive	Direct
	Capacity, scfm	52,088 each
	Total pressure, in. H_2O	4.75
	Motor, hp	75
b.	Filters	
	Type	Disposable cartridge
	Quantity	One bank
	Media	Glass fiber (fire retardant)
	Efficiency (NBS Dust Spot Test)	85 percent
	Capacity, scfm	104,176
	Pressure Drop (Clean), in. H_2O	0.5
c.	Heating Coils	
	Type	Finned tube
	Quantity	One bank
	Capacity, Btu/hr	8.4×10^6
B.	Reactor Auxiliary Building Ventilation Exhaust Fans	
	Type	Vaneaxial
	Quantity	Three, 50 percent capacity
	Drive	Direct
	Capacity, scfm	54,388 each
	Total pressure, in. H_2O	5.1
	Motor, hp	75
C.	Battery Room Exhaust Fans	
	Type	Centrifugal
	Drive	Direct
	Quantity	Four
	Capacity, scfm	400

TABLE 9.4-3 REACTOR/AUXILIARY BUILDING VENTILATION AND COOLING SYSTEM COMPONENTS DESCRIPTIONS

Total static pressure, in. H_2O	1.7
Motor, hp	1

D. HPCI Pump Cubicle Fan-Coil Unit

1. Type	Package
2. Quantity	One
3. Components of each unit	
a. Fan	
Type	Centrifugal
Quantity	One
Drive	Belt
Capacity, scfm	6400
Total static pressure, in. H_2O	3.3
Motor, hp	7.5
b. Heat Exchange Coil	
Type	Finned tube
Face velocity, ft/minute	650
Capacity, Btu/hr	2.95×10^5

E. Core Spray Pump Cubicle Fan-Coil Unit

1. Type	Package
2. Quantity	One
3. Components of each unit	
a. Fans	
Type	Centrifugal
Quantity	Two
Drive	Belt
Capacity, scfm	11,800 total
Total static pressure, in. H_2O	4.1
Motor, hp	15
b. Heat Exchange Coil	

TABLE 9.4-3 REACTOR/AUXILIARY BUILDING VENTILATION AND COOLING SYSTEM COMPONENTS DESCRIPTIONS

Type	Finned tube
Face velocity, ft/minute	690
Capacity, Btu/hr	5.4×10^5

F. Core Spray/RCIC Pump Cubicle Fan-Coil Unit

1. Type — Package
2. Quantity — One
3. Components of each unit

a. Fans

Type	Centrifugal
Quantity	Two
Drive	Belt
Capacity, scfm	14,500
Total static pressure, in. H_2O	3.3
Motor, hp	15

b. Heat Exchange Coil

Type	Finned tube
Face velocity, ft/minute	645
Capacity, Btu/hr	6.25×10^5

G. RHR Pumps Cubicles Fan-Coil Units

1. Type — Package
2. Quantity — Two
3. Components of each unit

a. Fans

Type	Centrifugal
Quantity	Two
Drive	Belt
Capacity, scfm	18,200
Total static pressure, in. H_2O	3.5
Motor, hp	20

TABLE 9.4-3 REACTOR/AUXILIARY BUILDING VENTILATION AND COOLING SYSTEM COMPONENTS DESCRIPTIONS

b. Heat Exchange Coil

Type	Finned tube
Face velocity, ft/minute	589
Capacity, Btu/hr	8.43×10^5

H. Essential Switchgear Room Fan-Coil Units

1. Type	Package
2. Quantity	Four

3. Components of each unit

a. Fans

Type	Centrifugal
Quantity	Two
Drive	Belt
Capacity, acfm	9750
Total static pressure, in. H_2O	2.5
Motor, hp	5

b. Cooling Coil

Type	Finned tube
Face velocity, ft/minute	696
Capacity, Btu/hr	10.5×10^4

I. SGTS Cubicle Fan-Coil Units

1. Type	Package
2. Quantity	Two

3. Components of each unit

a. Fans

Type	Centrifugal
Quantity	One
Drive	Belt
Capacity, scfm	9030
Total static pressure, in. H_2O	0.5
Motor, hp	3

TABLE 9.4-3 REACTOR/AUXILIARY BUILDING VENTILATION AND COOLING SYSTEM COMPONENTS DESCRIPTIONS

b. Heat Exchange Coil

Type	Finned tube
Face velocity, ft/minute	516
Capacity, Btu/hr	1.95×10^5

J. Deleted

K. Control Air Compressor Fan-Coil Units

1. Type	Package
2. Quantity	Two

3. Components of each unit

a. Fans

Type	Centrifugal
Quantity	One
Drive	Belt
Minimum capacity, acfm	4600
Total static pressure, in. H_2O	Free delivery
Motor, hp	5

b. Heat Exchange Coil

Type	Finned tube
Minimum capacity, Btu/hr	49,500

L. Thermal Recombiner Fan-Coil Units

1. Type	Package
2. Quantity	Two

3. Components of each unit

a. Fans

Type	Centrifugal
Quantity	One
Drive	Belt
Capacity, scfm	6500

TABLE 9.4-3 REACTOR/AUXILIARY BUILDING VENTILATION AND COOLING SYSTEM COMPONENTS DESCRIPTIONS

Total static pressure, in. H_2O	Free delivery
Motor, hp	5

b. Heat Exchange Coil

Type	Finned tube
Face velocity, ft/minute	812
Capacity, Btu/hr	68,975

M. EECW Pump Fan-Coil Units

1. Type — Package
2. Quantity — Two
3. Components of each unit

a. Fans

Type	Centrifugal
Quantity	One
Drive	Belt
Minimum capacity, acfm	4600
Total static pressure, in. H_2O	Free delivery
Motor, hp	5

b. Heat Exchange Coil

Type	Finned tube
Minimum capacity, Btu/hr	49,500

N. Battery Room Air Conditioning Unit

1. Type — Package
2. Quantity — One
3. Components of each unit

a. Fans

Type	Centrifugal
Quantity	One
Drive	Belt
Capacity, scfm	6000

TABLE 9.4-3 REACTOR/AUXILIARY BUILDING VENTILATION AND COOLING SYSTEM COMPONENTS DESCRIPTIONS

Total external static pressure, in. H_2O	0.5
Motor, hp	5

b. Evaporator Coil

Type	Finned tube
Face velocity, ft/minute	500
Capacity, Btu/hr	1.38×10^5

c. Condenser

Type	Shell and tube, water cooled

d. Compressor

Type	Hermetic
Nameplate data	26 amp @ 460-V ac

O. Battery Charging Area Fan-Coil Units

1.	Type	Horizontal package
2.	Quantity	Two

3. Components of each unit

a. Fans

	Division I	Division II
Type	Centrifugal	Centrifugal
Quantity	One	One
Drive	Belt	Belt
Capacity, acfm	5370	2800
Total static pressure, in. H_2O	1/3	1/4
Motor, hp	5	2

b. Cooling Coil

Type	Fin-tube, water cooled	
Capacity, Btu/hr	69,000	33,000

P. Switchgear Room Air Conditioning Units

1.	Type	Split system
2.	Capacity, Btu/hr	120,000

TABLE 9.4-3 REACTOR/AUXILIARY BUILDING VENTILATION AND COOLING SYSTEM COMPONENTS DESCRIPTIONS

3.	Quantity	Four (two per room)
4.	Condensing Unit	
	Fans	Propeller
	Quantity	One each
	Motor, hp	1 each
	Refrigerant	Freon 22
5.	Air-Handling Unit	
	Fan	Centrifugal
	Quantity	One each
	Drive	Belt
	Motor, hp	3
	Coil face area, ft^2	11.2

TABLE 9.4-4 RADWASTE FACILITY VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

A.	Radwaste Building Ventilation Supply	
1.	Type	Built-up
2.	Components	
a.	Fans	
	Type	Centrifugal
	Quantity	Two
	Drive	Belt
	Capacity, scfm	32,400
	Total static pressure, in. H_2O	3.00
	Motor, hp	25
b.	Prefilter	
	Type	Pad
	Quantity	One bank (15 filters)
	Medium	Glass fiber (fire retardant)
	Nominal capacity, scfm	30,000
	Pressure Drop (Clean), in. H_2O	
	At rated flow (30,000 cfm)	0.4
	At actual flow (32,800 cfm)	0.45
c.	High-Efficiency Filter	
	Type	Vericel
	Quantity	One bank (15 filters)
	Medium	Glass fiber (fire retardant)
	Efficiency	80-85 percent
	Nominal capacity, scfm	30,000
	Pressure Drop (Clean), in. H_2O	
	At rated flow (30,000 cfm)	0.55
	At actual flow (32,800 cfm)	0.64
d.	Heating Coil	
	Type	Finned tube
	Quantity	One bank
	Capacity, Btu/hr	2.88×10^6

TABLE 9.4-4 RADWASTE FACILITY VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

B.	Radwaste Building Ventilation Exhaust	
1.	Type	Built-up
2.	Components	
a.	Fans	
	Type	Centrifugal
	Quantity	Two
	Capacity, scfm	33,700
	Total static pressure, in. H_2O	6.5
	Motor, hp	50
b.	Prefilter	
	Type	Disposable cartridge
	Quantity	One bank
	Efficiency (NBS Dust Spot Test)	85 percent
	Nominal capacity, scfm	60,000
	Resistance (Clean), in. H_2O	
	At rated flow (60,000 cfm)	0.55
	At actual flow (45,945 cfm)	0.42
c.	HEPA Filters	
	Type	Astrocel
	Quantity	One bank (30 filters)
	Medium	Glass fiber (fire retardant)
	Efficiency, percent with 0.3 micron dioctyl phthalate (DOP)	99.97
	Nominal capacity, scfm	60,000
	Pressure Drop (Clean), in. H_2O	
	At rated flow (60,000 cfm)	1.16
	At actual flow (45,945 cfm)	0.80
C.	Radwaste Battery Room Air Conditioning Unit Package	
1.	Type	Package
2.	Components	
a.	Fans	
	Type	Centrifugal
	Quantity	One
	Drive	Belt

TABLE 9.4-4 RADWASTE FACILITY VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

Capacity, scfm	2000
Total external static pressure, in. H_2O	0.25
Motor, hp	3/4

b. Evaporator

Type	Finned tube
Face velocity, ft/minute	460
Capacity, Btu/hr	56,500

c. Condenser

Type	Tube-in-tube, water cooled

d. Compressor

Type	Hermetic

D. Health Physics Laboratory Air Conditioning Unit

1. Type — Split system

2. Components

a. Fans

Type	Centrifugal
Quantity	One
Drive	Belt
Capacity, scfm	11,280
Total external static pressure, in. H_2O	4.5
Motor, hp	20

b. Evaporator

Type	Finned tube
Face velocity, ft/minute	343
Capacity, Btu/hr	4.69×10^5

c. Condenser

Type	Shell and tube

d. Compressor

TABLE 9.4-4 RADWASTE FACILITY VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

Type	Hermetic
Motor, hp	40

e. Preheat Coil

Type	Finned tube
Face velocity, ft/minute	500
Capacity, Btu/hr	3.57×10^5

f. Reheat Coil

Type	Finned tube
Face velocity, ft/minute	454
Capacity, Btu/hr	2.36×10^5

E. Fume Hood Exhaust Fan

Type	Centrifugal
Drive	Belt
Capacity, scfm	6500
Total static pressure, in. H_2O	6.0
Motor, hp	1

F. Dedicated Shutdown Air Conditioning Unit Package

1. Type — Split System

2. Components

a. Air Handling Unit Fan

Type	Centrifugal
Drive	Belt
Capacity,scfm	6,000
Total external Static Pressure,(in.H20)	1.84
Motor,(HP)	5

b. Evaporator

Type	Finned Tube
Face velocity,(Ft/Minute)	616
Capacity (BTU/Hr)	240,830
Refrigerant Type	R22

c. Condenser

TABLE 9.4-4 RADWASTE FACILITY VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

Number of Condensers	2
Type	Finned Tube-Air Cooled
Fan Motor(HP)	1 (for each condenser)
Type	Direct Drive

d. Compressor

Number of Compressors	2
Type	Hermetic Scrolls
Motor (HP)	10

TABLE 9.4-5 TURBINE BUILDING VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

A.	Turbine Building Ventilation Supply System	
1.	Type	Built-up
2.	Components of each unit	
a.	Fans	
	Type	Vaneaxial
	Quantity	Three, 50 percent capacity
	Drive	Direct
	Capacity, cfm	205,000
	Total pressure, in. H_2O	5.54
	Motor, hp	250
b.	Filter	
	Type	High efficiency
	Quantity	One bank
	Media Efficiency (NBS Dust Spot Test)	85 percent
	Capacity, scfm	390,000
	Pressure Drop (Clean), in. H_2O	0.5
c.	Heating Coil	
	Type	Finned tube
	Quantity	One bank
	Face velocity, ft/minute	695
	Capacity, Btu/hr	20×10^6
d.	Evaporative Air Cooler	
	Type	Wetted fill
	Quantity	Two sections
	Flow Rate	250,000 cfm
	Pressure Drop	0.5 in WG
B.	Turbine Building Ventilation Exhaust Fans	
	Type	Vaneaxial
	Quantity	Three, 50 percent capacity
	Drive	Direct
	Capacity, cfm	215,000
	Total pressure, in. H_2O	4.5

TABLE 9.4-5 TURBINE BUILDING VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

Motor, hp	250

C. Offgas Adsorber Room Air Conditioning System

1. Type	Split system
2. Quantity	Three, 50 percent capacity
3. Components of each unit	
a. Fan-Coil Units	
Quantity	Three
Fans	
Type	Centrifugal
Quantity (per fan-coil unit)	Two
Drive	Belt
Capacity, scfm	2250 each fan
Total external static pressure, in. H_2O	0.1
Motor, hp	1
Evaporator Coils	
Type	Finned tube
Quantity (per fan-coil unit)	One
Face velocity, ft/minute	470
Capacity, Btu/hr	129,600
b. Condensers	
Type	Shell and tube
Quantity	Three
c. Compressors	
Type	Semi-Hermetic reciprocating
Quantity	Three
Power input	22.5 amps @ 460 V ac

D. Deleted

E. Excitation Equipment Area Air Cooling System

TABLE 9.4-5 TURBINE BUILDING VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

1.	Type	Self Contained Water Cooled Air Conditioning Units
2.	Quantity	Two
3.	Capacity	30 Tons Cooling Each
4.	Manufacturer	Trane
5.	Components of Each Unit	
	Fan Type	Vertical Discharge Direct Drive
	Quantity	Two
	Capacity, scfm	12,000
	Static Pressure, in. WC	4.5
	Motor HP	25

F. Operational Support Center (OSC) Air Conditioning System

1.	Type	Split system
2.	Quantity	One
3.	System Capacity	15 Tons Cooling
4.	Design Flow	6,000 scfm
5.	Manufacturer	Trane
6.	Components of Unit	
	Fan Types	Supply (5.0 hp) (Centrifugal) Return (3.0 hp) (Centrifugal)
	Condensing Unit	
	Compressors	2 @ 7.5 hp each
	Condenser Fans	2 @ 1/2 hp each
	Refrigerant	R-22

TABLE 9.4-5 TURBINE BUILDING VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

G. SCCW Chiller Area (Turbine Building Basement) Fan Cooler

Quantity	1
Fans	
Type	Centrifugal
Drive	Belt Driven
Capacity, scfm	9000
Total Pressure, in H_2O	2.00
Motor, hp	5
Cooling Coil	
Type	Finned tube, 6 Rows
Quantity	1 Bank
Face Velocity, fpm	470
Capacity, Btu/hr	387,187 Total 322,596 Sensible
Chilled Water Flow, gpm	50
Chilled Water Temp, °F	60 in/75.7 out
Filters	
Type	Medium Efficiency, Throwaway
Quantity	1 Bank
Pressure Drop (Dirty), in H_2O	0.40

TABLE 9.4-6 DRYWELL COOLING SYSTEM COMPONENTS DESCRIPTIONS

A.	Drywell Fan-Coil Units	
1.	Type	Built-up
2.	Quantity	14
3.	Components of each unit	
a.	Fans	
	Type	Vaneaxial
	Quantity	One
	Drive	Direct
	Capacity, scfm	20,000
	Total pressure, in. H_2O	5.0
	Motor, hp	30
b.	Coils	
	Type	Finned tube
	Quantity	Two (see Note below)
	Capacity, Btu/hr	324,000

Note: Various drywell coolers have been replaced utilizing a split coil design in place of the original single full size coil while retaining the units' functionality and capacity.

TABLE 9.4-7 STEAM TUNNEL COOLING SYSTEM COMPONENTS DESCRIPTIONS

A.	Steam Tunnel Fan-Coil Units	
1.	Type	Package
2.	Quantity	Two
3.	Components of each unit	
a.	Fan	
	Type	Centrifugal
	Quantity	One
	Drive	Belt
	Capacity, scfm	24,700
	Total static pressure, in. H_2O	3.7
	Motor, hp	25
b.	Heat Exchange Coil	
	Type	Finned tube
	Face velocity, ft/minute	645
	Capacity, Btu/hr	6.95×10^5

TABLE 9.4-8 RHR COMPLEX HEATING AND VENTILATION SYSTEM FAILURE ANALYSIS

System	Component Malfunction	Comments
Diesel generator room ventilation	One or both the supply air fans for a diesel room fail	Failure of one or both of the supply air fans will actuate a no-flow alarm in the main control room through its associated differential pressure switch, and the temperature in the diesel room will rise. The operator will take the necessary actions in accordance with the alarm response procedures
	Outside air damper fails closed and recirculating air damper fails open	The system will operate at 100 percent recirculation air. The temperature may rise as a result of the outside air damper failing closed. The high temperature in the diesel generator room will actuate an alarm in the control room, and the operator will take the necessary actions in accordance with the alarm response procedures
Switchgear room ventilation	Failure of one or both fans for individual switchgear room ventilation	Failure of one or both fans will actuate a no- flow alarm in the main control room through its associated differential pressure switch, and the temperature in the switchgear room will rise. The operator will take the necessary actions in accordance with the alarm response procedures
	Outside air damper fails closed and recirculating air damper fails open	The system will operate at 100 percent recirculation air. The temperature may rise as a result of the outside air damper failing closed. The high temperature in the switchgear room will actuate an alarm in the control room, and the operator will take the necessary actions in accordance with the alarm response procedures
	High pressure differential across the supply air filter	High pressure differential across the filter will illuminate a local indicator light. The operator will take the necessary actions depending upon the room temperature
Pump room ventilation	Failure of one or both fans for individual pump room ventilation	Failure of one or both supply air fans will actuate a no-flow alarm in the main control room through its associated differential pressure switch, and the temperature in the pump room will rise. The operator will take the necessary actions in accordance with the alarm response procedures
	Outside air damper fails closed and recirculating air damper fails open	The system will operate at 100 percent recirculation air. The temperature may rise as a result of the outside air damper failing closed. The high temperature in the pump room will actuate an alarm in the control room, and the operator will take the necessary actions in accordance with the alarm response procedures
	High pressure differential across the supply air filter	High pressure differential across the filter will illuminate a local indicator light. The operator will take the necessary actions depending upon the room temperature.

TABLE 9.4-9 DIESEL GENERATOR ROOM VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

(Per Division of RHR Complex)

Ventilation Fans

Type	Vaneaxial
Quantity	Four
Drive	Direct
Capacity, scfm	34,000
Total pressure, in. H_2O	2
Motor, hp	15

TABLE 9.4-10 SWITCHGEAR ROOM VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

(Per Division of RHR Complex)

Ventilation Fans

Type	Centrifugal
Quantity	Four
Drive	Direct
Capacity, scfm	3900
Total pressure, in. H_2O	2
Motor, hp	3

TABLE 9.4-11 PUMP ROOM VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

(Per Division of RHR Complex)

Ventilation Fans

Type	Vaneaxial
Quantity	Two
Drive	Direct
Capacity, scfm	12,500
Total pressure, in. H_2O	2
Motor, hp	7.5

TABLE 9.4-12 DIESEL-FUEL-OIL STORAGE ROOM VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

(Per Division of RHR Complex)

Ventilation Fans

Type	Centrifugal
Quantity	Two
Drive	Direct
Capacity, scfm	2500
Total pressure, in. H_2O	2
Motor, hp	2

TABLE 9.4-13 PLANT HEATING SYSTEM COMPONENTS DESCRIPTIONS

A.	Condensate Return Unit (Turbine Building)	
1.	Condensate return tank capacity, gal	2000
2.	Pump	
	Number supplied	Three
	Type	Centrifugal
	Design pressure, psig	150
	Design temperature, °F	365
	Capacity, gpm	120
	Total head, psi	70
	Motor	
	Horsepower	10
	Speed, rpm	3550
	Voltage/frequency/phase	460/60/3
B.	Condensate Return Unit (Boiler Building)	
1.	Condensate return tank capacity, gal	36
2.	Pump	
	Number supplied	Two
	Type	Centrifugal
	Design pressure, psig	150
	Design temperature, °F	365
	Capacity, gpm	15
	Total head, psi	26
	Motor	
	Horsepower	3/4
	Speed, rpm	3500
	Voltage/frequency/phase	460/60/3
C.	Condensate Return Unit (Reactor Building)	
1.	Condensate return tank capacity, gal	198
2.	Pump	
	Number supplied	Two
	Type	Centrifugal
	Design pressure, psig	150
	Design temperature, °F	365
	Capacity, gpm	90
	Total head, psi	35
	Motor	
	Horsepower	5
	Speed, rpm	3500
	Voltage/frequency/phase	460/60/3
D.	Unit Heaters	
	Steam pressure, psig	15
	Capacity, mBtu/hr	44.4 to 310

TABLE 9.4-13 PLANT HEATING SYSTEM COMPONENTS DESCRIPTIONS

E. Auxiliary Steam Boilers

Number supplied	Two
Steam capacity, lb/hr	50,000 (each)
Operating pressure, psia	120
Design pressure, psig	250
Feedwater temperature, °F	227
Steam temperature	Saturated
Fuel	No. 2 oil

F. Feedwater Pumps

Number supplied	Three
Type	Centrifugal
Fluid	Demineralized condensate
Design pressure, psig	200
Design temperature, °F	250
Capacity, gpm	120 (each)
Total head, ft	400
Motor	
Type	324 TS
Horsepower	30
Speed, rpm	3500
Voltage/frequency/phase	400/60/3

G. Deaerating Heater

Capacity, lb/hr	100,000
Design pressure, psig	120
Design temperature, °F	450
Operating pressure, psig	5
Dissolved oxygen at design load, cm^3/l	0.005
Dissolved at 120 percent design load, cm^3/l	0.005
Vented steam required at full load, lb/hr	169

TABLE 9.4-14 GENERAL SERVICE WATER PUMP HOUSE HEATING AND VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

A. Pump Room Ventilation Exhaust Fans

Type	Vertical roof ventilator
Quantity	Three
Drive	Direct
Capacity, scfm	25,300
Total external static pressure, in. H_2O	1/4
Motor, hp	5

B. Switchgear Room Ventilation Supply

1. Fan

Type	Centrifugal
Quantity	One
Drive	Belt
Capacity, scfm	2850
Total ext. static pressure, in. H_2O	5/8
Motor, hp	3/4

2. Filter

Type	Disposable
Quantity	One bank
Medium	2-in.-thick flat fiberglass

C. Pump Room Heating

Type	Vertical electric unit heaters
Quantity	Five
Capacity, kW	20 (68,200 Btu/hr)
Fan capacity, scfm	1300
Motor, hp	1/6

D. Switchgear Room Heating

Type	Horizontal electric unit heater
Quantity	One
Capacity, kW	10
Fan capacity, scfm	750
Motor, hp	1/10

TABLE 9.4-15 CIRCULATING WATER PUMP HOUSE VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

A. Pump House Ventilation

1. Fans

Type	Axial flow
Quantity	Five
Drive	Direct
Capacity, scfm (each)	21,400/32,000
Total external static pressure, in. H_2O	0.90/2.00
Motor, hp	20

B. Pump Room Heating

1. Heaters

Type	Horizontal elec. unit heaters
Quantity	10
Capacity, kW/Btu/hr	15/51,195
Fan capacity, scfm	750

C. Chemical Treatment Room Ventilation and Heating

Type	Built-up

1. Exhaust System

Fan

Type	Axial flow roof exhauster
Quantity	One
Drive	Belt
Capacity, scfm	6000
Total ext. static pressure, in. H_20	0.45
Motor, hp	1

2. Supply System

Fan

Type	Axial duct
Quantity	One
Drive	Direct
Capacity, scfm	6000
Total ext. static pressure, in. H_2O	0.875
Motor, hp	2

TABLE 9.4-15 CIRCULATING WATER PUMP HOUSE VENTILATION SYSTEM COMPONENTS DESCRIPTIONS

a. Duct Heater

Type	Electric fin tube
Quantity	One
Capacity, kW/Btu/hr	80/273,000

b. Duct Heater

Type	Electric fin tube
Quantity	One
Capacity, kW/Btu/hr	22.5/76,770

D. Switchgear Room Ventilation and Heating

1. Fan

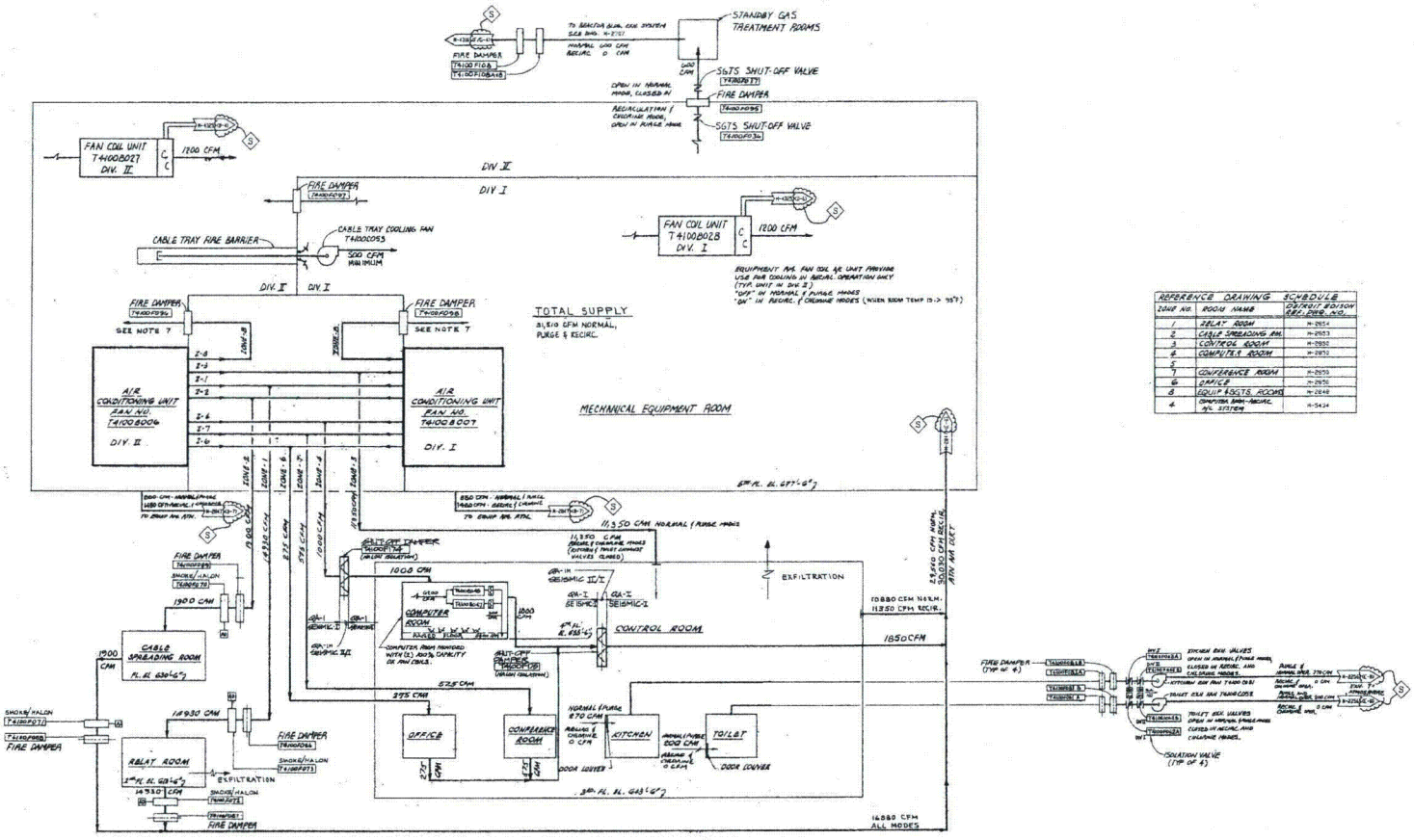
Type	Axial flow roof exhauster
Quantity	One
Drive	Belt
Capacity, scfm	6000
Total ext. static pressure, in. H_2O	0.45
Motor, hp	1

2. Heater

Type	Horizontal electric unit
Quantity	Five
Capacity, kW/Btu/hr	5/17,076
Fan capacity, scfm	420

TABLE 9.4-16 MOTOR-GENERATOR SET COOLING SYSTEM COMPONENTS DESCRIPTIONS

1.	Type	Built-up
2.	Quantity	Three
3.	Components of each unit	
	a. Fan	
	Type	Vaneaxial
	Quantity	One
	Drive	Direct
	Capacity, scfm	38,000
	Total pressure, in. H_2O	1.9
	Motor, hp	20
	b. Heat Exchange Coil	
	Type	Finned tube
	Face velocity, ft/minute	650
	Capacity, Btu/hr	1.8×10^6



AIR CONDITIONING SYSTEM - AIR FLOW DIAGRAM
NOT TO SCALE

REFERENCE DRAWING SCHEDULE		
ZONE NO.	ROOM NAME	DETROIT EDISON DET. DWG. NO.
1	RELAY ROOM	M-2954
2	CABLE SPREADING RM.	M-2953
3	CONTROL ROOM	M-2950
4	COMPUTER ROOM	M-2951
5		
7	CONFERENCE ROOM	M-2955
6	OFFICE	M-2956
8	EQUIP. & SGTS ROOMS	M-2949
4	COMPUTER ROOM - RECIRC. H/L SYSTEM	M-5434

GENERAL NOTES:

1. FOR SYSTEM DIAGRAM, SEE D.E. ED. DWG. M-2947 (AIR SYSTEM) & M-1305 (CHILLED WATER SYSTEM).
2. THE CONTROL CENTER COMPLEX IS MAINTAINED AT A POSITIVE PRESSURE DIFFERENTIAL OF 1/8 INCH WATER GAUGE RELATIVE TO THE SPACE SURROUNDING THE CONTROL CENTER COMPLEX DURING THE RECIRCULATING MODE, AND AT 1/4 INCH WATER GAUGE DURING THE NORMAL MODE.
3. THIS DRAWING IS TO BE WORKED IN CONJUNCTION WITH D.E. CO. DESIGN INTERACTION (D.I.) NO. 40.
4. AIR QUANTITIES SHOWN ARE BASED ON LEAD EXFILTRATION. EMERGENCY MAKE-UP CAPACITY OF 1800 CFM IS PROVIDED.
- A. RETURN AIR VALVES WILL BE ADJUSTED TO MAINTAIN DESIGN DIFFERENTIAL PRESSURES

GENERAL NOTES (CONT.)

5. FOR CONTROL SEE CONTROL DIAGRAM 1-26619-57,26,27, & 28 AND SCHEMATIC DIAGRAM 1-26862-58 & 59.
- 6. DELETED
7. 1800 CFM (TOTAL) IS SUPPLIED TO ZONE 2 THRU DIV. I & DIV. II SUPPLY DIFFUSERS WHEN EITHER OF A/C UNITS B.004 OR B.007 IS OPERATING.
- 8. FOR SYSTEM FUNCTIONAL OPERATING SKETCH, SEE DWG. M-5730-3

Fermi 2

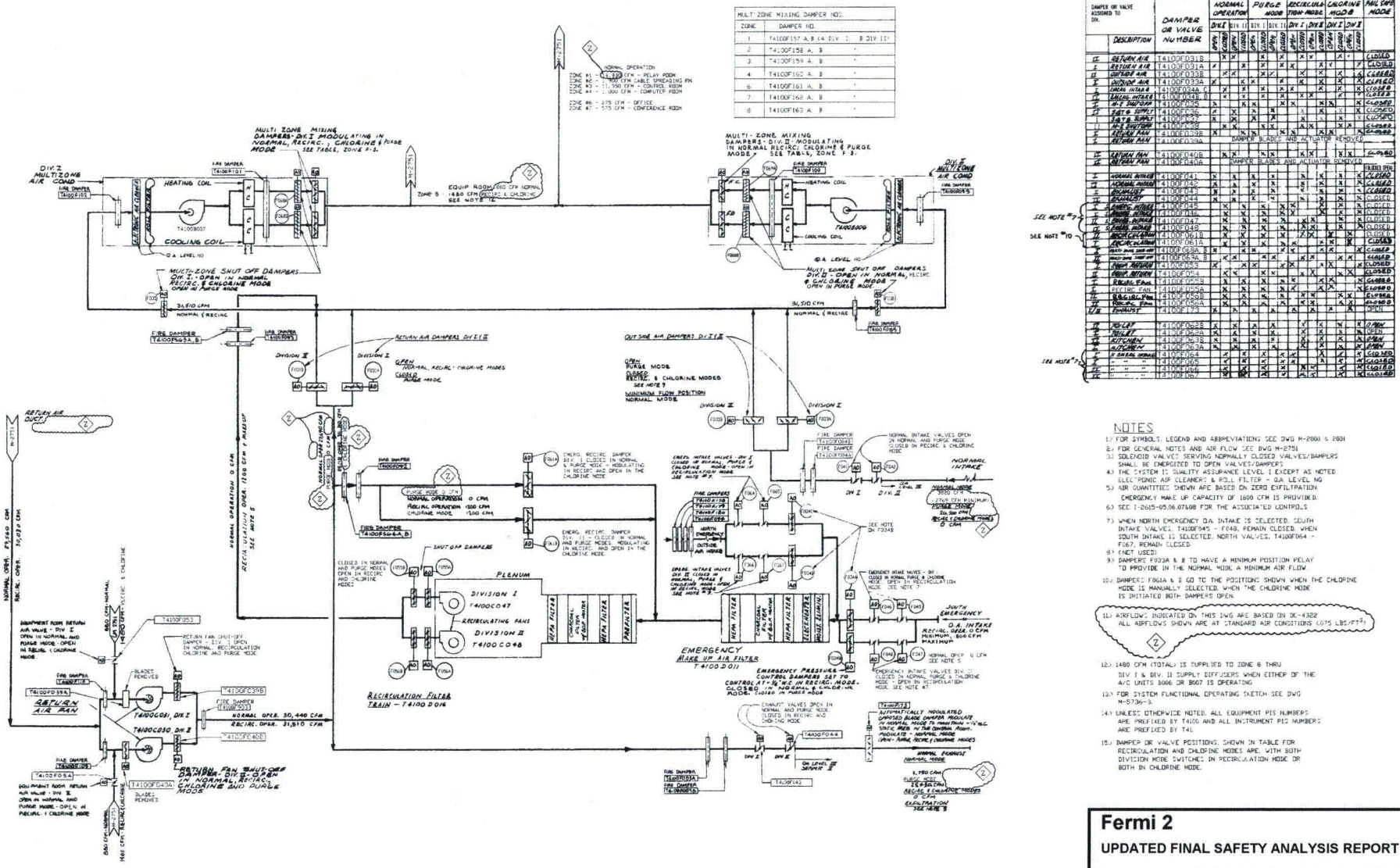
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-1

CONTROL CENTER AIR CONDITIONING SYSTEM AIR FLOW DIAGRAM

DETROIT EDISON COMPANY DRAWING NO. 6M721-2751, REV. S

REV 19 10/14



MULTI ZONE MIXING DAMPER NOS.	
ZONE	DAMPER NO.
1	T4100F157 A, B (A DIV. I, B DIV. II)
2	T4100F158 A, B "
3	T4100F159 A, B "
4	T4100F160 A, B "
5	T4100F161 A, B "
7	T4100F162 A, B "
8	T4100F163 A, B "

DAMPER OR VALVE POSITIONS

DAMPER OR VALVE ASSIGNED TO DIV.	DESCRIPTION	DAMPER OR VALVE NUMBER	NORMAL OPERATION DIV I	NORMAL OPERATION DIV II	PURGE MODE DIV I	PURGE MODE DIV II	RECIRCULATION MODE DIV I	RECIRCULATION MODE DIV II	CHLORINE MODE DIV I	CHLORINE MODE DIV II	FAIL SAFE MODE
I	RETURN AIR	T4100F031B	X	X		X		X	X		CLOSED
II	RETURN AIR	T4100F031A	X		X		X	X		X	CLOSED
II	OUTSIDE AIR	T4100F033B		X	X			X	X		CLOSED
I	OUTDOOR AIR	T4100F033A	X			X	X			X	CLOSED
I	INTAKE INTAKE	T4100F034A	X		X		X		X		CLOSED
II	INTAKE INTAKE	T4100F034B		X		X		X		X	CLOSED
II	A-C SHUTOFF	T4100F035	X		X		X		X		CLOSED
I	A-C SHUTOFF	T4100F036		X		X		X		X	CLOSED
I	FAN'S SUPPLY	T4100F037	X		X		X		X		CLOSED
II	FAN'S SUPPLY	T4100F038		X		X		X		X	CLOSED
II	A-C SHUTOFF	T4100F039B	X		X		X		X		CLOSED
I	RETURN FAN	T4100F039A			DAMPER BLADES AND ACTUATOR REMOVED						CLOSED
I	RETURN FAN	T4100F040B									CLOSED
II	RETURN FAN	T4100F040A			DAMPER BLADES AND ACTUATOR REMOVED						CLOSED
I	NORMAL INTAKE	T4100F041	X	X	X	X	X	X	X	X	CLOSED
II	NORMAL INTAKE	T4100F042	X	X	X	X	X	X	X	X	CLOSED
II	EXHAUST	T4100F044	X	X	X	X	X	X	X	X	CLOSED
I	EXHAUST	T4100F045	X	X	X	X	X	X	X	X	CLOSED
I	EMERG. INTAKE	T4100F046	X	X	X	X	X	X	X	X	CLOSED
II	EMERG. INTAKE	T4100F047	X	X	X	X	X	X	X	X	CLOSED
II	EMERG. INTAKE	T4100F048	X	X	X	X	X	X	X	X	CLOSED
II	RECIRCULATION	T4100F061B	X	X	X	X	X	X	X	X	CLOSED
I	RECIRCULATION	T4100F061A	X	X	X	X	X	X	X	X	CLOSED
	MAKE UP AIR UNIT	T4100F058A, B	X	X	X	X	X	X	X	X	CLOSED
I	EXHAUST	T4100F053A	X	X	X	X	X	X	X	X	CLOSED
II	EXHAUST	T4100F053	X	X	X	X	X	X	X	X	CLOSED
II	EXHAUST	T4100F054	X	X	X	X	X	X	X	X	CLOSED
I	RECIRC. FAN	T4100F055B	X	X	X	X	X	X	X	X	CLOSED
I	RECIRC. FAN	T4100F055A	X	X	X	X	X	X	X	X	CLOSED
II	RECIRCULATION	T4100F056B	X	X	X	X	X	X	X	X	CLOSED
II	RECIRC. FAN	T4100F056A	X	X	X	X	X	X	X	X	CLOSED
I/II	EXHAUST	T4100F173	X	X	X	X	X	X	X	X	OPEN
II	RELIEF	T4100F063B	X	X	X	X	X	X	X	X	OPEN
I	RELIEF	T4100F063A	X	X	X	X	X	X	X	X	OPEN
II	KITCHEN	T4100F063B	X	X	X	X	X	X	X	X	OPEN
I	KITCHEN	T4100F063A	X	X	X	X	X	X	X	X	OPEN
I	F. SERVICE WATER	T4100F064	X	X	X	X	X	X	X	X	CLOSED
II	" "	T4100F065	X	X	X	X	X	X	X	X	CLOSED
II	" "	T4100F066	X	X	X	X	X	X	X	X	CLOSED
I	" "	T4100F067	X	X	X	X	X	X	X	X	CLOSED

SEE NOTE #7
SEE NOTE #10
SEE NOTE #7

NOTES

1. FOR SYMBOLS, LEGEND AND ABBREVIATIONS SEE DWG M-2000 & 2001
2. FOR GENERAL NOTES AND AIR FLOW SEE DWG M-2751
3. SOLENOID VALVES SERVING NORMALLY CLOSED VALVES/DAMPERS SHALL BE ENERGIZED TO OPEN VALVES/DAMPERS
4. THE SYSTEM IT QUALITY ASSURANCE LEVEL I EXCEPT AS NOTED ELECTRONIC AIR CLEANERS & ROLL FILTER - QA LEVEL NQ
5. AIR QUANTITIES SHOWN ARE BASED ON ZERO EXFILTRATION EMERGENCY MAKE UP CAPACITY OF 1800 CFM IS PROVIDED.
6. SEE I-2615-05.06.07698 FOR THE ASSOCIATED CONTROLS
7. WHEN NORTH EMERGENCY O.A. INTAKE IS SELECTED, SOUTH INTAKE VALVES, T4100F045 - F048, REMAIN CLOSED. WHEN SOUTH INTAKE IS SELECTED, NORTH VALVES, T4100F064 - F067, REMAIN CLOSED.
8. (NOT USED)
9. DAMPERS F031A & B TO HAVE A MINIMUM POSITION RELAY TO PROVIDE IN THE NORMAL MODE A MINIMUM AIR FLOW
10. DAMPERS F061A & B GO TO THE POSITIONS SHOWN WHEN THE CHLORINE MODE IS MANUALLY SELECTED. WHEN THE CHLORINE MODE IS INITIATED BOTH DAMPERS OPEN.
11. AIRFLOWS INDICATED ON THIS DWG ARE BASED ON DE-4322 ALL AIRFLOWS SHOWN ARE AT STANDARD AIR CONDITIONS (.075 LBS/FT³).
12. 1480 CFM (TOTAL) IS SUPPLIED TO ZONE 8 THRU DIV I & DIV II SUPPLY DIFFUSERS WHEN EITHER OF THE A/C UNITS B006 OR B007 IS OPERATING
13. FOR SYSTEM FUNCTIONAL OPERATING SKETCH SEE DWG M-5736-3.
14. UNLESS OTHERWISE NOTED, ALL EQUIPMENT PIS NUMBERS ARE PREFIXED BY T4100 AND ALL INSTRUMENT PIS NUMBERS ARE PREFIXED BY T41.
15. DAMPER OR VALVE POSITIONS, SHOWN IN TABLE FOR RECIRCULATION AND CHLORINE MODES ARE, WITH BOTH DIVISION MODE SWITCHES IN RECIRCULATION MODE OR BOTH IN CHLORINE MODE.

Fermi 2

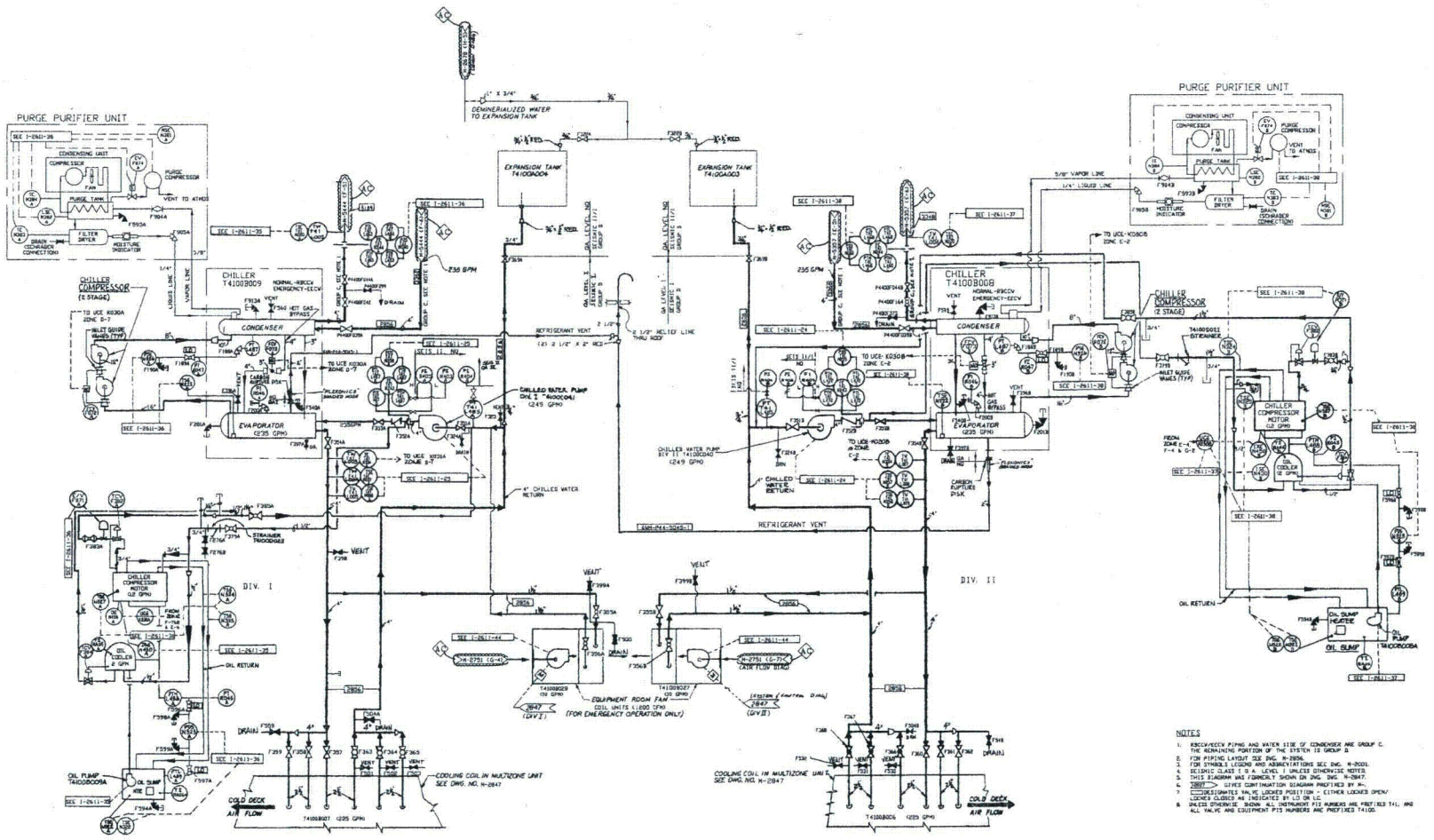
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-2

CONTROL CENTER AIR CONDITIONING SYSTEM FLOW DIAGRAM

DETROIT EDISON COMPANY DRAWING NO. 6M721-2847, REV. Z

REV 14 11/06



DETROIT EDISON COMPANY DRAWING NO. 6M721-4325, REV. AC

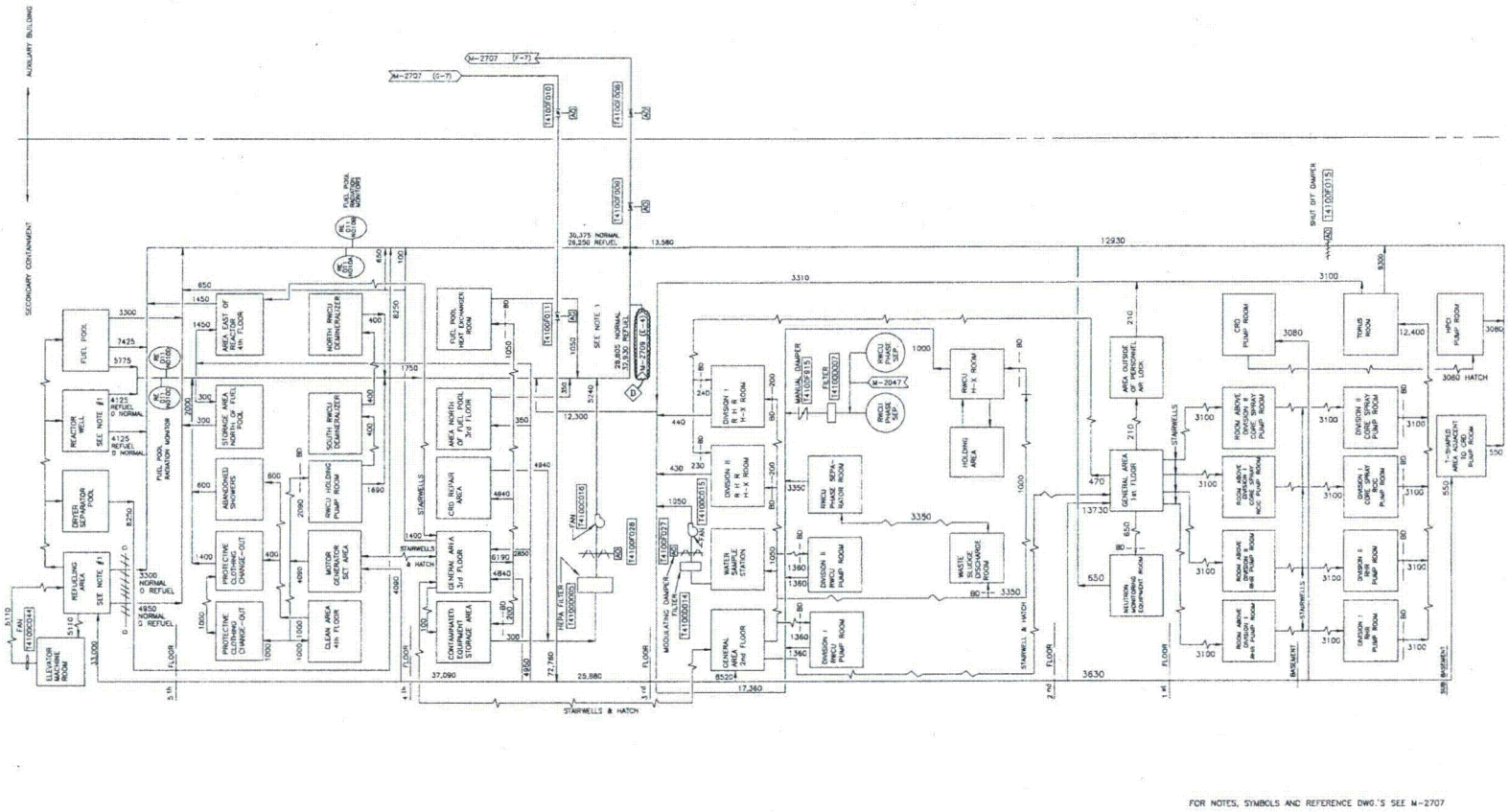
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-3

CONTROL CENTER AIR CONDITIONING WATER CONTROL FLOW DIAGRAM

REV 19 10/14



FOR NOTES, SYMBOLS AND REFERENCE DWG.'S SEE M-2707

USE THIS DRAWING
IN CONJUNCTION WITH
M-2707

Fermi 2

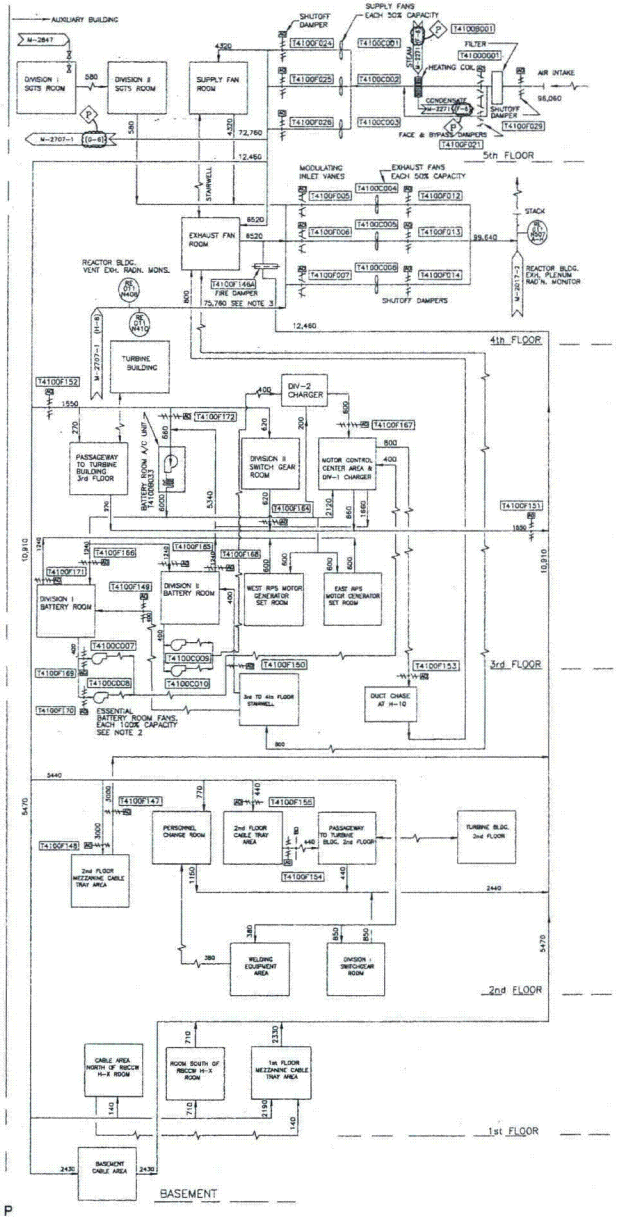
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-4, SHEET 1

REACTOR AND AUXILIARY BUILDING
VENTILATION SYSTEM FLOW DIAGRAM
UNIT NO. 2

DETROIT EDISON COMPANY DRAWING NO. 6M721-2707-1, REV. D

REV 19 10/14



NOTES:

(1) REACTOR WELL IS EXHAUSTED ONLY DURING REFUELING WITH SHIELD PLUG REMOVED. THE SAME AIR QUANTITY IS EXHAUSTED FROM ABOVE THE FLOOR BY OPENING TWO MANUAL DAMPERS WHEN THE PLUG IS REPLACED.

(2) BATTERY ROOM FANS OPERATE ONLY WHEN NORMAL AIR SUPPLY FROM A/C UNIT IS UNAVAILABLE.

(3) 3000 CFM ADDED FOR SECONDARY CONTAINMENT INFILTRATION.

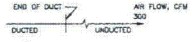
(5) FOR INSTRUMENTATION & CONTROLS, SEE DWG.'S I-2615-G1 THROUGH I-2615-07.

(6) FOR LEGEND & SYMBOLS, SEE DWG. M-2001.

REFERENCE DRAWINGS

M-2251 VENTILATION-DUCTWORK SUB-BASEMENT EL. 540'-0" REACTOR BUILDING
M-2252 VENTILATION-DUCTWORK BASEMENT EL. 562'-0" REACTOR BUILDING
M-2253 VENTILATION-DUCTWORK 1st FLOOR EL. 583'-6" REACTOR BUILDING
M-2254 VENTILATION-DUCTWORK 2nd FLOOR EL. 613'-6" REACTOR BUILDING UNIT #2
M-2255 VENTILATION-DUCTWORK 3rd FLOOR REACTOR BUILDING UNIT #2
M-2256 VENTILATION-DUCTWORK 4th FLOOR EL. 659'-6" REACTOR BUILDING UNIT #2
M-2257 VENTILATION-DUCTWORK 5th FLOOR EL. 564'-6" REACTOR BUILDING UNIT #2
M-4128 REACTOR BUILDING VENTILATION EXHAUST FANS LAYOUT - AUXILIARY BUILDING UNIT #2
M-4316 REACTOR BUILDING VENTILATION SUPPLY FANS LAYOUT AUXILIARY BUILDING
I-2181-01-08 PROCESS RADIATION MONITORING SYSTEM DIAGRAM

LINE SYMBOLS



Fermi 2

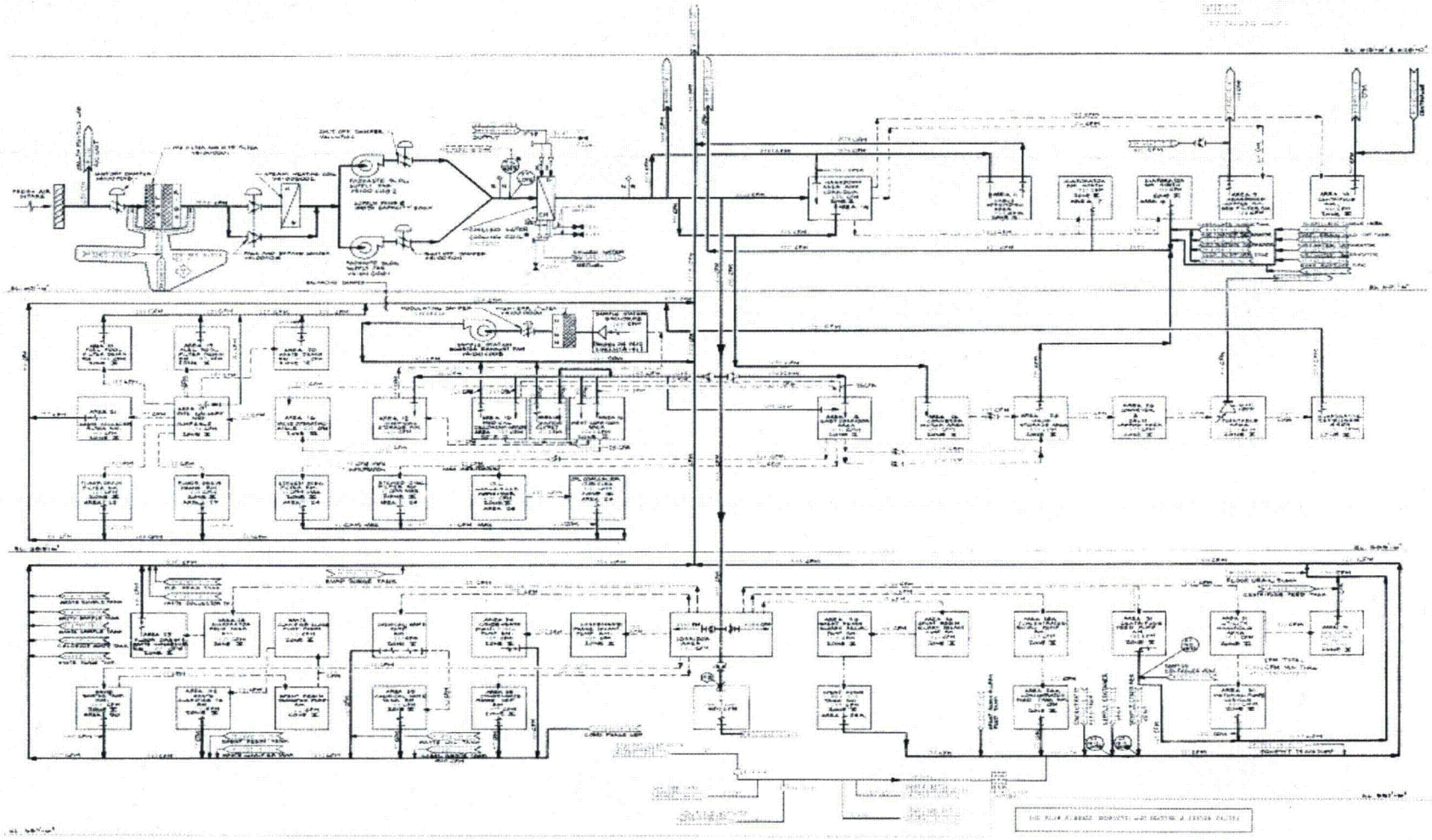
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-4, SHEET 2

REACTOR AND AUXILIARY BUILDING VENTILATION SYSTEM FLOW DIAGRAM UNIT NO. 2

DETROIT EDISON COMPANY DRAWING NO. 6M721-2707, REV. P

REV 19 10/14



Fermi 2

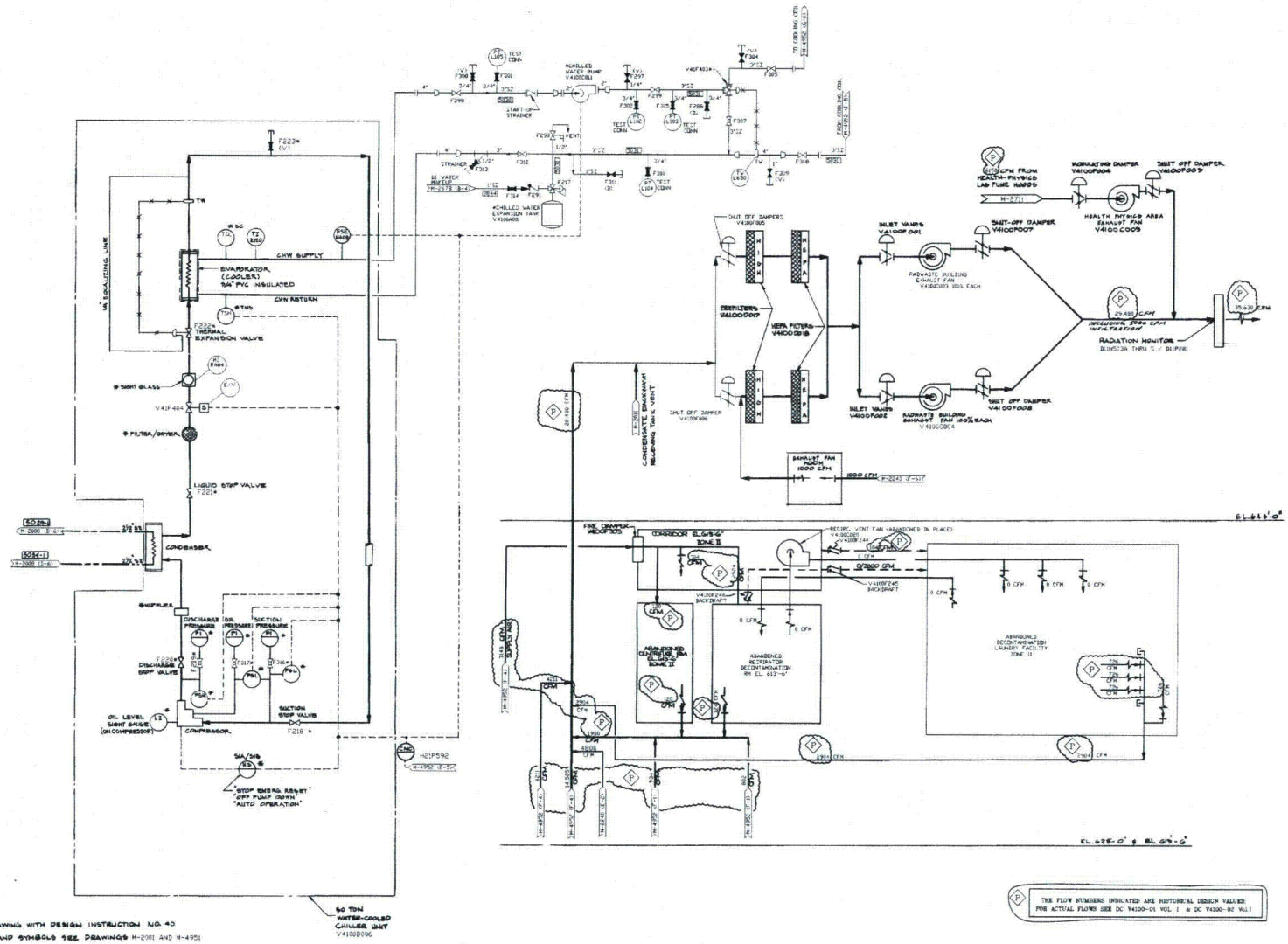
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-5, SHEET 1

RADWASTE BUILDING VENTILATION FLOW DIAGRAM

DETROIT EDISON COMPANY DRAWING NO. 6M721-4952, REV. Y

REV 16 10/09



NOTES:
1. WORK THIS DRAWING WITH DESIGN INSTRUCTION NO. 40
2. FOR LEGEND AND SYMBOLS SEE DRAWINGS M-2001 AND M-4951
3. FOR INSTRUMENTATION AND CONTROLS SEE DRAWING I-2755-01, 03, 07, 09 & 11.
4. TO ASSIST DIRECTION OF AIRFLOWS DURING DOOR OPENINGS, SIZE EXHAUST DUCTWORK FOR A MINIMUM FLOW OF 2500 CFM.
5. # DENOTES EQUIPMENT SUPPLIED BY CHILLER UNIT SUPPLIER.
6. UNLESS OTHERWISE SHOWN: ALL INSTRUMENT PIS NUMBERS ARE PREFIXED V41. ALL VALVE AND EQUIPMENT PID NUMBERS ARE PREFIXED V4100

DETROIT EDISON COMPANY DRAWING NO. 6M721-4953, REV. P

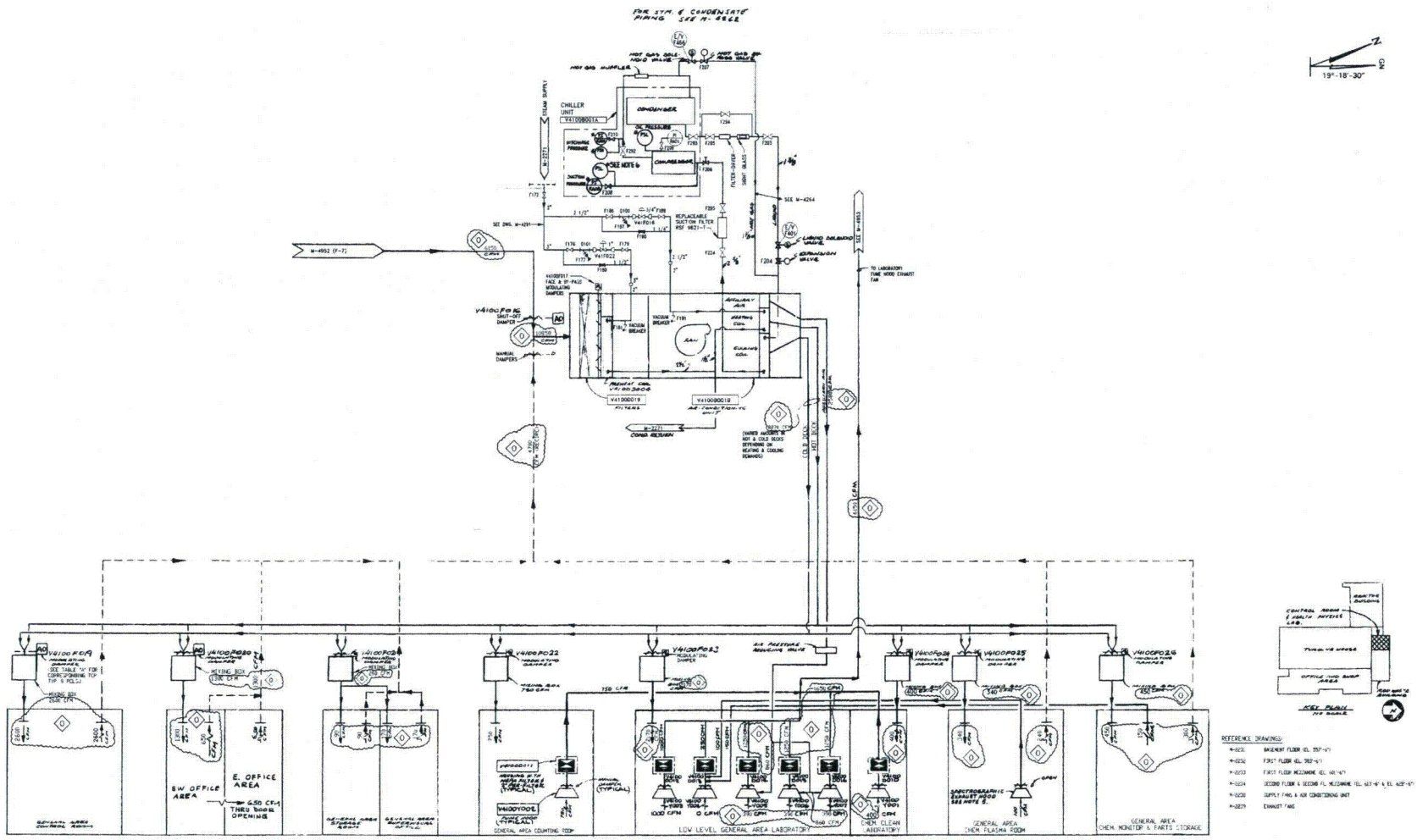
Fermi 2

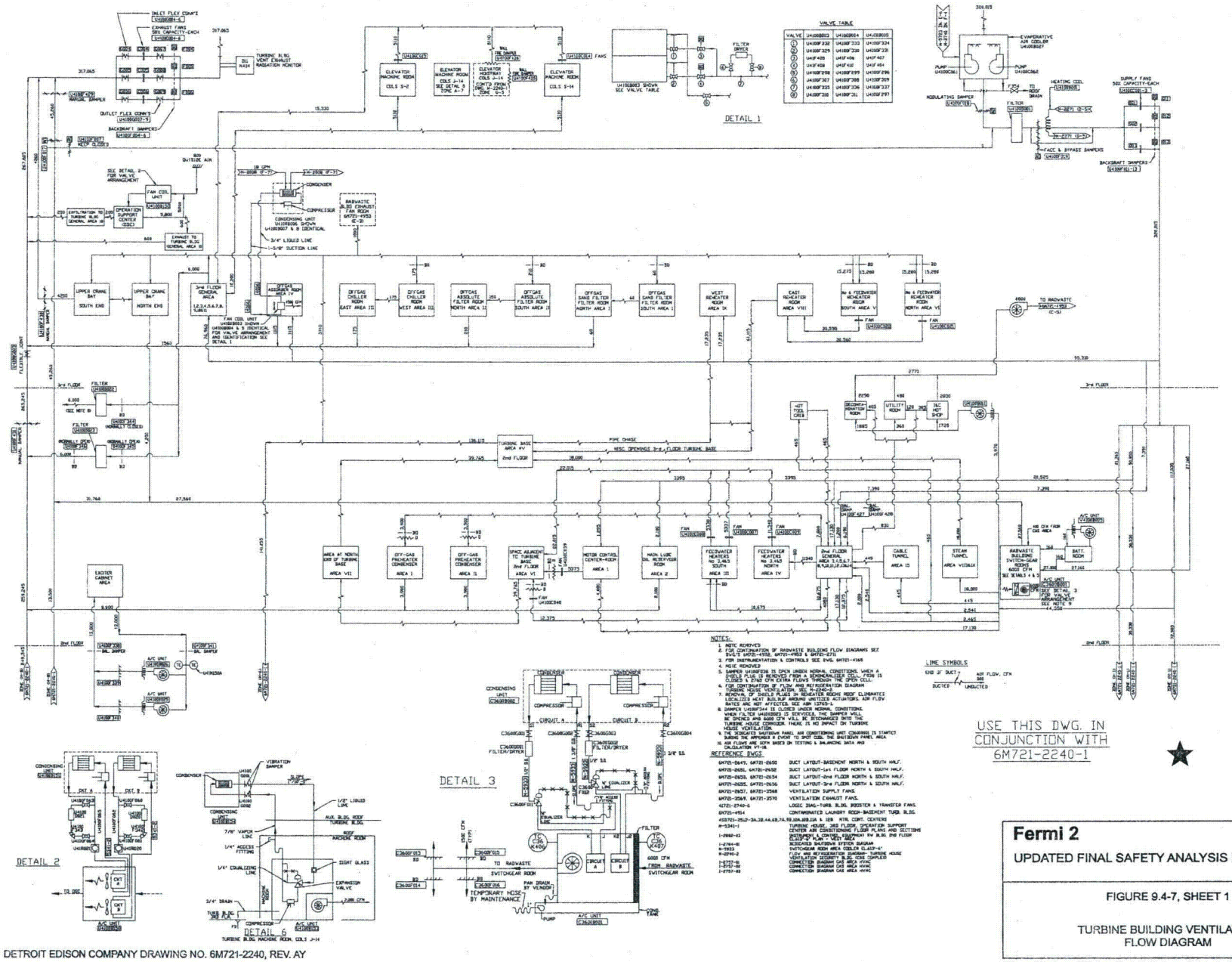
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-5, SHEET 2

RADWASTE BUILDING VENTILATION FLOW DIAGRAM

REV 11 05/02


CHILLER UNIT V4100B001A
CONDENSER
COMPRESSOR
REPLACEABLE SUCTION FILTER
V4100F018
V4100F019
V4100F020
V4100F021
V4100F022
V4100F023
V4100F024
V4100F025
V4100F026
V4100P030
V4100P031
V4100P032
V4100P033
V4100P034
V4100P035
V4100P036
V4100F017
V4100F016
V4100F015
V4100F014
V4100F013
V4100F012
V4100F011
V4100F010
V4100F009
V4100F008
V4100F007
V4100F006
V4100F005
V4100F004
V4100F003
V4100F002
V4100F001
V4100F000
V4100B001B
V4100B002
V4100B003
V4100B004
V4100B005
V4100B006
V4100B007
V4100B008
V4100B009
V4100B010
V4100B011
V4100B012
V4100B013
V4100B014
V4100B015
V4100B016
V4100B017
V4100B018
V4100B019
V4100B020
V4100B021
V4100B022
V4100B023
V4100B024
V4100B025
V4100B026
V4100B027
V4100B028
V4100B029
V4100B030
V4100B031
V4100B032
V4100B033
V4100B034
V4100B035
V4100B036
V4100B037
V4100B038
V4100B039
V4100B040
V4100B041



DETROIT EDISON COMPANY DRAWING NO. 6M721-2240, REV. AY

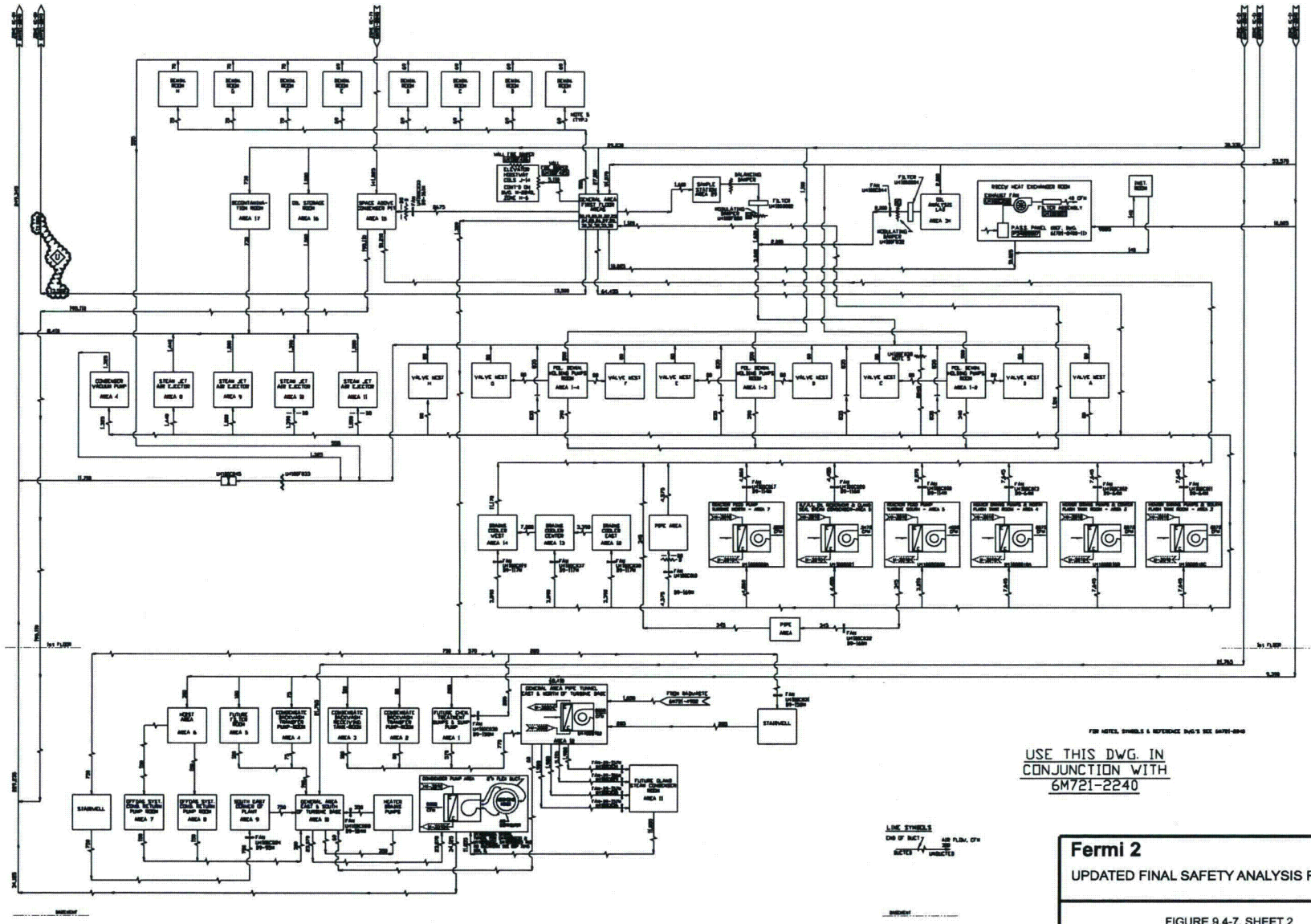
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-7, SHEET 1

TURBINE BUILDING VENTILATION FLOW DIAGRAM

REV 19 10/14



USE THIS DWG. IN CONJUNCTION WITH 6M721-2240

DETROIT EDISON COMPANY DRAWING NO. 6M721-2240-1, REV. U

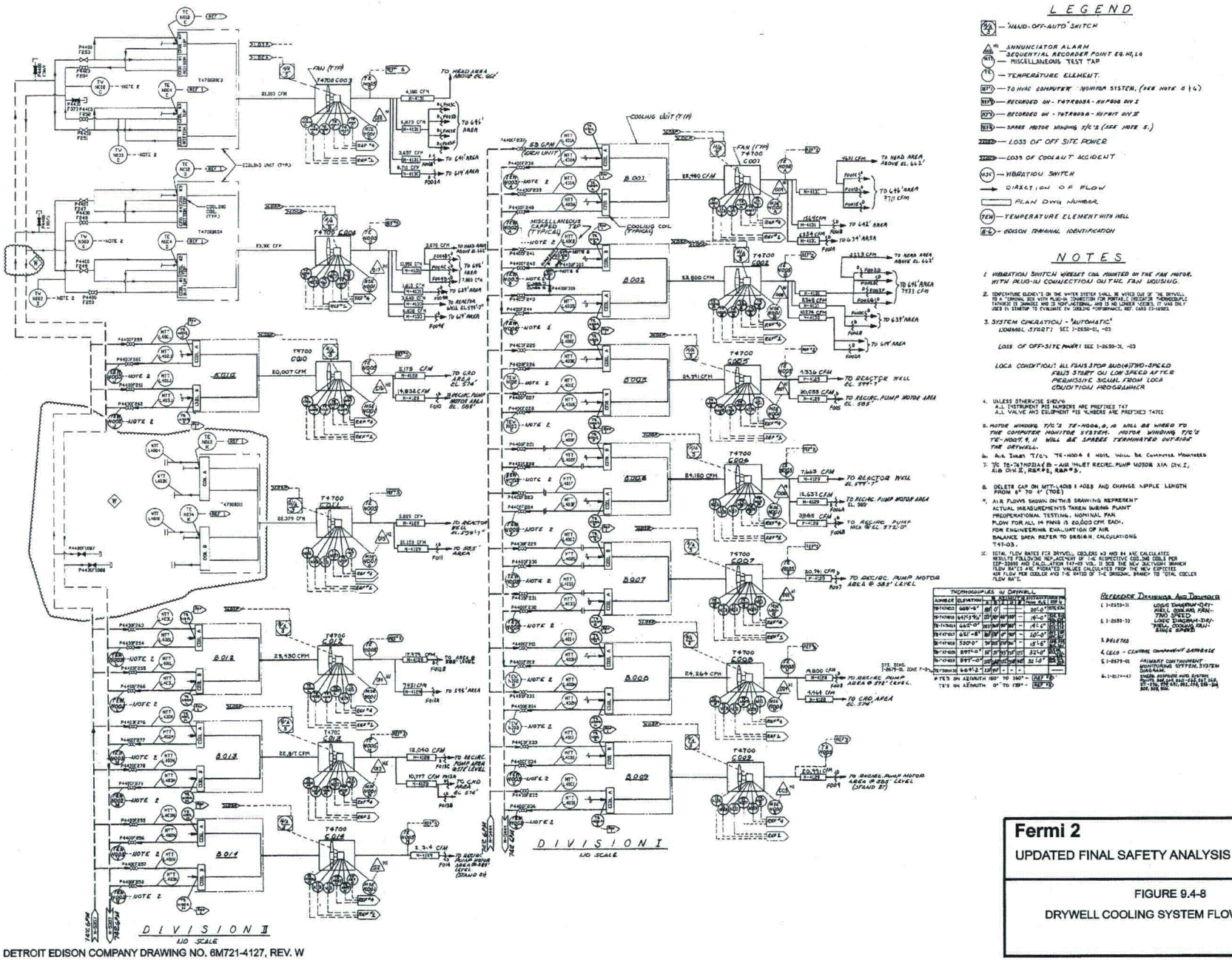
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-7, SHEET 2

TURBINE BUILDING VENTILATION FLOW DIAGRAM

REV 18 10/12



DETROIT EDISON COMPANY DRAWING NO. 6M721-4127, REV. W

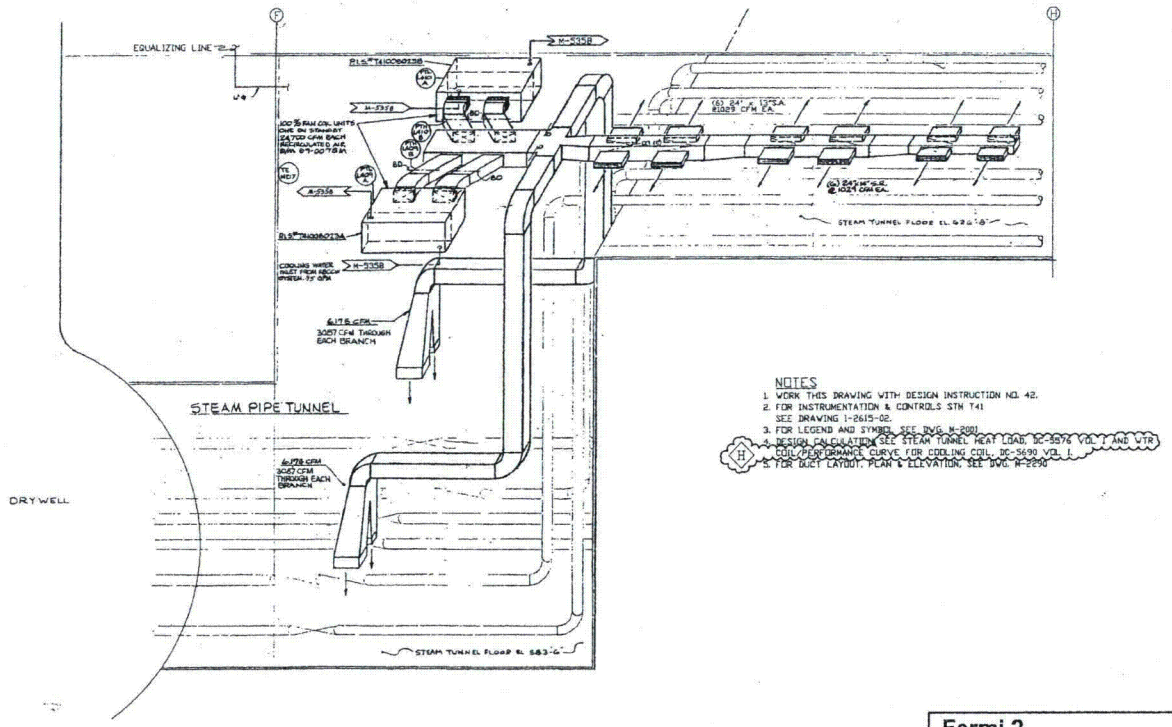
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-8

DRYWELL COOLING SYSTEM FLOW DIAGRAM

REV 17 05/11



Fermi 2

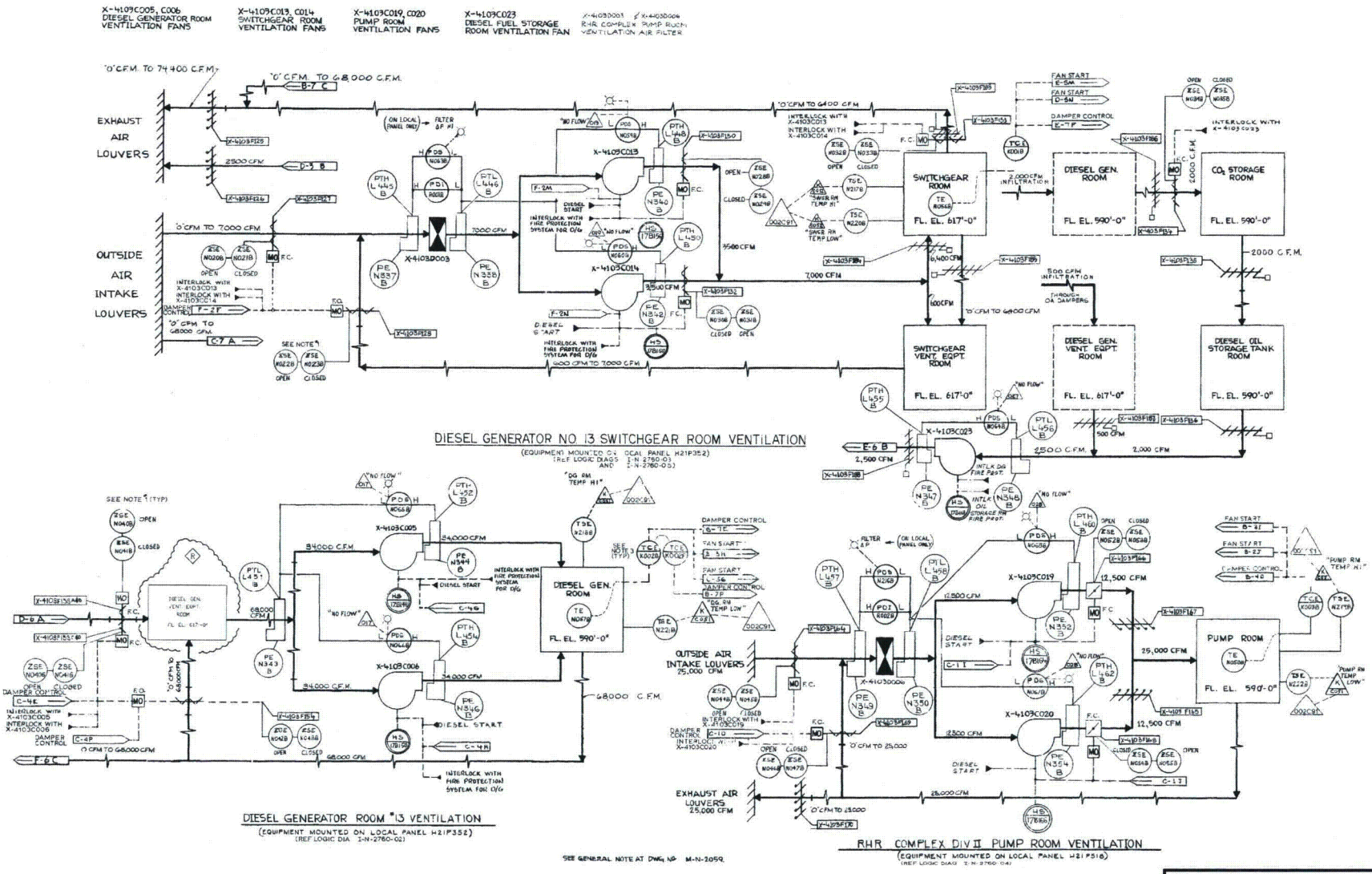
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-9

STEAM TUNNEL COOLING SYSTEM
FLOW DIAGRAM

DETROIT EDISON COMPANY DRAWING NO. 5M721-2756, REV H

REV 19 10/14



DETROIT EDISON COMPANY DRAWING NO. 6M721N-2058, REV. R

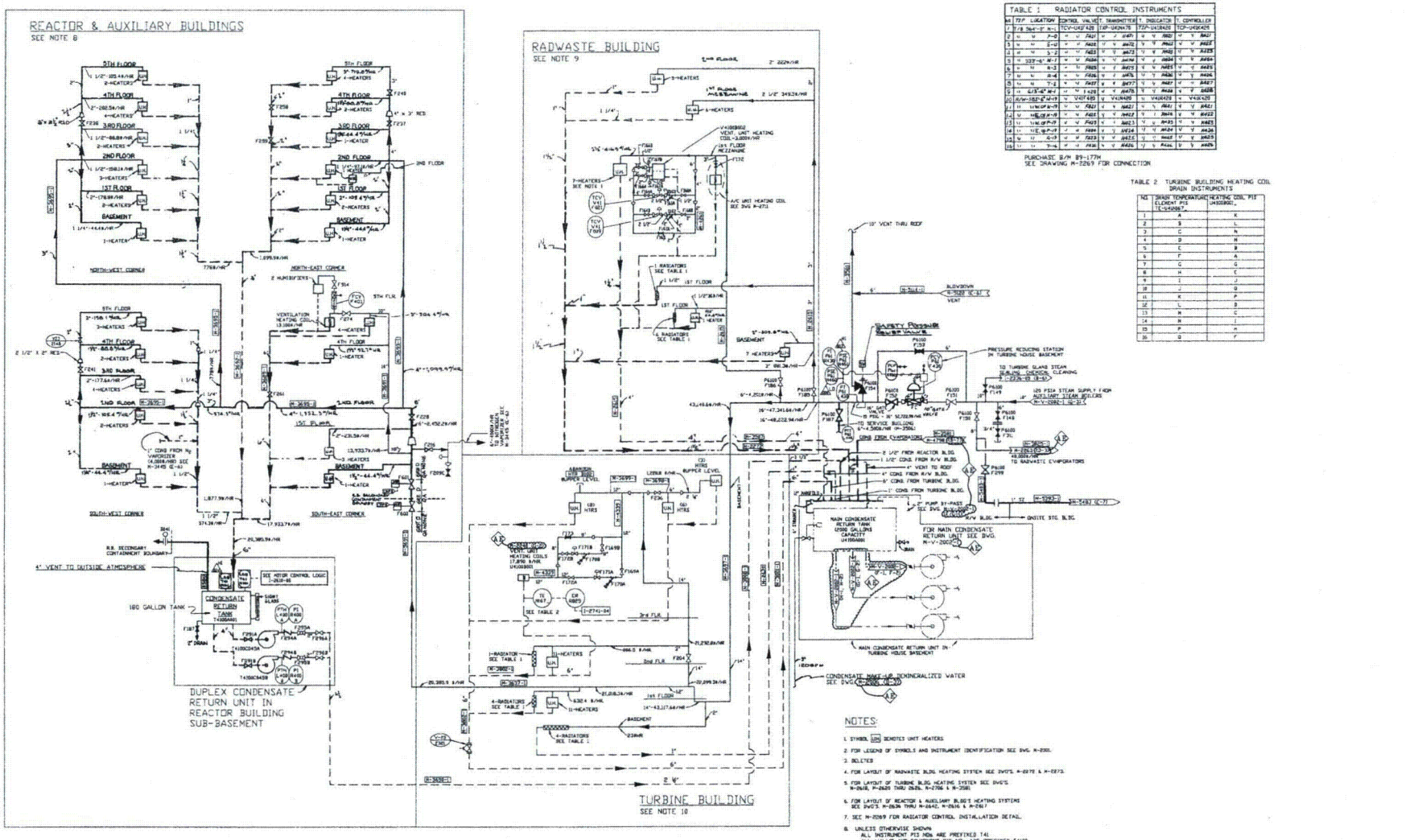
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-10

DIVISION II RESIDUAL HEAT REMOVAL COMPLEX TYPICAL VENTILATION SYSTEM – DIESEL GENERATOR 13 – FLOW DIAGRAM

REV 12 11/03



Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

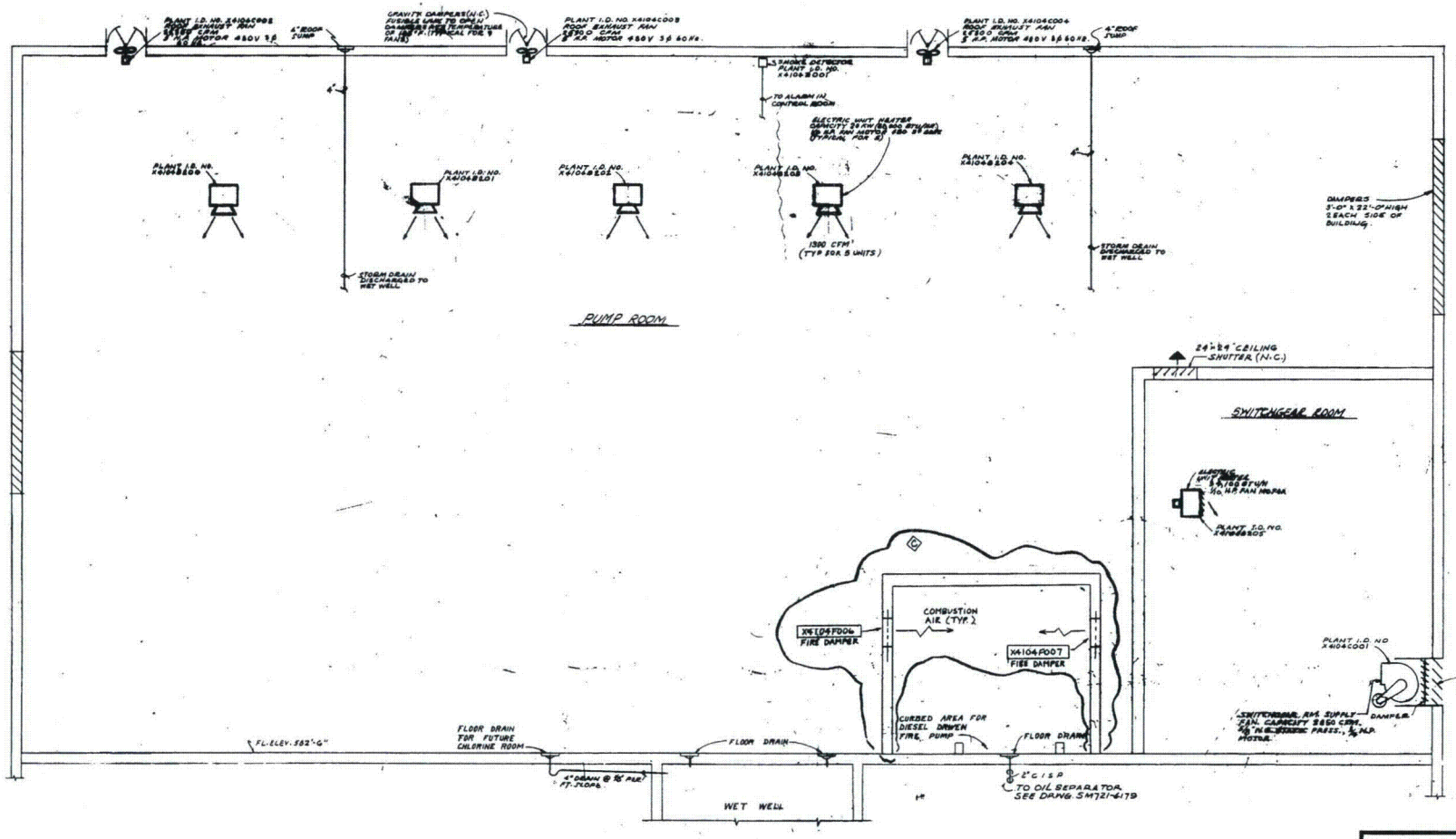
FIGURE 9.4-11

PLANT HEATING SYSTEM
FLOW DIAGRAM

DETROIT EDISON COMPANY DRAWING NO. 6M721-2271, REV. AE

REV 19 10/14

NOTE:
1. HEATING LOADS ARE BASED ON ¼ AIR CHANGE PER HOUR INFILTRATION.



VENTILATING	
PUMP ROOM	
INSIDE DESIGN TEMPERATURE BASED ON 95° AMBIENT	112°F
CFM CAPACITY	75,900
SIZE OF EXHAUST FANS, CFM	25,300
MOTOR HORSEPOWER	5
NUMBER OF EXHAUST FANS	3
NUMBER OF AIR CHANGES/HR. (SUMMER)	24
SWITCHGEAR ROOM	
INSIDE DESIGN TEMPERATURE BASED ON 95° AMBIENT	105°F
CFM CAPACITY – ONE (1) FAN	2850
NUMBER OF AIR CHANGES/HR. (SUMMER)	15
MOTOR HORSEPOWER	¼
HEATING	
PUMP ROOM	
INSIDE DESIGN TEMPERATURE	50°F
OUTSIDE DESIGN TEMPERATURE	-10°F
HEATING LOAD BTU/HR.	319,900
SIZE OF HEATING UNITS	
5 UNITS @ 20 KW	
TOTAL CAPACITY BTU/HR.	340,000
SWITCHGEAR ROOM	
INSIDE DESIGN TEMPERATURE	50°F
OUTSIDE DESIGN TEMPERATURE	-10°F
HEATING LOAD BTU/HR.	18,100
SIZE OF HEATING UNIT BTU/HR.	34,100

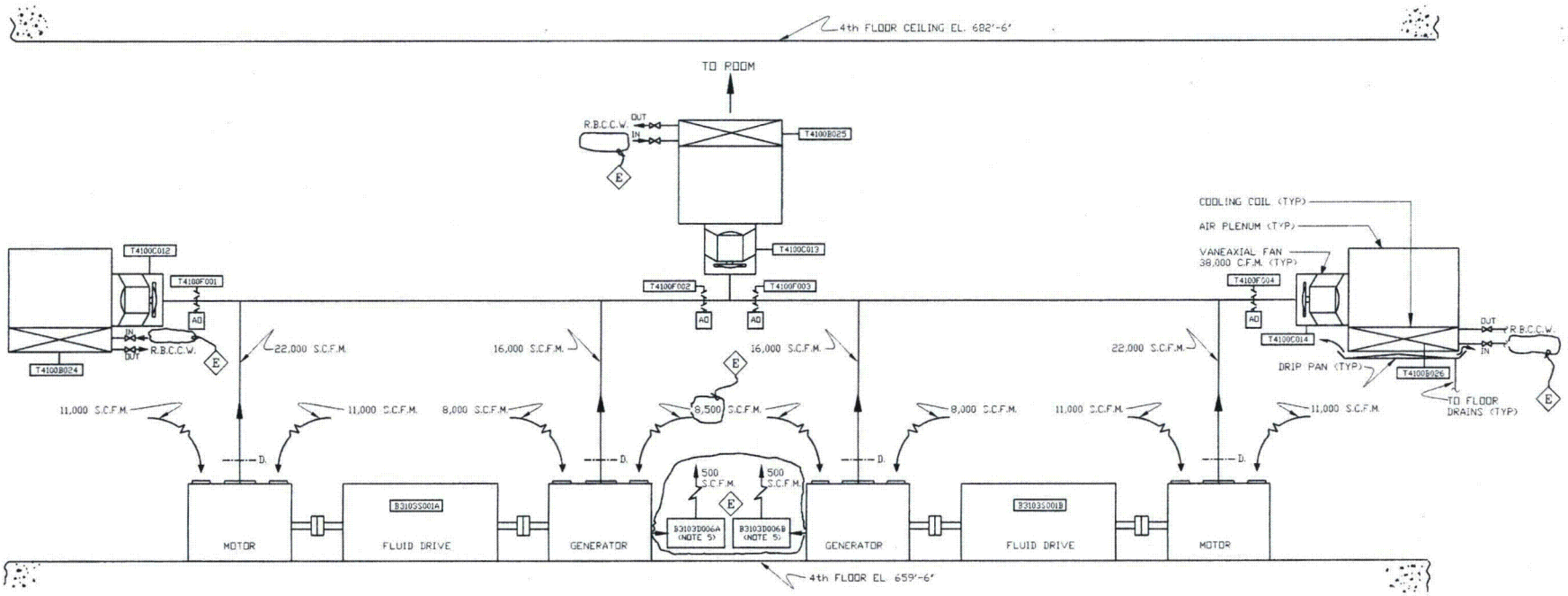
Fermi 2
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-12

GENERAL SERVICE PUMP HOUSE VENTILATION SYSTEM FLOW DIAGRAM

DETROIT EDISON COMPANY DRAWING NO. 6M721S-2003, REV. C

REV 7 5/95



NOTES:

1)

2) FOR LEGEND AND SYMBOLS SEE DRAWINGS M-2291 AND M-2001

3) FOR RBCCW SYSTEM AND FECW SYSTEM DIAGRAM REFER TO DRAWINGS M-5357, M-5358 AND M-5444

4) FOR INSTRUMENTATION AND CONTROLS SEE DRAWING I-2615-03

5) MG SET HEPA FILTER UNITS TO BRUSH/SLIP RING HOUSING

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.4-13

MOTOR-GENERATOR SET COOLING SYSTEM FLOW DIAGRAM

DETROIT EDISON COMPANY DRAWING NO. 5M721-2708, REV E

REV 10 11/00

9.5 OTHER AUXILIARY SYSTEMS

9.5.1 Fire Protection System

9.5.1.1 Design Basis

9.5.1.1.1 Introduction

The fire protection system is designed to provide adequate fire protection for all potential fire hazards. It provides prompt fire detection, alarm, and suppression. The fire protection system is designed to supplement the other fire protection safeguards incorporated into the plant design, including a low combustible fire loading and adequate separation of fire areas. Included in the total fire protection system are a fire protection water supply and distribution system, a fire detection and alarm system, and gaseous extinguishing systems, as well as fixed water spray and automatic sprinkler systems. Manual fire protection hose connections are provided on all floors, and hydrants are located in the yard. Plant operators are trained on a routine basis in fire-fighting techniques.

The Fermi 2 fire protection system has been developed using the fire hazards analysis, National Fire Protection Association (NFPA) standards, and recommendations made by the Nuclear Energy Liability-Property Insurance Association (NEL-PIA) (now named American Nuclear Insurers (ANI)) after its review of the entire system. This method is equivalent to postulating peak fire intensities due to the fire calculations and experience inherent in the standards and NEL-PIA recommendations.

The entire fire protection system is designed using the NFPA standards and the NEL-PIA recommendations for guidance.

The concrete building materials, the compartmentalization, and fire doors provide the structural features needed to prevent the spread of fires in Category I structures. The concrete used in the walls, floors, and ceilings will not support combustion. The compartmentalization of the plant for shielding purposes also provides fire barriers between equipment areas. The fire zones in the safety-related areas are established in the fire hazards analysis presented in Appendix 9A.

Because of the plant construction using noncombustible materials, the fire protection system is a nonseismic system. The piping is designed to Category II/I criteria (Section 3.7).

9.5.1.1.2 Codes and Standards

The following codes and standards were used for guidance in the design of the Fermi 2 fire protection system:

a. NFPA-10, Portable Fire Extinguishers - 1978

b. NFPA-12, Carbon Dioxide Systems - 1977

c. NFPA-12A, Halogenated Fire Extinguishing Agent Systems - 1977

d. NFPA-13, Installation of Sprinkler Systems - 1980. Certain deviations to NFPA-13 requirements, with supporting justifications, are identified in sections 9.5.1.2.3.3, 9A.4.1.6.1, 9A.4.1.7.1, 9A.4.2.3.1, 9A.4.3.1 and 9.5.1.2.1.

e. NFPA-13A, Care and Maintenance of Sprinkler Systems - 1976

f. NFPA-13E, Fire Department Operations in Properties Protected by Sprinklers and Standpipe Systems - 1973

g. NFPA-14, Standpipe and Hose Systems - 1976

Certain deviations to NFPA-14 requirements, with supporting justifications, are identified in sections 9.5.1.2.1 and 9A.2.3.5.2.

h. NFPA-15, Water Spray - Fixed Systems - 1979

i. NFPA-20, Centrifugal Fire Pumps - 1970

Certain deviations to NFPA-20 requirements, with supporting justifications, are identified in section 9.5.1.2.3.2.

j. NFPA-24, Outside Protection – 1970

Certain deviations to NFPA-24 requirements, with supporting justifications, are identified in section 9.5.1.2.1.

k. NFPA-30, Flammable and Combustible Liquids - 1977

l. NFPA-72D, Proprietary Protective Signaling Systems for Watchman, Fire Alarm, and Supervisory Service - 1975

m. NFPA-72E, Automatic Fire Detectors - 1974

n. NFPA-198, Fire Hose (Including Couplings and Nozzles) - 1972

o. Underwriters Laboratories approved materials for fire protection

p. ANSI Specification B1.1, B18.2.1, Nuts and Bolts

q. ANSI Specification B31.1.0, Power Piping

r. ANSI Specification B16.1 - 1967, Standard Flange

s. 10 CFR 50, Appendix A, Criterion 3, Fire Protection.

9.5.1.1.3 Multiple-Unit Fire Protection

Fermi 2 is not a multiple-unit plant; therefore, no precautions are necessary to protect the operating plant during the construction of multiple units.

9.5.1.2 System Description

9.5.1.2.1 General Description

The FPS is shown in Figures 9.5-1, 9.5-2, and 9.5-3.

The dedicated fire protection water supply is obtained from a 2500-gpm electric-driven fire pump and a 2500-gpm diesel-driven fire pump located in the GSW pump house. Either fire

pump will supply the required fire protection water demands. The diesel- and electric-driven fire pumps are normally on standby, since the fire mains are supplied with makeup water and pressurization from the FPS jockey pump which takes suction from the GSW pump header. The FPS jockey pump operates continuously, maintaining pressure in the fire main. If fire header pressure falls below GSW header pressure, makeup water will also be supplied via the cross-tie line between GSW and FPS. The electric fire pump starts automatically when the fire protection system header pressure drops to 130 psig, and the diesel fire pump starts when the fire protection system header pressure drops to 110 psig; both require manual shutdown once started. The fire pumps meet the intent of NFPA Standard 20 (except for certain deviations identified in section 9.5.1.2.3.2) and NEL-PIA recommendations, and are Underwriters Laboratories (UL) approved. The fire main loop is completely isolable from the GSW system, and a check valve is provided to prevent flow from the fire main loop into the GSW system. This design provides flexibility to support the fire main loop while maintaining its integrity with respect to system flow.

The distribution fire main in the yard surrounding the plant is a 12-in. underground header, which is buried below the frost line to prevent freezing. Normally open valves with post indicators are installed in the fire main on each side of every branch and also on every branch leading from the fire main. Those valves, together with individual hydrant shutoff valves, permit isolation of a line break anywhere, with minimum interruption of service to undamaged sections. Hydrants and underground fittings are provided with suitable thrust blocks to prevent blowouts of the system. The underground portion of the system is coated with corrosion-resistant materials and is also protected by cathodic protection, as applicable.

The 12-in. fire main is designed to provide the required water demands for the automatic sprinkler systems and 500 gpm for all hose demands. The hose pipe system is designed as an NFPA Standard 14 Class II hose system. Pressure reducing devices are not installed as required by NFPA-14 at all hose station outlets where the pressure exceeds 100 psig, to reduce the pressure with required flow at the outlet to 100 psig. This is acceptable because the hose stations and fire hose are only used by trained fire brigade members, and adjustable pattern fog nozzles are provided at all hose stations, except for the fifth^{h} (refueling) floor of the reactor building where solid stream nozzles are provided. Pressure reducing devices that significantly reduce pressure are provided for hose station outlets on the fifth floor of the reactor building and on floors below the grade floor of 583 ft 6 in., due to excessively high pressure at those hose stations. The reason for utilizing a higher pressure at hose stations is to be able to more effectively fight fires at the ceiling height where cable trays are located. The fuel storage tank for the diesel fire pump holds sufficient fuel to continuously operate the pump for a minimum of 8 hr.

The fire main loop serves the outdoor hydrants, which are spaced in accordance with NFPA Standard 24. Additional hydrants on branches of the main loop are located in the general vicinity of the cooling water towers, in the protected area, and in the vicinity of the warehouses and the CTG fuel storage tank outside the protected area. Underground branches from the fire main loop supply water to standpipes and hose stations in the reactor, turbine, radwaste, auxiliary, residual heat removal (RHR) complex, service, Independent Spent Fuel Storage Installation (ISFSI) equipment storage, and warehouse buildings within the protected area. A separate branch with an isolation valve supplies warehouses, fire hydrants and other buildings as shown in Figure 9.5-1, Sheet 2. In addition to the 12-in. steel pipe, this branch

includes 12-in., 8-in. and 6-in. portions of transite pipe, 6-in. cement lined ductile iron pipe, as well as 6-in. portions of poly vinyl chloride pipe, as shown in Figure 9.5-1, Sheet 2. The underground fittings are provided with suitable thrust blocks to prevent blowouts of the system. Valves are provided to isolate this branch in the event of a pipe failure. The underground feeds into the RHR Complex building are embedded in an exterior wall and floor where the two lines are exposed to outdoor temperatures. Freezing is avoided by a combination of exterior wall insulation and by running a continuous amount of water through the lines during the winter season. This is an alternative method of providing freeze protection to the specific requirements of NFPA 13 and 24 and was in a report filed with the NRC in VP-85-0204 (Reference section 9A.1.1.2).

The sprinkler system supplies water to the sprinklers, which have a fusible link that at a set ambient temperature initiates water flow in the sprinkler. An alarm valve and/or flow switch in the line actuates a visible and audible alarm in the main control room for sprinklers in the protected area. Indication for those sprinkler systems in the owner controlled area are located within normally manned security areas. The areas covered by the sprinkler systems are indicated in Table 9.5-1.

The deluge system consists of a system employing open sprinklers attached to a piping system connected to the fire protection water supply through a valve that is opened by the operation of a fire detection system installed in the same area as the sprinklers. Audible and visible alarms are actuated in the main control room for the deluge systems located in the protected area. The deluge valves in the protected area can also be opened by manual switches from the main control room. These deluge valves can be reset only when there is no pressure upstream of the valve. This can be achieved by manually closing the outside screw and yoke valve upstream of the deluge valve. Position-indicating lights for the deluge (and outside screw and yoke) valves of both the sprinkler and the deluge systems in the protected area are provided in the main control room. Provisions for monitoring the electrical control circuits of the deluge valve manual switches are also incorporated into the main control room for valves in the protected area. Indications for those fire protection valves in the owner-controlled area are located within normally manned security areas. Areas with deluge system protection are listed in Table 9.5-1.

Each divisional pair of diesel generators is provided with a low-pressure CO_2 flooding system. The initiation of CO_2 in the diesel generator room does not affect the starting and running of the diesel generators. The diesel-fuel-oil storage tanks are protected by wet-pipe sprinkler systems. The fuel oil storage tanks are contained in their own rooms with elevated doorways that would prevent the fuel oil from flowing into other adjacent areas in the event of a rupture of the tanks. In addition, floor drains are provided in these rooms to drain the oil, and the water from the sprinkler system, to the outside liquid chemical waste holding pond. Diking is also provided around the 150,000-gal auxiliary boiler fuel-oil storage tank.

The standby gas treatment system (SGTS) charcoal filters are provided with a low-pressure CO_2 flooding system.

Fire protection and detection also include provisions of motor-operated dump valves on the reactor feedpump (RFP) turbine-oil reservoir and the emergency diesel generator (EDG) fuel-oil storage tank, fusible-link fire dampers in the supply and return air ducts of the ventilation systems of the reactor and service buildings, control center, and RHR complex,

and ionization detectors and/or photoelectric detectors for the detection of combustion products and smoke. The turbine building is provided with 13 heat- and smoke-relief vents in the roof, which open either automatically on high temperature or high pressure in the building or manually from the main control room.

Portable fire extinguishers are deployed throughout the plant, and each unit is selected on the basis of the type of fire anticipated. NFPA Standard 10 was used as a guide for the selection, spacing, location, use, and maintenance of the portable extinguishers. Approximately 200 portable fire extinguishers are distributed throughout all the floors of the reactor, auxiliary, RHR, turbine, and radwaste buildings. These include multipurpose portable dry-chemical extinguishers for Class A, B, and C fires and portable CO_2 and Halon extinguishers. Where necessary, in support of the manual fire suppression systems, masks and portable breathing apparatus are provided for personnel protection.

Temperature, photoelectric, infrared, or ionization detectors are provided throughout the plant and are identified in Appendix 9A. In addition, the activation of any automatic fire-fighting equipment, component, or detector energizes visible and audible alarms in the main control room.

The type of fire-extinguishing equipment provided for each area is as follows:

Type	Area
Yard main and hydrants	Exterior of buildings, yard structures, and storage areas
Deludge and sprinkler systems	Parts of reactor, turbine, radwaste, and service buildings, transformer area, oil storage, reservoirs, diesel-fuel-oil storage tanks in RHR complex, ISFSI equipment storage building, and warehouse
Standpipe system and hose stations	On every floor inside all major plant buildings, except the office building annex (034)
Automatic CO_2 extinguishing systems	Diesel generator rooms, SGTS charcoal filters, cable tunnel (manual only), outside Division II switchgear room, and selected cable tray areas
Portable fire extinguishers	Throughout the plant, especially in critical control areas where general flooding could adversely affect safety-related equipment
Automatic Halon suppression systems	Relay room, cable spreading room, computer room and other selected minor areas
Automatic Clean Agent suppression system	Parts of radwaste building and the Security Diesel Generator enclosures

9.5.1.2.2 Control Room Protection Systems

A potential main control room fire would be extinguished by manual fire-fighting techniques. Portable CO_2 and Halon extinguishers are provided, and if needed, the normal standpipe and hose connections are located outside the main control room. Equipment in the main control room is noncombustible.

The main control room fire detection system covers the main control room, the areas above the false ceiling, inside the COP panels, and under the computer area floor. Main control room habitability in the event of smoke is maintained by the ventilation system as described below.

The exhaust from each zone listed in Subsection 9.4.1.2.1 is either partially recirculated or completely exhausted under normal operating conditions. All of the control center air conditioning system (CCACS) zones are equipped with ionization-type detectors or other approved types of detectors. These areas include the air conditioning system mechanical equipment room, computer/main control room, cable spreading room, and relay room. If smoke is detected by any of the early-warning ionization detectors, an indicating light on the area smoke, fire, and radiation protection panel in the main control room will illuminate, indicating the zone, and an audible alarm will be sounded in the main control room. The control center ventilation will automatically be placed in the smoke purge mode of operation upon confirmed actuation of the Halon system in the cable spreading room or relay room. The ventilation systems for the cable spreading room and relay room automatically isolate when the Halon system initiates in these areas. This prevents dilution of the Halon when the control center ventilation is placed in the purge mode of operation. The purge mode results in once-through ventilation system operation throughout the control center (approximately seven air changes per hour) with no recirculation. This operation clears smoke from the fire area and prevents smoke and Halon from being recirculated into the main control room. The smoke purge mode, however, is overridden by a LOCA signal which places the ventilation system into 100 percent recirculation.

Wherever the control center ventilation supply or return ducts penetrate a fire barrier wall, a 3-hr fire damper installation is provided or a specific fire hazards analysis evaluation has been performed and documented. These fire dampers automatically close either by spring action or by gravity when a fusible link melts on high temperature. In the cable spreading and relay room supply and return ducts, remotely resettable dampers are provided that automatically close when the gaseous system actuates. These dampers can be reset from the main control room. Position indication is provided on the remotely resettable dampers.

In the event of a fire outside the main control room but within the control room complex, the early-warning fire detection system will alert the operators to the problem. The fire detection system includes all areas of the control center. A ventilation equipment room fire will be extinguished by manual fire-fighting means. A relay or cable spreading room fire will be extinguished by manual means or by the automatic Halon suppression system.

A panel is installed outside the main control room that satisfies the requirements of 10 CFR 50, Appendix R, paragraph III.L for alternative or dedicated plant shutdown. The approach to the alternative shutdown design, the analysis, and method used are described further in Subsection 7.5.1.5.

Automatically initiated water systems are not employed on control center complex Class 1E electrical equipment because of the loss of reliability associated with the operation of fire protection equipment. The relay room, selected cable tray areas, and the EDGs are protected with automatic gaseous systems. Class 1E equipment located in other areas is protected by early-warning fire detectors. The above areas are identified in Appendix 9A.

9.5.1.2.3 Design Features

The design features of the Fermi 2 fire protection system equipment are described in the subsections that follow.

9.5.1.2.3.1 Electric Fire Pump

The electric fire pump has the following specifications: 2500 gpm at a discharge pressure of 150 psi, 1780 rpm, and 370-ft total developed head. The motor is 4000 V, 300 hp. The fire pump is UL listed equipment. The controller is not UL listed but does meet the general design and functional requirements of listed controllers. Status alarms indicating the availability of the electric fire pump are provided in the control room.

9.5.1.2.3.2 Diesel Fire Pump

The diesel fire pump has the following specifications, UL listed for 2500 gpm at a discharge pressure of 150 psi, 1775 rpm, and 370-ft total developed head. The engine is a diesel engine, UL listed for 340 hp, 2300 rpm, with a 275-gal fuel-oil tank for 8 continuous hr of operation. This pump and controller are UL listed equipment. Alarms are provided in the control room to indicate pump availability.

The electric fire pump was rebuilt and has replaced the original diesel fire pump. The diesel engine driver, when de-rated in accordance with NFPA 20, cannot develop the required horsepower to operate the diesel fire pump at rated speed to meet NFPA 20 requirements at the 100 percent and 150 percent flow points. The inability of the de-rated diesel driver and pump to meet the NFPA 20 flow and pressure requirements is an acceptable deviation because the diesel fire pump can provide the required flow and pressure demand for simultaneous operation of a suppression system and 500 gpm for hose streams.

9.5.1.2.3.3 Sprinkler Systems

The sprinkler systems are wet- or dry-pipe systems designed to provide a minimum water spray density per square foot of the most hydraulically remote area using NFPA Standard 13 and NEL-PIA requirements as guidelines. The sprinkler alarm check valves have been modified by adding a small bypass line to the trim of each valve to prevent any overpressure developing on the sprinkler system because of temperature changes or other reasons. This trim arrangement differs from the listed alarm check valve trim arrangements required by NFPA 13 but has no adverse effect on the functions of the Fermi sprinkler systems.

Other noncompliances with NFPA 13 have been evaluated in accordance with Generic Letter 86-10 as acceptable. These include the omission of return bend piping on pendent sprinklers, the omission of auxiliary drains on small trapped sections of sprinkler piping, the use of in-place welding to join and modify piping, and the lack of minimum required clearance

distance for sprinklers below ceilings, ducts, or other items. The lack of return bends is acceptable based on the periodic change-out of the pendent sprinkler to prevent excessive accumulation of sediment in the sprinkler waterway. The other subject noncompliances are acceptable based on not adversely affecting the required function of the sprinkler systems and based on the administrative controls of the plant Fire Protection Program procedures.

The minimum water spray density used for each sprinkler system was determined by the occupancy classification defined in NFPA Standard 13 listed below:

Sprinkler System	Occupancy Classification
High pressure coolant injection (HPCI) room	Extra hazard, group #1
Reactor core isolation cooling (RCIC) room	Ordinary hazard, group #3
Motor-generator (M-G) set and oil cooler area	Extra hazard, group #1
Torus room	Ordinary hazard, group #3
Equipment unloading area	Ordinary hazard, group #3
2^{nd} floor reactor building area	Ordinary hazard, group #3
Auxiliary building basement area	Ordinary hazard, group #3
Auxiliary building 1^{st} floor mezzanine	Extra hazard, group #1
Cable spreading room (Elevation 630 ft)	Extra hazard, group #1
EDG fuel tank rooms	Extra hazard, group #1
Diesel fire pump room	Ordinary hazard, group #3

The sprinkler heads used in these systems are all fusible-link closed heads.

9.5.1.2.3.4 Deluge Systems

The deluge systems are open directional spray nozzle systems designed to provide density in accordance with NFPA Standard 15 and NEL-PIA requirements.

Deluge valves are solenoid valve operated, controlled automatically by the fire protection system or controlled manually from the main control room.

9.5.1.2.3.5 Gaseous Suppression Systems

A 6-ton low pressure CO_2 storage unit is provided for two EDGs in the same division. A total of two units each serving two EDGs is located in the RHR complex. The CO_2 system for the SGTS provides internal protection for the charcoal beds. Each SGTS division has an independent 1.25-ton CO_2 system. CO_2 systems are provided to protect certain areas of the reactor/auxiliary building, as listed in Table 9.5-1. A low pressure CO_2 storage unit is located outside the reactor building. A distribution system will select the proper zone where the fire is detected. Halon and Clean Agent suppression systems are provided in areas identified in Table 9.5-1.

9.5.1.2.3.5.1 General Design Information for the RHR Complex and Reactor/Auxiliary Building CO_2 Systems

The CO_2 system instrumentation and control equipment detects fires, initiates and terminates fire suppression discharges, and monitors system performance. Detection of fires is accomplished by heat and/or smoke detectors. Detection devices activate alarms to indicate the presence of a fire and activate control equipment to initiate discharge of fire-extinguishing agents. Discharge is delayed for sufficient time to enable personnel to leave the area. Activation of fire suppression equipment is accomplished either manually at local panels or automatically by fire detection devices. The control instrumentation directs the discharge into the selected area and closes ventilation dampers to isolate the fire and contain the discharge. Alarms indicate the operation of the systems.

Controls automatically terminate the discharge after a predetermined time. Instrumentation monitors the system operation and alarms under abnormal conditions. The CO_2 system controls provide for proper operation of the storage tank refrigeration unit.

Wall and floor penetrations for the areas protected by the CO_2 system are sealed to contain the CO_2 discharge. Any CO_2 leakage that may occur after the area is isolated is included in the extended discharge application rate. Further, upon completion of the system, a concentration test was conducted to confirm the design parameters.

Entrance to an area after a CO_2 discharge can be gained by resetting the ventilation dampers to the open position and initiating the exhaust function. To further aid in purging, portable smoke fans can be used as needed. Self-contained breathing apparatus is available and can be used to gain access for manual fire fighting or cleanup.

9.5.1.2.3.5.2 Design Guidance for Reactor/Auxiliary Building CO_2 Systems

a. The CO_2 storage capacity is sufficient to provide two-shot (100-percent redundancy) protection for the hazard area requiring the greatest quantity of CO_2, based on a design concentration of 50 percent. The quantity of CO_2 includes a 50 percent margin for leakage during an extended discharge. This allowance is based on all accesses and ventilation ducts being closed

b. The distribution system pipe sizing and arrangement are based on providing and maintaining an extinguishing concentration of CO_2 in the hazard area for 20 minutes. This is accomplished by applying an initial discharge at a sufficiently high rate to achieve a 30 percent concentration in 2 minutes or less, and the design 50 percent concentration in 7 minutes or less, in conjunction with an extended discharge at a lower rate sufficient to maintain the 30 percent concentration for 20 minutes

c. The design CO_2 concentration is 50 percent for each protected area. Flooding factors are based on the guidelines of NFPA Standard 12 for total flooding systems, assuming dry electrical wiring hazards in general cable areas

d. The storage tank refrigeration unit is sized to maintain the storage tank at 0°F and 300 psig, assuming the highest expected ambient temperature of 105°F. Power is provided as described in item e below

e. Fire detection devices, actuating instrumentation, and control equipment are powered from the 120-V restored ac bus. In addition, the fire detection system for CO_2 actuation is provided with a 4-hr, 24-V dc battery system.

9.5.1.2.3.5.3 Design Guidance for Diesel Generator CO_2 Systems

a. Each division contains two EDGs. The 6-ton storage tank for each division will provide one complete shot to both EDGs or double shot protection for one EDG

b. The design CO_2 concentration is 50 percent for each protected area. Based on guidelines of NFPA 12, the minimum design concentration for diesel fuel is 34 percent

c. Detection devices consist of thermal detectors

d. Fire detection and CO_2 controls are normally powered from the balance-of-plant 130-V dc system. Emergency power for the fire detection and CO_2 controls are powered from a 120-V manual restored ac bus. The power is then rectified to 130-V dc. Power for the refrigeration units and room warning lamps are powered from a 120-V manual restored ac bus

e. The system is designed to maintain the room concentrations for 20 minutes.

9.5.1.2.3.5.4 Design Guidance for the Standby Gas Treatment System CO_2 System

a. When the SGTS charcoal bed temperature reaches 250°F, an alarm sounds, which alerts the control room operator to an overtemperature condition well before there is danger of ignition. If the beds continue to heat up and reach 310°F, the low pressure CO_2 Suppression System will be automatically initiated and 250 lb of CO_2 are injected in the bed over a 10-minute period. This actuation of the CO_2 system is indicated on the fire protection mimic panel and an alarm on the control panel. Based on the alarm response procedure, the SGTS exhaust and cooling fans will be manually shut off if they are running.

   This cycle is repeated as long as the temperature exceeds 310°F. Each of the divisional CO_2 storage tanks holds enough CO_2 for 10 injections

b. Detection devices consist of a continuous thermal fire detection system

c. The detection devices and CO_2 controls are powered from the 120-V restored ac bus.

9.5.1.2.3.5.5 Design Guidance for Halon Systems

a. The Halon storage capacity consists of a main bank and a reserve bank for each system. Each bank will provide sufficient capacity for a complete shot

b. The systems are designed to provide a minimum 5 percent concentration for a 10-minute holding period

c. Emergency power for the fire detection and halon control systems is powered from a 120-V restored ac bus.

9.5.1.2.3.6 Design Guidance for Clean Agent Systems

a. The Clean Agent storage capacity consists of two storage cylinders, a primary and a reserve, for each system. Each will provide sufficient capacity to provide protection for the potential hazard based on concentration, volume of area, and known leakage pathways out of the designated area.

b. The systems are designed for a discharge time to provide a 95 percent minimum design concentration for flame extinguishment based on a 20 percent safety factor and will not exceed 10 seconds.

c. Power for the fire detection and Clean Agent control systems is provided by a separate dedicated 120V, 1 phase 60Hz source that will not be shutdown on system operation.

Use of this system is limited to the Security Diesel Generator enclosures and areas in the Radwaste Building which do not include any systems or circuits credited for reactor shutdown in the event of a fire (i.e. – activation of the Clean Agent fire suppression system will not adversely affect the plant's ability to achieve and maintain shutdown in the event of a fire).

9.5.1.2.3.7 Turbine Room Roof Vents

Thirteen roof vents in the turbine room are opened automatically at 20-psf differential pressure, or at 160°F by fusible link, or manually from the main control room, or locally by pull rings.

9.5.1.2.3.8 Dampers

Fire dampers located in the ventilation ductwork are curtain type with fusible links. Dampers are either spring loaded or rely on gravity to close. The fire damper will close only when high temperature melts the fusible link. Resettable smoke/halon and smoke/CO_2 dampers provided with the gaseous systems have the damper position monitored in the main control room.

9.5.1.2.3.9 Instrumentation

a. Flow Switches

Flow switches are provided in various locations of the standpipe system to detect water flow

b. Thermal Detectors

Thermal detectors are provided as part of the equipment package for the deluge systems, the EDG CO_2 systems, and the Security Diesel Generator enclosures.

c. Ionization Detectors

Ionization detectors are provided in areas requiring early-warning detection. Additionally, a separate ionization detection system was installed to actuate the gaseous systems (except for the CO_2 systems in the EDG rooms in the RHR

building, where thermal detectors are used as noted above and the under-floor detectors in the main control room computer room where photoelectric detectors are used along with ionization detectors above the floor).

d. Photoelectric Detectors

Photoelectric detectors are used in areas requiring early-warning detection. These are usually used in place of ionization detectors in areas with difficult access. Photoelectric detectors are used under the floor, to actuate the halon system, in the main control room, computer room.

e. Infrared Detectors

Infrared detectors are utilized on the fifth floor of the reactor building and in the Security Diesel Generator enclosures.

f. Instrumentation and Control

Instrumentation and control of the fire protection systems is fed from various power sources identified in Sections 9.5.1.2.3.5 and 9.5.1.2.3.9. The sprinklers operate independently of ac or dc power. The deluge valves are controlled and fed from the dc power system. The standpipe system, which also supplies the sprinkler and deluge systems, is pressurized in a ready-for- service condition without need for valve operation. The GSW pumps and the electric fire pump operate from the ac system service and are not connected to the onsite power source. On loss of offsite power, the diesel fire pump starts and operates from its own 24-V battery and charger system

g. Fire Detector Location

The types and locations of fire detectors are provided in Appendix 9A.

9.5.1.2.3.10 Fire Detection Circuits

The Fermi 2 early warning only fire detection high-voltage system is a Class B system as defined in NFPA Standard 72D, employing a configuration of two independent detector circuits designated Group A and Group B. Because of the 220-V dc operating voltage, the fire detection circuits are not Class I per NFPA Standard 70. It is not a requirement of Appendix A to BTP APCSB 9.5-1 for the detection circuits to meet NFPA Standard 70, Class I. The Fermi 2 design does meet the Class 3 requirements of this code. However, the danger of a fault-initiated fire is minimized because the current is low (milliamperes) and the power is only about 200 W at each detection panel. Also, the fire detection circuits are routed in non-safety-related trays and are contained in conduits outside the trays.

In the redundant safety division areas, the early warning only fire detection circuits employ a two-circuit configuration of detectors designated Group A and Group B. Each detector group has approximately half the detectors of a given detection area. The two groups of detectors are installed in an interspersed configuration covering the protected region. The detector density in each detection area is such that floor area per detector is within the current NFPA recommendation.

In non-safety-related areas, the early warning only detector circuits are of a single group energized from either of the two main panels. The single group detector circuits are about

evenly divided between the two panels to achieve a balanced arrangement. The service building complex has a separate fire detection panel.

The two early warning only fire detector groups are powered from separate non-Class 1E motor control centers (MCCs). Each MCC is fed from opposite divisional Class 1E switchgear. Normal offsite power provides the primary supply for the detectors. Upon loss of offsite power, the detectors are automatically connected to the onsite EDG. This design meets the requirements of Appendix A of BTP APCSB 9.5-1.

The reactor/auxiliary building gaseous suppression systems use a low-voltage smoke detection system. The design is a Class A cross-zoned detection system with a detector required from each zone to actuate the gaseous systems. Power is supplied from a 120-V ac restored bus. Additionally, a 4-hr, 24-V dc battery package provides secondary (backup) power.

For the Security Diesel Generator enclosures, a cross-zoned fire detection system uses both infrared and heat detectors. Should the second heat detector alarm, then the clean agent solenoid activates and, after the thirty second timer expires, the clean agent is released.

All fire detector circuits, flow switch circuits, and alarm bell circuits are electrically supervised in accordance with requirements of the NFPA.

Sensitivity of the ionization smoke detectors is adjustable. Final sensitivity settings are determined after a period of fire detection system operation. The sensitivity used is the highest that is practical and consistent with minimization of false alarms.

In the main control room, annunciator windows are provided for fire alarm (detector actuation or flow switch actuation) and fault in the fire detection/protection circuits. A fault annunciation would occur upon a detector circuit or bell circuit open, ground, or short; detector out of socket (open circuit); power loss; or outside screw and yoke water valve not full open. Other fault conditions, such as low CO_2 pressure, also are covered by an alarm.

On the main control room panel, a display is provided to indicate fire detection zone number in the alarm state, CO_2 release, outside screw and yoke valve closed, power status at panels, and smoke/CO_2 shutoff damper open/closed.

The fire annunciator system, a fire protection system mimic, is combined with the area radiation mimic. The mimic shows the building outlines, with orientation in respect to one another as accurately as possible, within which are color-coded alarm lights for fire, high temperature, smoke, and radiation.

A fire alarm will sound when flow switches indicate flow in the fire protection ring header, or flow in a deluge or sprinkler system, or flow from the electric or diesel fire pump. The alarm will designate the area on the mimic panel. An area indication on the mimic will alarm when any of the outside screw and yoke valves are closed or any deluge valve is opened. The panel will indicate the general area in which a fire detector is indicating the presence of smoke or fire. In the plant, a local panel for each area will display detailed information for each detector. Startup of either the electric or diesel fire pump will be alarmed.

The following remote manual control functions can be performed in the main control room: the deluge valves can be manually initiated by pushbutton. The smoke roof vents in the turbine house can be manually opened, and the smoke dampers can be manually closed. The

electric and diesel fire pumps can be manually started from the main control room. The motor-operated dump valves on the EDG fuel-oil storage tank, on the main turbine-oil reservoir, and on the reactor feed pump oil reservoir can be operated from the main control room.

The system diagram of the fire protection system is given in Figure 9.5-1. Table 9.5-1 provides a list of the equipment and devices that make up the fire protection system.

9.5.1.2.3.11 Fire Barriers

The fire hazards analysis has identified the fire barriers and determined the barrier requirements for the floors, walls, and ceilings enclosing separate fire areas and for the doors and other penetrations through these barriers. (See Appendix 9A.) See Subsection 8.3.1.4.2.2 for a discussion of cable tray fire barriers at floor and wall penetrations.

9.5.1.2.3.12 Fire Emergency Lighting and Communications

Fixed emergency lighting with 8-hr battery power supplies is provided in the main control room, in all plant areas where operator action, for safe shutdown in the event of fire, is required within 8 hrs and along access and egress routes for these areas. Emergency communications capability is provided by telephones, public address systems, and radio communications equipment powered from redundant power sources. Repeater stations are installed to improve the quality of radio communication. Loss of a particular repeater will not result in a loss of communication capability in the area adjacent to the repeater.

9.5.1.2.4 Atmosphere Control

To aid in smoke removal, the reactor/auxiliary building ventilation system will continue to operate in the event of a fire in the reactor/auxiliary building except when a loss of offsite power results in initiation of the standby gas treatment system and automatic isolation of RBHVAC. The airflow will generally follow a path from areas of low potential radioactivity to areas of progressively higher potential radioactivity before finally being exhausted to the atmosphere at the roof of the reactor/auxiliary building. Fire dampers are provided where all ventilation ducts penetrate fire barrier walls.

The control center in the auxiliary building is equipped with its own air conditioning system and is not connected with the reactor/auxiliary building ventilation system during emergency mode operation of the CCACS as described in Section 6.4.4.2. Smoke, combustible and explosive gases, and airborne toxic contaminants in the reactor/auxiliary building atmosphere will not enter the control center because the CCACS maintains the atmosphere at a slight positive pressure with respect to the reactor/auxiliary building atmosphere.

The air conditioning zones within the control center can be individually isolated by smoke dampers that are operated from the control room. The detection system and smoke removal process are described in Subsection 9.5.1.2.2. Habitability of the main control room after a chlorine-release accident is discussed in Appendix A, Regulatory Guides 1.78 and 1.95.

Because of the combustible liquids stored in the diesel-oil storage room and the diesel generator room of the RHR complex, a purge ventilation fan will operate continuously (except during an actual fire). The diesel generator room, the CO_2 storage room, diesel-oil

storage room, and diesel generator ventilation equipment room will be continuously purged with a 2500-cfm exhaust fan. Each EDG and diesel-oil storage room has a separate exhaust purge fan. Loss of airflow in the purge system is alarmed in the main control room. The exhaust fan will be automatically stopped if a signal is received from the automatic fire protection systems.

The RHR complex is divided into various fire zones, as indicated in Appendix 9A. The ventilation systems for the diesel generator switchgear zone and the EDG zone (two per division) and the pump room zone are entirely separate. Isolation of any of these zones will not affect the ventilation systems in other zones.

The CO_2 system for each EDG requires automatic shutdown of the ventilation system to be effective. The design of the system will allow operation of the remaining EDG in the division as well as the other unaffected division. Other zoned dampers are motor operated and controlled by startup or shutdown of the ventilation fans in the main control room. The ventilation fans for all zones can be manually shut down for fire containment or manually started or left running for smoke purge purposes. The 3-hr-rated fire dampers at ventilation duct penetrations of fire barriers will close only when high temperature melts the fusible link.

9.5.1.2.5 Electrical Cable Fire Protection

The electrical cables are fabricated with fire-retardant insulating and jacketing material. NEL-PIA has approved this design. Fire stops are included in all wall and floor tray penetrations, and fire barriers are installed in areas where a fire could propagate from one area or tray system to another. Details of the fire-resistant wall penetrations are found in Subsection 8.3.1.4.2.2.

Redundant engineered safety feature (ESF) equipment is fed by redundant essential electrical circuits. Physical separation is provided between electrical divisions to prevent loss of more than one division from a fire. As part of the fire hazards analysis, areas were identified that have more than one division in the same fire zone. In these areas, a fire barrier and/or a suppression system was added. The fire hazards analysis shows that any postulated fire will not prevent the ability to initiate or maintain shutdown of the reactor.

Fire protection instrumentation and control circuits are classified as non-safety-related and are not redundant. These cables could be lost and not cause loss of the portable fire extinguishers or loss of the standpipe automatic or manual systems. The electric fire pump and diesel fire pump with its own starting battery are normally on standby since the fire mains are supplied with makeup water and pressurization from the FPS jockey pump which takes suction from the GSW pump header.

These numerous sources of water to the fire protection water header ensure a source of water for extinguishing fires. No motor-operated valves are required to operate. The hose connections and valves are operated manually. Loss of fire protection instrumentation to the main control room would not prevent extinguishing a fire.

9.5.1.3 System Evaluation

9.5.1.3.1 Introduction

A fire hazards analysis of the Fermi 2 fire protection provisions was originally conducted in accordance with BTP APCSB 9.5-1 based on the Fermi 2 design as of April 1977. A point-by-point comparison was made with Appendix A to BTP APCSB 9.5-1. Subsequent minor revisions have been made to keep the analysis current. The results of these fire protection evaluations of Fermi 2 are included in Appendix 9A. Fermi 2 is in compliance with the guidance of Appendix R to 10 CFR 50, Sections III.G, III.J, and III.O. The deviations of Fermi 2 from Appendix R are addressed in Appendix 9A. These deviations provide an equivalent level of protection to the technical requirements of Section III.G of Appendix R.

The possibility of fire is minimized by the use of noncombustible materials in the construction of the plant. The spread of fire from one area to adjacent areas is prevented by high-integrity concrete enclosures and by fire-rated barrier walls where necessary.

The plant design is reviewed by NEL-PIA for potential fire hazards, and recommendations made by NEL-PIA on flame-retardant materials for structures, insulation, and electrical and mechanical equipment have been used.

The fire protection water system is not considered essential to the safe shutdown of the reactor. It is not designed to Category I requirements. The failure of the system piping or the inadvertent operation of the system does not affect the operation of the safety-related systems, as adequate drainage is provided in all buildings to prevent flooding and as all safety-related systems are designed to be protected from water spray and jet forces from the piping in the area. Flow switches provided throughout the system indicate system operation in the main control room. The layout and valving arrangement of the underground water system permit isolation of any defective section, without interruption of service to other parts of the plant. The inadvertent operation of the CO_2 systems does not affect the operation of safety-related equipment in the area. Smoke dampers in areas with gaseous fire suppression systems are remotely resettable from the main control room so that inadvertent actuation does not cause loss of ventilation to these areas.

The fire hydrants are installed at various yard locations such that the maximum distance between adjacent hydrants is not more than 300 ft, and, if possible, are within 40 ft of the plant buildings. Adequate pressure in the system lines will be available at the uppermost floors of all the buildings. Early-warning detection alarm instrumentation, smoke damper closure, CO_2 and Halon systems actuation alarms, and indication in the main control room of water fire protection system actuation provide reliable identification of the location of any fire so that corrective measures can be instituted with minimum delay. Temperature-operated (fusible-link) fire dampers in the ventilation ducts help contain the fire in the affected area. Audible fire alarms in the areas protected with CO_2 systems warn personnel of the impending actuation of the CO_2 system.

Table 9.5-2 provides a failure mode and effects analysis to demonstrate that operation of the fire protection system in areas containing safety-related equipment does not produce an unsafe condition or preclude a safe shutdown.

9.5.1.3.2 Failure of Nonseismic Fire Protection Systems

For safety-related buildings, the fire protection systems are seismic Category II/I. Therefore, the fire protection system piping will not fall and damage Category I equipment. The overall design of the fire protection system, because it is not a safety-related system, has not included design features to withstand the effects of single failures, except that the underground supply piping and fire pumps will allow for a single break or pump failure.

9.5.1.3.2.1 RHR Complex CO_2 System Failure

The CO_2 system is designed to discharge approximately 5000 lb of CO_2 into one diesel generator room. This quantity of CO_2 will flood the room and extinguish the fire by cutting off the supply of oxygen. If the CO_2 system inadvertently discharges into the diesel room, it will cause cooling that will lower the room temperature and the equipment temperature. The operating heat loads in the EDG room are less than 1,840,000 Btu/hr. The CO_2 discharge can provide approximately 20 minutes of cooling for this heat load. It is estimated that the CO_2 would not reduce the room temperature more than 100°F and at most would reduce the diesel engine generator temperature 40°F.

The inadvertent operation of the CO_2 system will not affect the operation of the EDG, since separate combustion air is provided for the engine by direct connection to the outside. Also, the CO_2 discharge horns are not directed toward any of the equipment. The horns are designed so that there is not a concentrated blast, but a diffuse stream of CO_2 vapor and solid particles. The cold gas will warm up and the solid particles will vaporize before coming into contact with the equipment. The quantity of cooling provided by the CO_2 system and the fact that it does not directly impact on the equipment will eliminate the possibility of thermal shock and will not cause a significant drop in equipment temperatures.

The rupture of a CO_2 storage tank will not cause damage to any safety-related equipment. Each CO_2 storage tank is located in its own room, and no safety-related equipment is located in that room. A rupture of the tank would confine the CO_2 to that room except for a possible small leakage under the doors. The CO_2 would extinguish any fire within that room. Leakage under the doors into the diesel generator room would not affect the operation of the diesels because they are designed to operate in a CO_2 environment.

9.5.1.3.2.2 Failure of Water Fire Protection Systems

The analysis of water fire protection line failures and the subsequent effect of water on safety-related equipment is presented in Subsection 3.6.2.3, which includes an analysis of the failure of all moderate-energy fluid systems throughout the plant, including the RHR complex.

To avoid freezing of the RHR fire protection water supply mains, a continuous flow of approximately 0.1 gpm is maintained during the winter.

9.5.1.3.2.3 Failure of Other Gaseous Systems

The gaseous systems provided other than in the control center will not cause loss of function of Class 1E equipment since the equipment can operate in a gaseous environment. The

gaseous systems in the control center will also not affect Class 1E equipment. Failure (closure) of the smoke/Halon dampers for the relay room, cable spreading room or computer room will cause loss of cooling to their respective rooms. Manual actions are required to reopen these dampers to reestablish airflow. As described in Subsection 9.5.1.2.2, the smoke purge mode of the control center ventilation prevents concentration of Halon in areas outside the Halon suppression zone. The CO_2 storage tank for CO_2 systems inside the auxiliary building is located outside the plant.

9.5.1.3.3 Removal of Fire-Fighting Water

Floor drains are designed to remove the expected fire-fighting water flow from areas where fixed water fire suppression systems are installed or where fire hoses may be used. Equipment is installed on pedestals to protect it from water. Water drainage from areas which may contain radioactivity is collected in the floor drain collection tank for normal liquid radioactive waste.

9.5.1.4 Inspection and Testing Requirements

Preoperational testing of the fire pumps, hydrants, sprinklers, deluge systems, gaseous systems, standpipe, and hose systems was performed in accordance with the applicable NFPA codes. In addition, the instrumentation and control for the automatic starting of the fire pumps, flow detection and alarm, and SGTS thermal detection systems was tested for operability and limits.

Inspection, testing, and maintenance of all equipment of the fire protection system use the applicable NFPA codes as guidelines.

9.5.1.5 Personnel Qualification and Training

The fire-fighting training program, testing, and inspection are discussed in Subsection 13.2.4.

9.5.2 Communications Systems

9.5.2.1 Design Bases

A comprehensive communications system is provided to ensure reliable intraplant communications, offsite commercial telephone service, and offsite emergency communications capabilities. Effective communication between personnel during startup, operation, shutdown, refueling, and maintenance is made possible by the use of an adequate number of telephones, public address speakers, and two-way radios.

The public address speaker system and the two-way radio repeaters are powered from emergency power bus 72B. The other diverse means of communications are physically independent to preclude the loss of all systems as a result of a single failure.

An emergency alarm system is installed that provides an alarm signal to ensure personnel evacuation.

9.5.2.2 System Description

9.5.2.2.1 Two-Way Radio

Two separate communication channels of unique wave lengths for operations personnel and for maintenance personnel are provided to enable two-way radio communication between the main control room and the various plant buildings. The main control room is equipped with handheld microphones on each panel section and at the operations desk console. Portable transmitter-receivers of the hearing-protector headset and boom-mike type, operating on either or both channels, are provided for use by the operations and maintenance personnel for communication between various areas of the plant.

To improve reception from the various plant buildings, monitor receivers are provided in these buildings. The radio transmitter carrier frequencies are chosen so that no interference with the reactor building or turbine building radio-controlled crane is possible.

9.5.2.2.2 Hi-Com (Public Address) System

The Hi-Com system provides two separate and independent channels of communication, namely page and party lines. The Hi-Com loud-speakers are powered by individual amplifiers, and the system is supplied from the ac emergency system, which is powered by the EDG upon loss of normal offsite power.

The system layout permits communication between the main control room and site buildings and areas of the plant. The volume level of each Hi-Com channel is adjusted to be louder than the ambient background noise level. For high-noise areas where ear protection is required, or site emergency evacuation notification is not broadcasted, special arrangements for evacuation notification have been provided as described in Subsection 9.5.2.2.4.

The handsets permit channel switchover from paging to party line conversations between any two or more handset stations.

9.5.2.2.3 Telephone System

An independent dial telephone system is provided to facilitate simultaneous conversations between extensions which are located throughout the plant and Detroit Edison network. The main control room is provided with telephones, some of which have access to the Edison network via microwave and also have access to the local telephone company exchange via land line. Incoming calls are received automatically from either network. Microwave provides backup offsite communication in the event of loss of land line resulting from environmental conditions. A telephone is installed in each elevator.

9.5.2.2.4 Emergency Alarm System

The emergency alarm system is designed to broadcast distinct signals using the plant Hi-Com system to the plant. This alarm system is activated from the control room, and different tones have been provided. Activation of the emergency alarm system automatically adjusts the output volume level of each Hi-Com station to a preferred level of 10 dB above the calculated background noise. If the preferred level of 10 dB (above background noise) cannot be obtained, a speaker output of not less than 7 dB above the calculated background noise is acceptable. In Hi-Com broadcast areas where the 7 dB differential could not be

obtained or the background noise exceeds 95 dB, visual beacons are provided for emergency notification. For high-noise areas where ear protection is required or site emergency evacuation notification is not broadcasted, special arrangements for evacuation notification are provided by damage and rescue team searches. If a plant area evacuation is required, the Emergency Director (Shift Manager - short term or Director - Nuclear Production - long term) will dispatch the damage and rescue team after Security receives notification of missing personnel.

9.5.2.3 Inspection and Testing Requirements

All communication systems were inspected and tested at the completion of installation to ensure their operability. Most of the systems, except for the emergency alarm system, are used daily and hence do not need any special testing. Testing of the emergency alarm system is carried out on a routine basis.

9.5.3 Lighting Systems

9.5.3.1 Design Bases

The lighting system is designed to provide indoor and outdoor illumination during normal plant operation and during shutdown. During failure of offsite power sources, the system provides alternative emergency lighting to critical facilities.

9.5.3.2 System Description

The lighting system is composed of the normal facilities, the emergency facilities, and the special lighting for the main control room.

The normal area lighting system consists of fixtures and facilities placed in areas of the plant to meet the target light intensities identified by the Illuminating Engineering Society (IES) for nuclear power plants and industrial facilities. In general, high intensity discharge (HID) lighting is used for general area lighting with florescent lighting used for office areas, entry points and stairwells. Provisions for containment of mercury containing elements are made where breakage of the bulbs could potentially result in direct mercury intrusion into the reactor coolant.

Normal lighting for the plant buildings is supplied by a grounded 480/277-V and 208/120-V, three-phase, four-wire distribution system from the distribution receptacle panels located in the reactor, auxiliary, and radwaste buildings. These panels receive power from the 480-208/120-V lighting transformers that are powered by 480-V switchgears in the master distribution panels.

Lights that utilize the 480/277-V system are directly supplied from the master distribution panels. The receptacle panels are conveniently located throughout the plant to permit efficient distribution of the lighting load.

One-third of the lights in vital operating areas such as the main control room, RHR complex, reactor building, safety-related equipment areas and access routes, stairwells, and exits are powered by the ESF 480-V buses so that an offsite power failure does not produce a total blackout in these areas. In addition, emergency lighting units consisting of battery-operated

sealed-beam units capable of 8 hr of continuous operation are provided in these critical areas of the plant where operator action is required within 8 hrs for safe shutdown in the event of a fire. Emergency lighting for Station Blackout (SBO) is provided by these 8-hr Appendix R Fire Protection units where they exist, or by 4-hr emergency battery lights where Appendix R lighting units are not required. These are activated automatically on loss of normal power. Adequate redundancy is provided in the emergency lighting equipment.

9.5.3.3 Safety Evaluation

Provision of normal power supply, diesel generator power, and individual batteries to the lighting system, together with physical separation and redundancy in the system, ensures dependable lighting to all critical areas at all times.

9.5.3.4 Inspection and Testing Requirements

Periodic inspection of the lighting system, including batteries and simulation tests to monitor operation for the automatic actuation of the emergency lighting, is performed to ensure a reliable lighting system.

9.5.4 Diesel Generator Fuel-Oil Storage and Transfer System

9.5.4.1 Design Bases

The diesel generator fuel-oil storage and transfer system is designed to perform its operational function automatically during emergency conditions. Each diesel generator is furnished with an individual fuel-oil storage tank.

The onsite storage capacity of each of the fuel-oil storage tanks is determined on the basis of continuous operation of the diesel generators for 7 days at continuous load. In addition, the storage capacity includes requirements for testing of the diesel generators. Full day tanks provide more than 2 hr of fuel supply to each diesel generator.

The system complies with Appendix B of ANSI Standard N195-1976, "Fuel Oil Systems for Standby Diesel Generators" and is designed to Category I requirements. The system piping and as much equipment as practicable are designed to either ASME B&PV Code Section III, Class 3 or the Diesel Engine Manufacturers Association (DEMA) standards as shown in Figures 9.5-4, 9.5-5, and 9.5-6. The diesel generator fuel-oil storage and transfer system for each diesel generator is separate and is located in separate compartments. The system is housed in the RHR complex, and, as such, is protected from flooding, tornado winds, and missiles. Adequate fire protection is provided and fire walls separate each compartment containing the individual diesel generator and its associated systems.

The ventilation system for the diesel generator room, fuel oil storage room, and CO_2 storage tank room is designed to maintain room temperatures between 65°F and 104°F when the diesel is not operating. When the diesel is operating, the ventilation system is designed to maintain the temperature in the fuel oil storage tank room and the CO_2 storage tank room below 125°F. A separate ventilation system maintains the diesel generator room below 122°F when the diesel is running.

Provisions are made for independently testing redundant components.

9.5.4.2 System Description

Four 2850-kW diesel-engine-driven generators power the ESF buses and are located in the RHR complex. The fuel-oil storage and transfer system is shown in Figures 9.5-4, 9.5-5, and 9.5-6. Power to all of the auxiliaries for each diesel generator is fed from the respective diesel generator.

Each diesel generator set is supplied by a 42,000-gal diesel-fuel storage tank located adjacent to the associated diesel generator. The capacity of the storage tank is based on 7 days fuel supply at 210 gal/hr, plus fuel requirements for routine engine testing. The fuel-oil day tanks are of 550-gal capacity. Two redundant motor-driven fuel-oil transfer pumps deliver fuel to the day tank. Fuel flows by gravity from the day tank to the suction of the engine-driven fuel pump.

The engine driven pump is safety related and required to operate in order to mitigate a design basis accident. An electric motor driven fuel pump is also provided to purge air from the fuel line following maintenance on the fuel oil system. The electric motor driven fuel pump will receive a start signal if a low pressure condition exists on the supply side of the duplex filter. Although the electric motor driven pump is not credited to operate during a design basis accident, it is considered to be a passive safety-related pump. Both pumps supply fuel to the engine fuel injectors.

One transfer pump is started automatically when the diesel generator starts and the day tank overflow is routed to the fuel-oil storage tank. The other transfer pump is started automatically by a low-level switch on the fuel-oil day tank.

The fuel oil storage tanks are filled from tanker trucks through yard couplings and are vented above grade. Each storage tank is fitted with level sight glasses and high- and low-level alarms. Each day tank is fitted with a level sight glass and low-level alarm. Redundant motor-operated and manual valves for draining of the storage tank are provided.

Fuel quality in the storage tanks is ensured by using two strainers between the storage tank and the fill line connection and by performing delivery and periodic sampling for water and sediment. Each of the four EDGs has redundant fuel transfer pumps and separate fill lines to each day tank from each storage tank. Each transfer pump is fitted with a strainer. In addition, between the day tank and the EDG skid there is a strainer for the engine-driven fuel-oil pump line and a duplex filter before the fuel injectors.

The day tank is kept full, and, as required, one of the transfer pumps automatically operates (with the other pump in standby) to maintain the tank level. If sediment plugs the running pump's strainer and the day tank level drops, the alternate transfer pump will automatically start and the low level alarm will sound if the level continues to drop. The plugged strainer can be cleaned by blowing down within the time interval established by the fuel inventory remaining when the low level alarm sounds. Also, the strainers at the fuel transfer pumps and between the day tank and the EDG have pressure differential indicators that are to be monitored during monthly testing.

9.5.4.3 Safety Evaluation

The diesel generator fuel-oil storage and transfer system is designed to Category I requirements and also to withstand any single failure and still satisfy the design requirements. Although any single failure may result in loss of fuel to one diesel generator, the plant demand is met by the remaining three diesel generators. There are no common components of the fuel-oil system between any EDGs. The diesel generator and its associated fuel-oil storage tank, fuel-oil day tank, transfer pumps, and piping are physically separated and adequately protected against tornado missiles, flooding, and fire. The EDG fuel-oil storage tank room is designed to contain the entire volume of oil and the floor drains are sized to handle the fuel oil and sprinkler volumes. Refer to Subsection 9.3.3 for details.

Independent thermal detectors for fire detection are provided in each diesel generator compartment. Automatic fire-fighting systems such as carbon dioxide and wet-pipe sprinkler systems are also provided. In the event of a fire, fuel oil from the storage tank can be dumped to a basin in the yard by opening the dump valves from the main control room. See Subsections 9.5.1.2.3.3 and 9.5.1.2.3.5 and Appendix 9A.

No shortage of fuel supply can be reasonably anticipated, because low-level alarms are periodically inspected and an ample fuel supply is ensured, both by redundant equipment and by conservatively sized reserves. Arrangements are made for the procurement of additional supplies of oil when needed.

The diesel-fuel-oil storage tanks are fabricated from ASME-SA285, Grade C carbon steel. The piping and tanks are inside the RHR complex, and hence no corrosion problems are anticipated during the life of the plant.

9.5.4.4 Inspection and Testing Requirements

All components of the diesel-generator fuel-oil storage and transfer system are tested after installation in accordance with the applicable codes. The Preoperational Test program verifies system performance including indicating instrumentation and alarm signals. Operation of the fuel-oil system is tested by periodic operation of each generator under load.

9.5.4.5 Instrumentation Application

Each diesel-fuel-oil storage tank and fuel-oil day tank is provided with local level sight glasses. High- and low-level alarms for the storage tank and low-level alarm for the day tank are provided. Fuel transfer pump motors are provided with automatic starting circuits and standard Institute of Electrical and Electronics Engineers protection.

Remote operation of each transfer system is possible from the main control room.

9.5.5 Diesel Generator Cooling Water System

9.5.5.1 Design Basis

The diesel generator cooling water system is designed to provide adequate cooling water to remove the heat given off by the lube-oil coolers, inlet air coolers, and the engine jacket

coolant heat exchangers. The engine jacket coolant system, which is a closed loop system, removes heat from the engine and transfers it to the diesel generator service water system. The diesel generator service water system is part of the RHR service water (RHRSW) system described in Subsection 9.2.5.

The jacket coolant system is designed to Category I requirements and the system piping, valves, and heat exchangers meet either the requirements of the ASME B&PV Code Section III, Class 3, the DEMA standards, or Group D (ANSI B31.1), and are seismically supported as shown in Figures 9.5-7 through 9.5-9.

9.5.5.2 System Description

The diesel generator service water system, which supplies cooling water from the RHR reservoir to the diesel generator components, is described in Subsection 9.2.5.

The diesel generator jacket coolant system shown in Figure 9.5-7 is described in this section. Each diesel generator is provided with a separate and independent jacket coolant system.

Major components of the system are an expansion tank, an engine-driven jacket coolant pump, an engine-driven air-cooler coolant pump, a standby coolant circulating pump, a heat exchanger, an air cooler, a standby heater, a three-way thermostatic bypass valve, a three-way air-operated bypass valve, high- and low-temperature alarms, low-pressure alarm, and indicators for pressure and temperature.

The jacket coolant is demineralized water with corrosion inhibitors. The engine-driven coolant pump maintains coolant circulation in the closed loop during diesel generator operation. The expansion tank accommodates the volume changes in the coolant due to temperature changes and also provides a means for venting the system. In addition, the expansion tank is to provide for minor system leaks at pump shaft seals, valve stems, and other components, and to maintain the net positive suction head (NPSH) on the system recirculating pump. System losses are made up by adding demineralized water to the expansion tank. The cooling-water expansion tank for each diesel engine has a capacity of 57 gal. The EDG manufacturer considers this tank size adequate to maintain continuous full-load operation for 7 days under normal conditions. To provide the required pump NPSH, the bottom of the expansion tank is located at an elevation of 603 ft, which is above the highest point of the engine cooling system (Elevation 601 ft).

The heat removed by the coolant from the engine is transferred to the diesel generator service water through a heat exchanger. To maintain the coolant temperature in the proper operating range, a three-way thermostatic valve controls the amount of coolant passing through or around the heat exchanger. The orifices in the bypass lines across the heat exchanger are sized based on the system piping and equipment pressure losses to provide design flows through the heat exchanger. To ensure quick starts, a motor-driven standby circulating pump maintains the jacket coolant temperature at approximately 110°F by pumping the coolant through a thermostat-controlled electric heater.

The system instrumentation consists of a low-level expansion tank alarm, a jacket coolant high- and low-temperature alarm, a jacket coolant low-pressure alarm, and system pressure and temperature indicators.

The jacket coolant also cools the scavenger air in a separate subloop of the engine jacket coolant system. This closed loop system has an engine-driven coolant pump, heat exchanger, and three-way air-operated bypass valve. This valve is automatically adjusted to maintain proper scavenger air temperature. The coolant loop is connected to the jacket water expansion tank for both filling and venting. Reliable cold fast starting requires initial EDG combustion air having a temperature of greater than 40°F. The RHR Complex Heating System, which normally maintains the EDG room temperature above 65°F, is relied upon to maintain the temperature of the initial combustion air above the 40°F design minimum required for reliable fast, cold starting of the units.

9.5.5.3 Safety Evaluation

Each diesel generator has independent jacket coolant and service water systems. The jacket coolant system meets the single- failure criterion in that if a failure in the system prevents the operation of its associated diesel generator, the remaining diesel generators will provide adequate emergency power to meet the safe-shutdown requirements of the plant.

The jacket coolant system is housed within Category I structures and the system piping, valves, and heat exchanger meet the seismic and other code requirements specified in Subsection 9.5.5.1.

9.5.5.4 Inspection and Testing Requirements

Inspection and testing of the system are performed as a part of the overall engine performance checks and routine scheduled engine testing. Instrumentation provided for expansion tank level and coolant temperature is inspected regularly. The jacket coolant chemistry is checked periodically and suitably treated to maintain desired quality.

9.5.6 Diesel Generator Starting System

9.5.6.1 Design Bases

Each diesel generator is equipped with a separate starting system to provide cranking power on demand. A compressed-air starting system is employed to provide fast starts and high reliability.

Each starting system includes separate air receivers, piping, and air start distributors and can independently start the EDG. The combined capacity of the two air receivers per system is sized to provide compressed air for starting a diesel generator five times without recharging.

One air compressor is provided for each diesel generator and automatically recharges the air receivers to normal operating pressure when required. Piping is provided to cross-connect the EDG Air Compressors so that one EDG's air compressor can charge the air receiver for both EDGs within a division.

The system piping and components, excluding the air compressors, dryers, and piping upstream of the air receiver inlet check valves, are designed to Category I requirements, and are also designed and constructed in accordance with ASME B&PV Code Section III, Class 3 where practicable. Code classifications are identified in Figures 9.5-8 through 9.5-10. The

system is protected from tornado winds, external missiles, and flooding since it is housed in the RHR complex. Separation is provided between systems so that failure of one starting system disables only the associated diesel generator.

9.5.6.2 System Description

The starting system for each diesel engine consists of a motor-driven air compressor which keeps two air receivers pressurized at all times. A separate compressed-air line from the outlet of each of these air receivers serves the start distributors for the air-over-piston starting mechanism. On the inlet side of each of the air receivers, a check valve has been provided to prevent backflow to the compressor. The diesel generator starting system is shown in Figures 9.5-8 through 9.5-10.

The air receivers have low-pressure alarms, pressure indicators, and low-pressure switches to start the motor-driven air compressors and thus ensure that the air receivers are filled with air to the required pressure for EDG standby. One air compressor can be manually valved to charge the air receivers for both EDGs within a division. This operation is for temporary situations and may require manual initiation of the air compressor. The air receivers are equipped with drain valves that are manually opened to drain moisture accumulation. In addition, a refrigerated air dryer is provided between the compressors and the receivers to ensure that the air supplied is adequately dehumidified. Relief valves are provided on the air receiver and on the discharge piping from the compressor to prevent overpressurization.

The air start system is redundant from the air receiver tanks through the air header. This redundancy increases the reliability of an air start in the case of a failure due to fouling of the air start valve with contaminants and moisture. The use of air strainers further precludes the fouling of the air start system.

9.5.6.3 Safety Evaluation

The diesel generator starting system, excluding the air compressor, is designed to Category I requirements and is located inside the RHR complex. The starting system for each diesel generator is independent and physically separated from starting systems of other diesel generators.

Failure of a motor-driven air compressor or the piping up to the air receiver check valves does not prevent the functioning of the starting system. Similarly, manually operating an air compressor connected to all EDG air receivers within a division does not affect the function of the starting air system as an operable EDG only requires that the air receivers be charged, regardless of the source of air. A single failure of the air receiver, starting solenoid valves air distributor, or connecting piping does not prevent the starting of the EDG. Adequate redundancy is provided in the starting system and in the number of diesel generators to effectively perform the required safety functions.

9.5.6.4 Inspection and Testing Requirements

The system is operated and tested initially for flow path obstructions, leaks, flow capacity, and mechanical operability. The low-pressure alarms are calibrated and the low-pressure switch is checked to ensure reliability of compressor activation. Relief valves are set and

checked. The diesel generator starting system was tested as part of the Preoperational Test program as discussed in Chapter 14. Subsequent testing is scheduled to meet plant Technical Specifications.

9.5.6.5 Instrumentation Application

The air receivers are provided with pressure indicators, low-pressure alarms, and low-pressure switches to activate the air compressor. Local manual starting of the air compressors is possible.

9.5.7 Diesel Generator Lubrication System

9.5.7.1 Design Bases

The diesel generator lubrication system is designed to provide adequate engine lubrication under all operating conditions, including immediate full-load operation after starting. The system maintains the lube-oil temperature in the specified range under all loading conditions and ambient temperatures.

The system is designed to Category I requirements and meets the DEMA or Quality Group D design and construction requirements except for the lube-oil cooler, which is designed and constructed in accordance with ASME B&PV Code Section III, Class 3 requirements. Specific code classifications are shown in Figures 9.5-4, 9.5-5, and 9.5-11.

9.5.7.2 System Description

The diesel generator lubrication system is shown schematically in Figure 9.5-11. This system is an integral part of the diesel generator package and is supplied by the vendor. Each diesel generator has a separate and independent lube-oil system.

Major components of the system are: a lube-oil tank, an engine-driven lube-oil pump, a lube-oil circulation pump and heaters, a full-flow lube-oil filter with an internal relief valve, a thermostat three-way bypass valve, a lube-oil cooler, a full-flow strainer, three lube-oil pressure switches, high- and low-temperature switches, a motor-driven prelube pump, and panel-mounted temperature, pressure, and crankcase vacuum gages.

The lube oil flows by gravity from the lube-oil tank to the sump located at the base of the engine. Lube-oil flow to the engine is regulated by a level control switch. The engine-driven lube-oil pump takes oil from the sump through a suction strainer and passes it through a full-flow filter. The lube-oil filters are equipped with a pressure indicator and an oil sample tap. Depending on the oil temperature, the thermostatically controlled three-way valve on the discharge side of the filter directs the lube oil through or around the lube-oil cooler. The lube oil is cooled by the diesel generator service water system, which flows through the tubes of the lube-oil cooler. Before being delivered to the engine, the lube oil passes through a three-element strainer that removes large particles that might have become entrained in the oil.

A 2-hp motor-driven prelube pump, which can be manually operated from the remote panel, is provided for prelubricating the engine prior to nonemergency starts. Prelubrication is not required on emergency starts. However, a vendor-supplied prelubrication piping modification is installed and eliminates the potential for dry starts. This piping routes the

keep-warm system so that it discharges into the upstream side of the lube-oil strainer. This will provide continuous lube oil to the lower bearings and greatly reduce voids in the lube-oil system. The solid lube-oil system will provide faster lubrication of the upper bearings on the starting of the diesel and the engine-driven pump.

For purposes of lubrication on the bearings of the upper crankline, operating procedures require approximately 2 minutes of prelubrication prior to planned starts of the diesel generators. Also, operating procedures require, whenever possible, gradual loading and unloading of the diesels to ensure that the bearings are adequately lubricated before they are subjected to the stress associated with high speed and large loads.

The lube-oil headers are routed so that they will not readily drain when the engine is stopped. In addition, lube-oil booster/accumulators are provided for the more remote areas of the engine (aft lower main bearing and upper crankline). This booster system fills with oil during normal engine operation. The next time the engine is started, the lube oil in the accumulator is forced into the subject bearings by starting air pressure, thus filling the bearings with oil as the engine begins to be rotated in starting. A standby motor-driven circulation pump keeps the lube oil in the system warm (when the diesel engine is idle) by passing the oil over thermostatically controlled heater elements and returning the oil to the engine-driven pump discharge.

Three lube-oil low-pressure switches are provided. Actuation of one of the switches causes an audible alarm, and actuation of any two switches shuts down the engine. Three high-pressure switches are provided for the crankcase which actuate an audible alarm and shut down the engine in the same manner as the lube-oil low- pressure switches. The lube-oil tank is provided with high- and low-level switches and alarms and a low-level switch and alarm is provided in the engine sump. In addition, high- and low-temperature alarms, crankcase low-level alarm, pressure gauges, and temperature indicators are provided as shown in Figure 9.5-11.

9.5.7.3 Safety Evaluation

The lube-oil system, including lube-oil storage for each diesel generator, is completely independent of the lube-oil systems of the other diesel generators. Therefore, failure of one lube-oil system results in the loss of only one diesel generator in a division. The other diesel generator in the division, along with the diesel generators in the second division, is adequate to meet the safe-shutdown requirements of the plant.

The lube-oil system is designed to Category I requirements.

The diesel engines are designed to contain a crankcase explosion. The manufacturer conducted actual crankcase explosion tests (20 lb/in.^{2}) and then designed the crankcase inspection cover and fasteners to contain such explosions (100 lb/in.^{2}). These tests showed that the explosion was not harmful to the engine and posed no danger to the operators.

9.5.7.4 Inspection and Testing Requirements

The operability of the lube-oil system is tested and inspected along with the scheduled overall testing of the engine. Lube-oil samples are analyzed and diesel engine main bearing gap checks are performed in accordance with the Technical Specifications.

TABLE 9.5-1 FIRE PROTECTION EQUIPMENT AND DEVICES LIST

I. Water Systems

A. Electric fire pump

B. Diesel fire pump

C. Fire Protection System Jockey Pump

D. Standpipe System

1. Hose reels and connections
2. Yard hydrants inside protected area
3. Yard hydrants outside protected area

E. Deluge Systems

1. Transformer Bay
   a. Service Transformer No. 64
   b. Service Transformer No. 65
   c. Main Transformer No. 2A
   d. Main Transformer No. 2B

2. Radwaste Building Roof
   a. Voltage Regulator Transformer No. 65L (On Roof)

3. Turbine Building
   a. Hydrogen Seal Oil Unit (EL 613'-6")

F. Pre-Action Sprinkler Systems

TABLE 9.5-1 FIRE PROTECTION EQUIPMENT AND DEVICES LIST

1. Service Building
   a. Receiving and Loading Dock Area

2. Outside Protected Area
   a. Piping Warehouse (Warehouse 21)
   b. Piping Warehouse (Warehouse 20)(Fed through Warehouse 21 above)

G. Wet Pipe Sprinkler Systems

1. Reactor Building
   a. RCIC Turbine and Pump and Core Spray Room (EL 540'-0")
   b. HPCI Turbine and Pump Room (EL 540'-0")
   c. Torus Room Floor (EL 540'-0")
   d. Railroad Unloading Area (EL 583'-6")
      Separation Area (EL 613'-6")
   e. Cable Trays (EL 613'-0")
   f. MG Sets/Duct Area (EL 569'-6")

2. Auxiliary Building
   a. Air Compressor Room (EL 551'-0")/Corridor
      (EL 562'-0")/Cable Trays (EL 562'-0")/Cable Tunnel
      Trays (EL 562'-0")
   b. Cable Trays (EL 583'-6" and 603'-6")

3. RHR Complex
   a. Emergency Diesel Generator Fuel Oil Tank Room No. 11
      (EL 590'-0")
   b. Emergency Diesel Generator Fuel Oil Tank Room No. 12
      (EL 590'-0")
   c. Emergency Diesel Generator Fuel Oil Tank Room No. 13
      (EL 590'-0")

TABLE 9.5-1 FIRE PROTECTION EQUIPMENT AND DEVICES LIST

d. Emergency Diesel Generator Fuel Oil Tank Room No. 14 (EL 590'-0")

4. Radwaste Building
   a. Storage Area
   b. Extruder Area and Chemical Stores
   c. Drum Storage and Conveyor Area

5. On-Site Storage Facility
   a. Solid Waste/Empty Drum Storage/Compactor Areas/Asphalt Tank and Pump Rooms
   b. Truck Loading/Dry Active Waste Areas

6. Turbine Building
   a. Equipment Hatch
   b. North RFPT Room
   c. Bearing Pits and Under Turbine Area
   d. Used Oil Storage Area
   e. South RFPT Room
   f. RFPT Oil Reservoir Room
   g. Main Turbine oil Reservoir
   h. Cable Tunnel Trays (EL 628'-6")

7. Service Building
   a. Warehouse Storage Area
   b. Material Store/Dead Files

8. Office Building Annex
   a. Record Storage Area

9. General Service Water Pump House

TABLE 9.5-1 FIRE PROTECTION EQUIPMENT AND DEVICES LIST

a. Diesel Engine Fire Pump Room

10. Miscellaneous Buildings Inside Protected Area
    a. Maintenance Oil Storage Building (Warehouse 18)
    b. Availability Improvement Building (AIB)
    c. ISFSI Equipment Storage Building

11. Miscellaneous Buildings Outside Protected Area
    a. Warehouse 19 (Warehouse B)
    b. General Training and Orientation Center (GTOC)(Warehouse 30)

H. Manual Wet Pipe Sprinkler Systems

1. Auxiliary Building
   a. Cable spreading Room (EL 630'-6")
      (System provides supplemental protection for the Halon suppression system provided for the Cable Spreading Room)

I. Manual Flooding Systems

1. Control Center HVAC Make-up Filter Charcoal Absorber Unit (EL 677'-6")
2. Reactor Building HVAC Recirculation Filter Charcoal Absorber Unit (EL 677'-6")
3. Office Building Annex Charcoal Filter Beds

J. Dry Pipe Sprinkler System Outside Protected Area
1. Equipment Warehouse (Warehouse 23)(Fed through Warehouse 22 below)
2. Electrical Warehouse (Warehouse 22)

TABLE 9.5-1 FIRE PROTECTION EQUIPMENT AND DEVICES LIST

II. Gaseous Systems

A. Carbon Dioxide Suppression Systems

1. RHR Complex
   a. Emergency Diesel Generator Room No. 11 (EL 590'-0")
   b. Emergency Diesel Generator Room No. 12 (EL 590'-0")
   c. Emergency Diesel Generator Room No. 13 (EL 590'-0")
   d. Emergency Diesel Generator Room No. 14 (EL 590'-0")

2. Auxiliary Building
   a. Cable Tunnel (EL 613'-6")
   b. Cable Trays (EL 631'-0")
   c. Outside Division II Switchgear Room (EL 643'-6")

3. Standby Gas Treatment System
   a. Standby Gas Treatment System Charcoal Filter Beds (EL 677'-6")

B. Carbon Dioxide Hose Reel Stations

1. Outside the Relay Room (EL 613'6")
2. Outside the Division I Switchgear Room (EL 613'6")
3. Inside the Division II Switchgear Room (EL 643'6")

C. Halon Suppression Systems

1. Auxiliary Building
   a. Relay Room (EL 613'-6")
   b. Cable Spreading Room (EL 630'-6")
   c. Computer Room (EL 655'-6")
   d. Computer Room Sub Floor (EL 655'-6")

TABLE 9.5-1 FIRE PROTECTION EQUIPMENT AND DEVICES LIST

2. Service Building
   a. Electrical Equipment Room
   b. Central Alarm Station

3. Office Building Annex
   a. Computer Room (Above Floor)
   b. Computer Room (Sub Floor)

4. Guard House
   a. File Room
   b. Defensive Equipment Room
   c. Secondary Alarm Station

D. Clean Agent Suppression System
   1. Parts of Radwaste Building
   2. Security Diesel Generator Enclosures

III. Confinement Control

A. Compartmentalization of structures with fire doors

B. Fire dampers in ventilation systems

C. Roof vents in Turbine Building Area

D. Remotely resettable smoke dampers in Carbon Dioxide suppression system protected areas

TABLE 9.5-1 FIRE PROTECTION EQUIPMENT AND DEVICES LIST

IV. Detection Systems

A. Thermal Detection

B. Photoelectric Detection

C. Ionization Detection

D. Infrared Detection

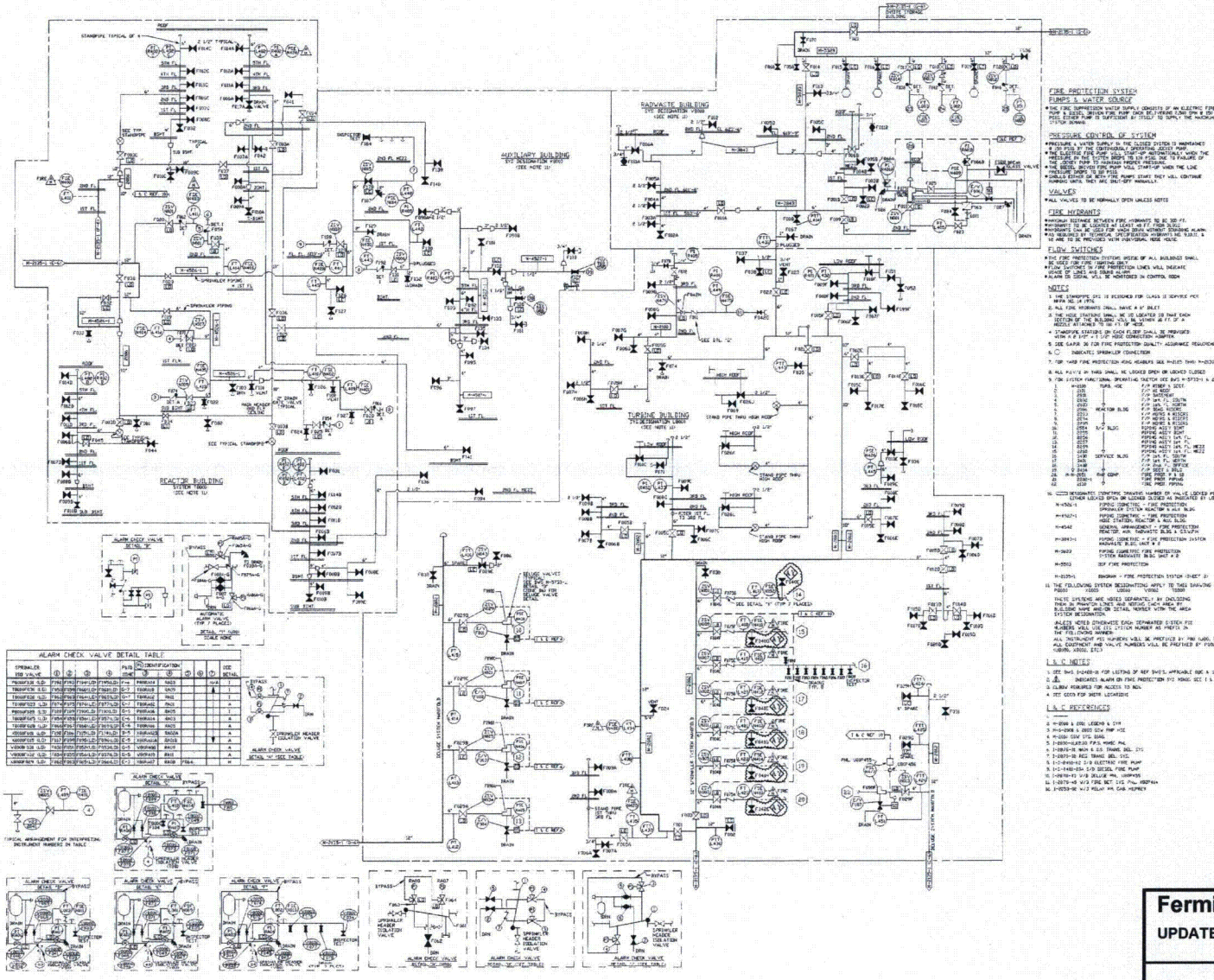
TABLE 9.5-2 FAILURE MODE AND EFFECTS ANALYSIS: INADVERTENT OPERATION OF SAFETY-RELATED FIRE PROTECTION SYSTEM

Fire Protection System	Safety-Related Equipment Protected	Results of Inadvertent Operation of Fire Protections System
HPCI turbine room sprinkler system	HPCI turbine	Loss of HPCI turbine. HPCI not needed for normal shutdown of reactor. Backup LOCA protection provided by automatic depressurization system and low-pressure ECCS
RCIC turbine room sprinkler system	RCIC turbine, core spray pumps	Loss of RCIC turbine. RCIC not needed for normal shutdown. If Division I reactor is isolated, backup protection provided by HPCI. Core spray pump motors are dripproof
M-G set oil coupler and oil cooler sprinkler system	Reactor building structure	Recirculation pumps lost if M-G sets lost. Recirculation pumps not needed for shutdown of reactor
EDG CO_2 system	EDG	Operation of CO_2 system will not hinder operation of an EDG
Diesel-fuel-oil storage room sprinkler system	EDG fuel-oil tanks, day tank, lube-oil tank, and fuel-oil transfer pumps	Tanks will not be affected, but transfer pumps could be lost. An EDG can run 2 hr without fuel-oil transfer pumps. At most, only one EDG can be lost. EDGs in other division provide backup to shut down reactor
SGTS CO_2 system	SGTS charcoal beds	One division of the SGTS temporarily lost until it is manually restarted. No permanent damage to the charcoal filter beds. Remaining SGTS not affected
Sprinkler system in cable tray area over torus	Cable trays, torus, and reactor building structure	Cable trays not affected by sprinklers. Motor-operated valve operators are dripproof. A sump pump is provided in torus area
Sprinkler system in railroad bay area in reactor building at Elevation 583 ft 6 in.	Division II cable trays	Cable trays not affected by sprinklers
Sprinkler system in reactor building at Elevation 613 ft 6 in.	Divisions I and II cable trays	Cable trays not affected by sprinklers
Sprinkler system in auxiliary building at Elevation 551 ft and 562 ft	Divisions I and II cable trays	Cable trays not affected by sprinklers. Control air compressors in Divisions I and II separated by 65 ft

TABLE 9.5-2 FAILURE MODE AND EFFECTS ANALYSIS: INADVERTENT OPERATION OF SAFETY-RELATED FIRE PROTECTION SYSTEM

Fire Protection System	Safety-Related Equipment Protected	Results of Inadvertent Operation of Fire Protections System
Sprinkler system in auxiliary building at Elevation 583 ft and 603 ft	Divisions I and II cable trays	Cable trays not affected by sprinklers
Halon system in relay room, control center at Elevation 613 ft	Divisions I and II relay cabinets and cable trays	Electrical equipment not affected by Halon system. Ventilation dampers remotely resettable (1)
CO_2 system in cable tunnel, auxiliary building at Elevation 613 ft	Divisions I and II cable trays	Cable trays not affected by CO_2 system
Halon system in cable spreading room, at control center Elevation 630 ft	Divisions I and II cable trays	Cable trays not affected by Halon system. Ventilation dampers remotely resettable (1)
CO_2 system in cable tray area, auxiliary building at Elevation 630 ft	Divisions I and II cable trays	Cable trays not affected by CO_2 system
CO_2 system outside switchgear room in auxiliary building at Elevation 641 ft	Divisions I and II cable trays, motor control centers	Cable trays and electrical equipment not affected by CO_2 control centers system
Halon system in main control room computer under and above floor area, Elevation 655 ft	Main control room	Computer not safety related. Control room habitability discussed in Subsection 9.5.1.2.2 (1)

Note 1): Fire Protection relay failure will cause loss of cooling to relay room, cable spreading room or computer room.



Fermi 2

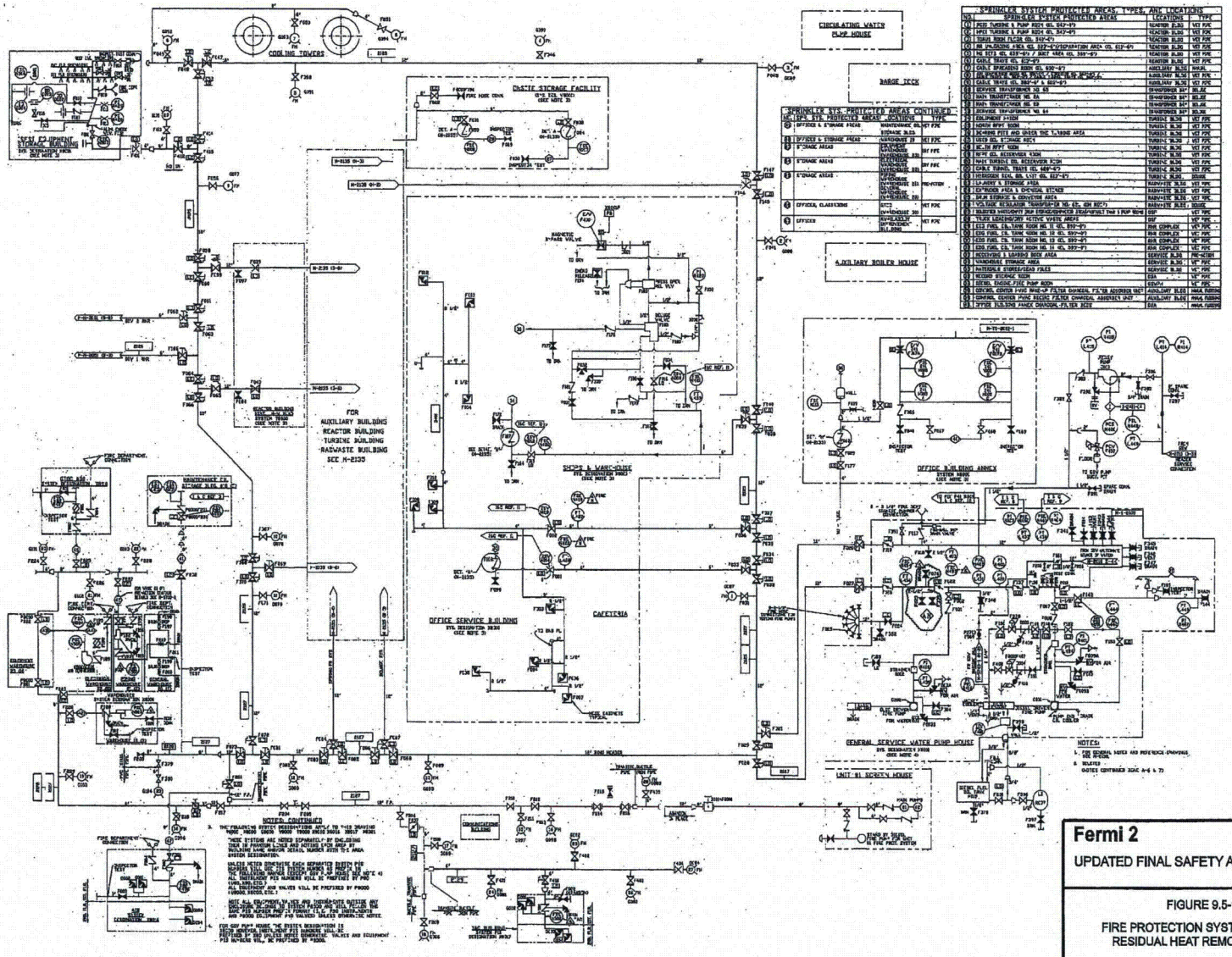
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-1, SHEET 1

FIRE PROTECTION SYSTEM DIVISIONS I AND II RESIDUAL HEAT REMOVAL COMPLEX P&ID

DETROIT EDISON COMPANY DRAWING NO. 6M721-2135, REV. AY

REV 14 11/06



DETROIT EDISON COMPANY DRAWING NO. 6M721-2135-1, REV. AN

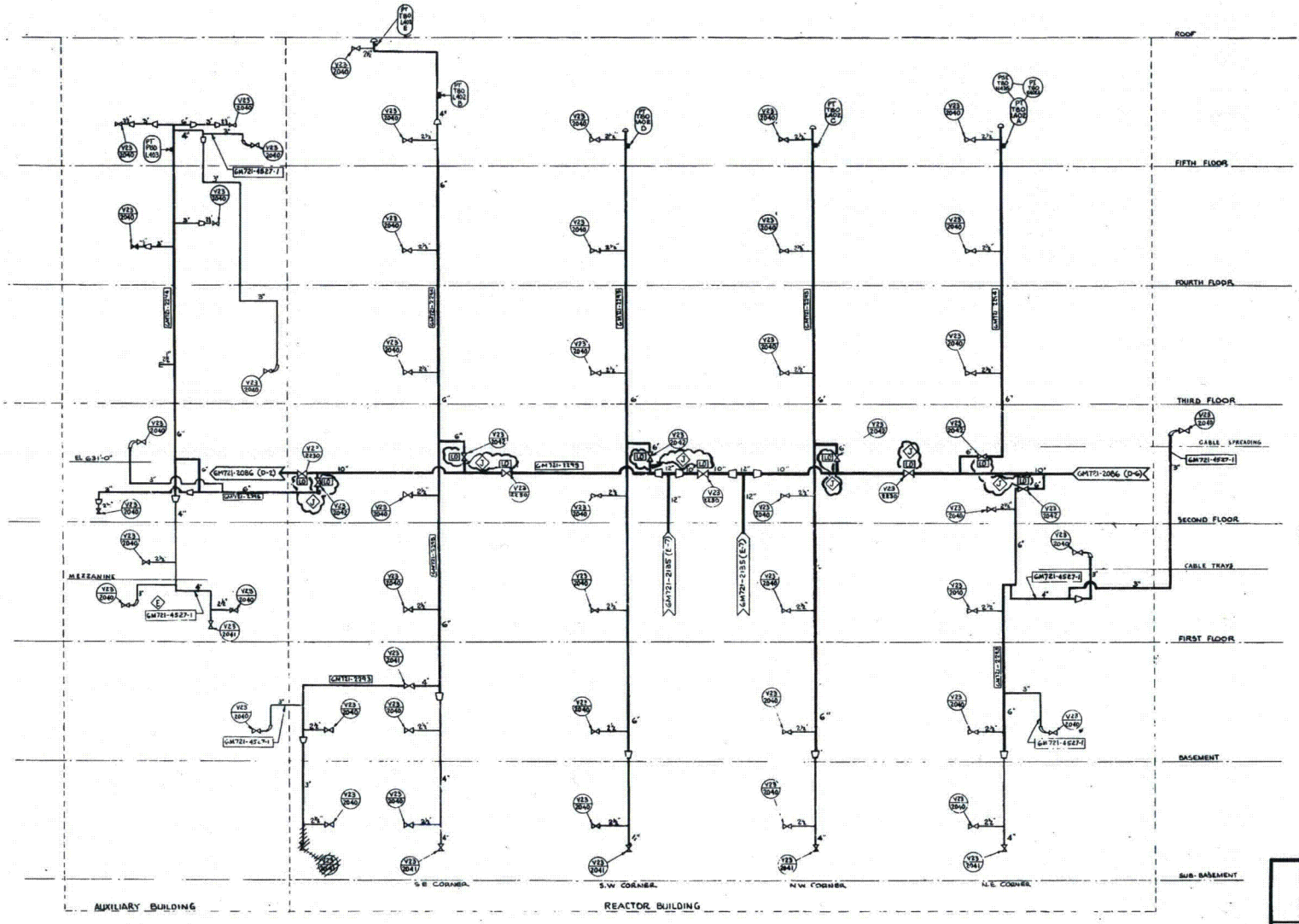
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-1, SHEET2

FIRE PROTECTION SYSTEM DIVISIONS I AND II
RESIDUAL HEAT REMOVAL COMPLEX P&ID

REV 17 05/11



NOTES:
1. SPECIFIC DESIGN REQUIREMENTS ARE GIVEN IN THE FIRE PROTECTION SYSTEM DESIGN INSTRUCTION NO. 23.
2. ☐ DESIGNATES VALVE LOCKED POSITION EITHER LOCKED OPEN OR LOCKED CLOSED AS INDICATED BY LO OR LC.

INSTRUMENTATION

INSTRUMENTATION AS SHOWN AND PER DECO INSTRUMENT LIST

GM721-____ DWG. NO. — IDENTIFIES PIPING DRAWING FOR FABRICATION AND ERECTION

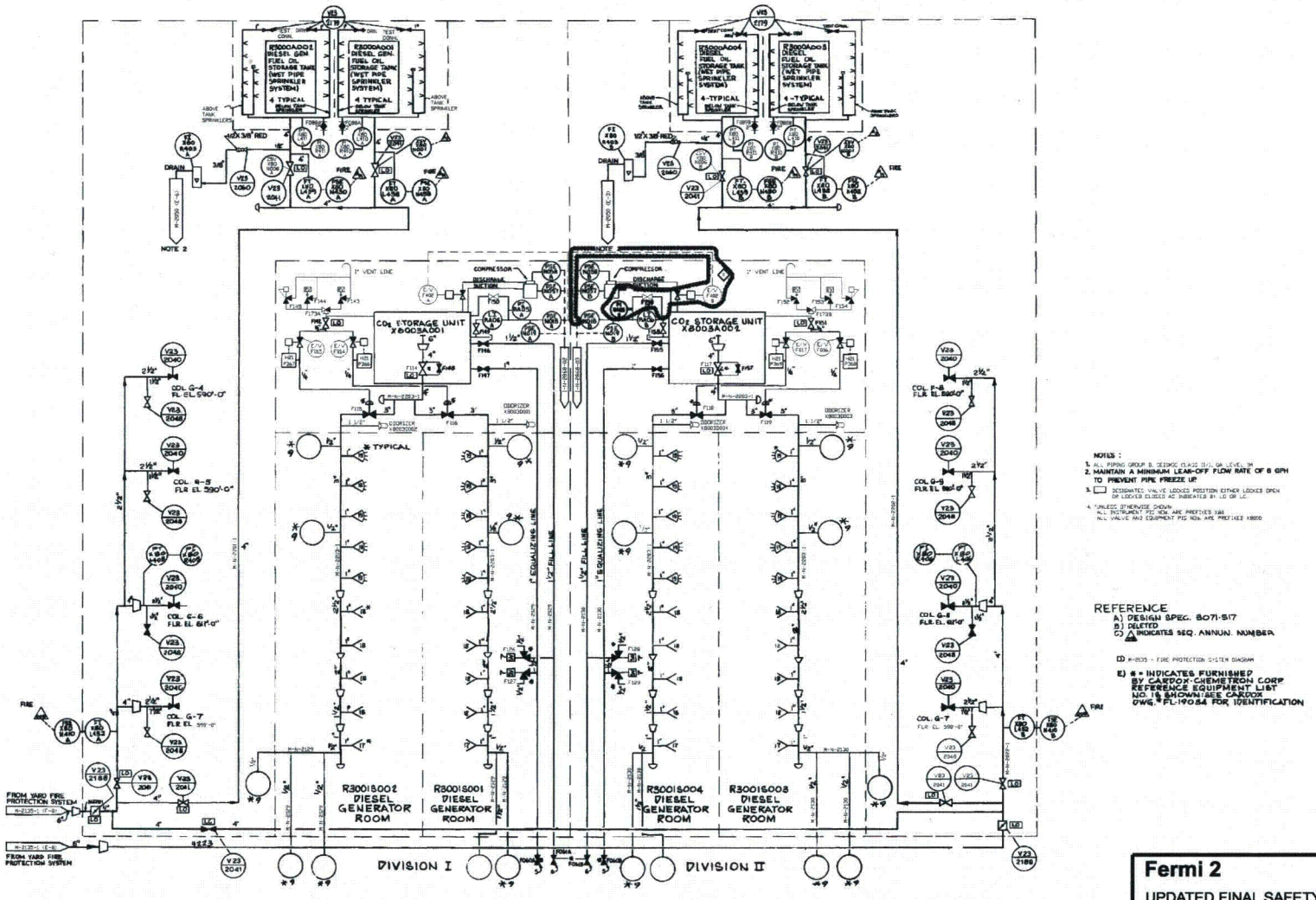
DETROIT EDISON COMPANY DRAWING NO. 6M721-2086, REV. J

Fermi 2
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-2

FIRE PROTECTION SYSTEM
REACTOR AND AUXILIARY BUILDINGS P&ID

REV 3 3/90



DETROIT EDISON COMPANY DRAWING NO. 6M721N-2051, REV. X

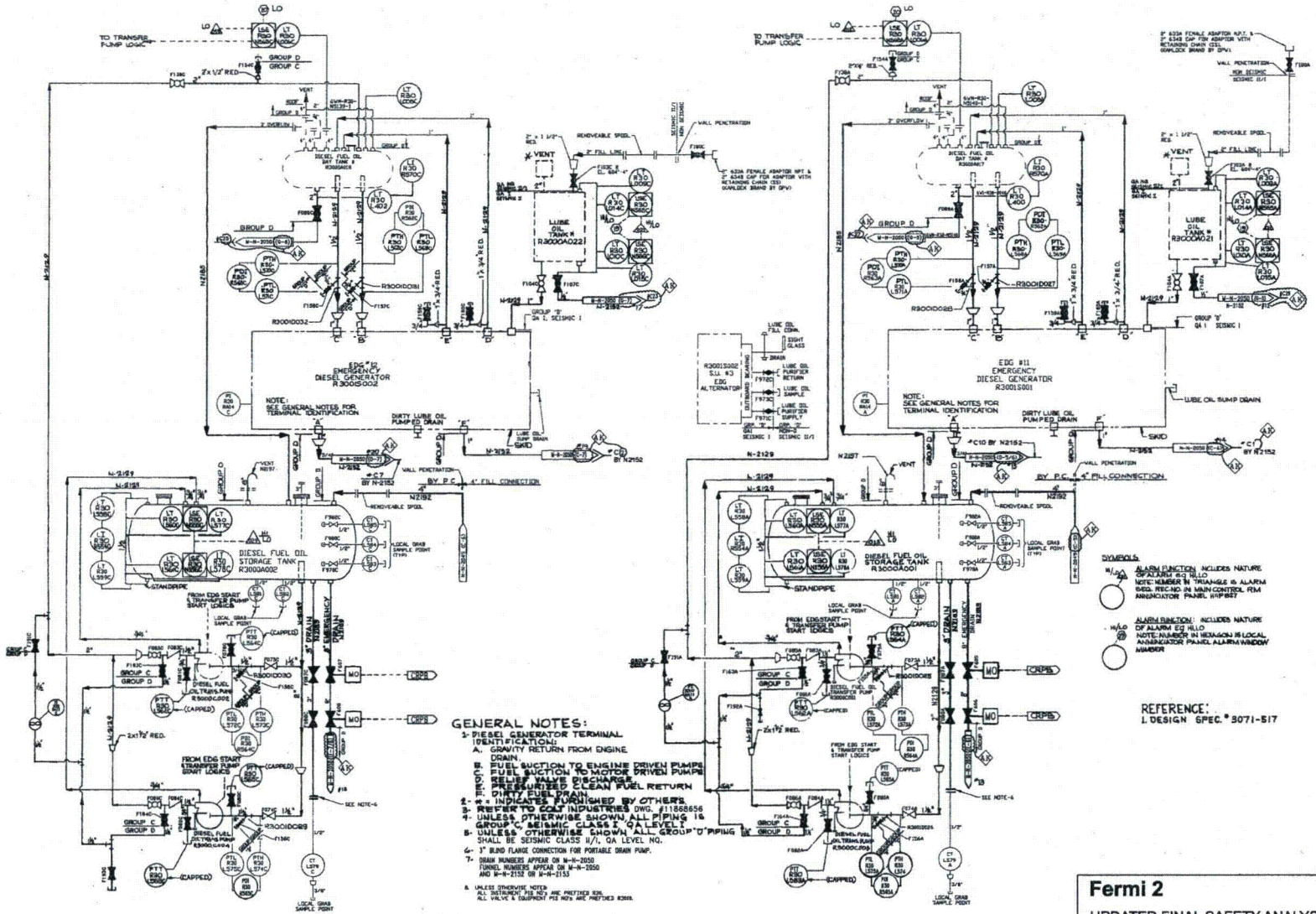
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-3

FIRE PROTECTION SYSTEM - DIVISIONS I AND II DIESEL GENERATOR ROOM P&ID

REV 18 10/12



GENERAL NOTES:

1. DIESEL GENERATOR TERMINAL IDENTIFICATION:
   A. GRAVITY RETURN FROM ENGINE DRAIN.
   B. FUEL SUCTION TO ENGINE DRIVEN PUMPS, FUEL SUCTION TO MOTOR DRIVEN PUMPS, RELIEF VALVE DISCHARGE, PRESSURIZED CLEAN FUEL RETURN
   C. DIRTY FUEL DRAIN.
2. * = INDICATES FURNISHED BY OTHERS. REFER TO COLT INDUSTRIES DWG. #11868656
3. UNLESS OTHERWISE SHOWN ALL PIPING IS GROUP "C" SEISMIC CLASS I, QA LEVEL I.
5. UNLESS OTHERWISE SHOWN ALL GROUP "D" PIPING SHALL BE SEISMIC CLASS II/I, QA LEVEL NO.
6. 3" BLIND FLANGE CONNECTION FOR PORTABLE DRAIN PUMP.
7. DRAIN NUMBERS APPEAR ON M-N-2050 FUNNEL NUMBERS APPEAR ON M-N-2050 AND M-N-2152 OR M-N-2153

8. UNLESS OTHERWISE NOTED ALL INSTRUMENT PIS NO'S ARE PREFIXED N36. ALL VALVE & EQUIPMENT M12 NO'S ARE PREFIXED N3648.

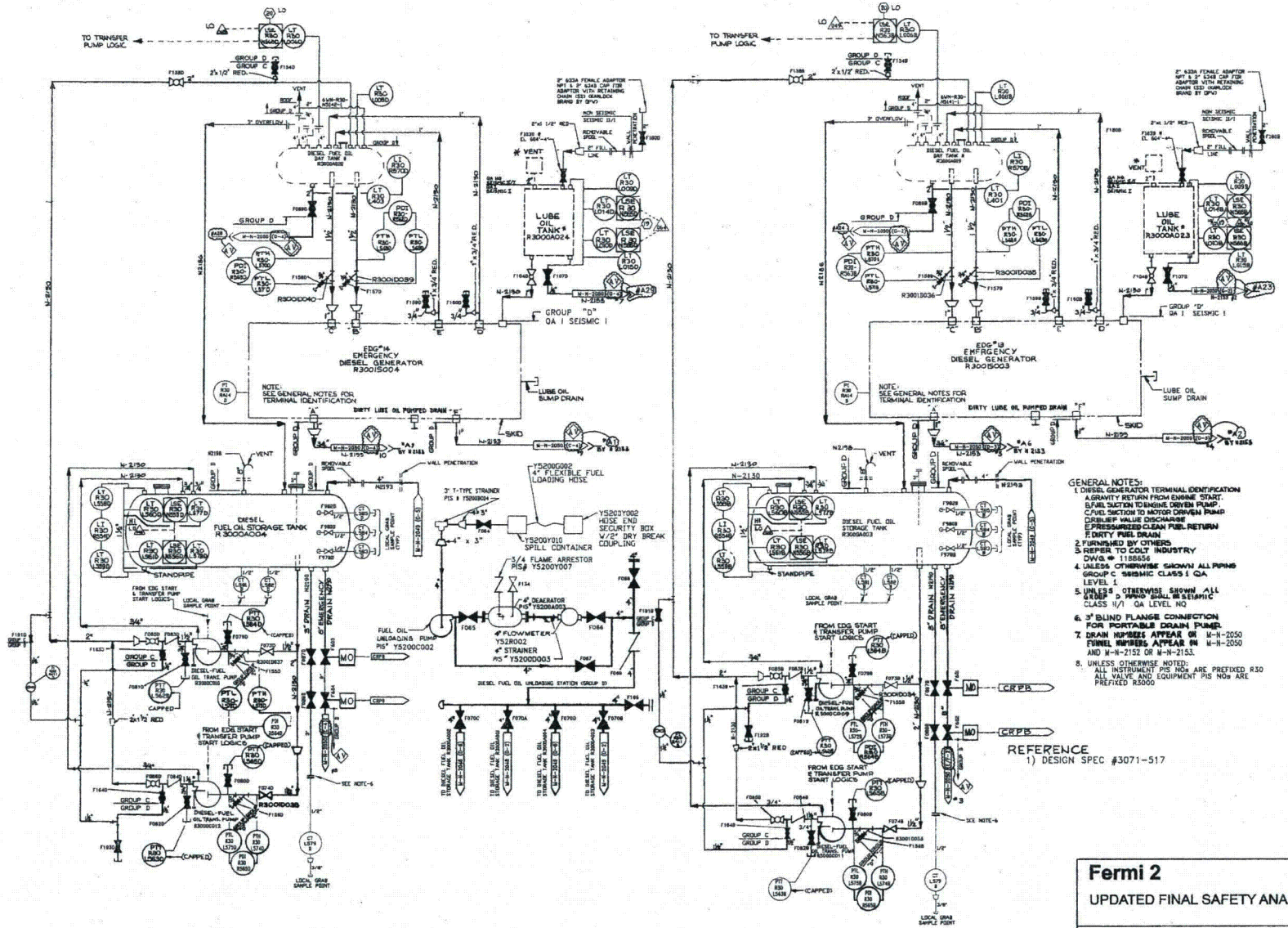
DETROIT EDISON COMPANY DRAWING NO. 6M721-N-2048, REV. AK

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-4

DIESEL-FUEL-OIL SYSTEM AND LUBE OIL SYSTEM
DIVISION I - RESIDUAL HEAT REMOVAL COMPLEX
P&ID



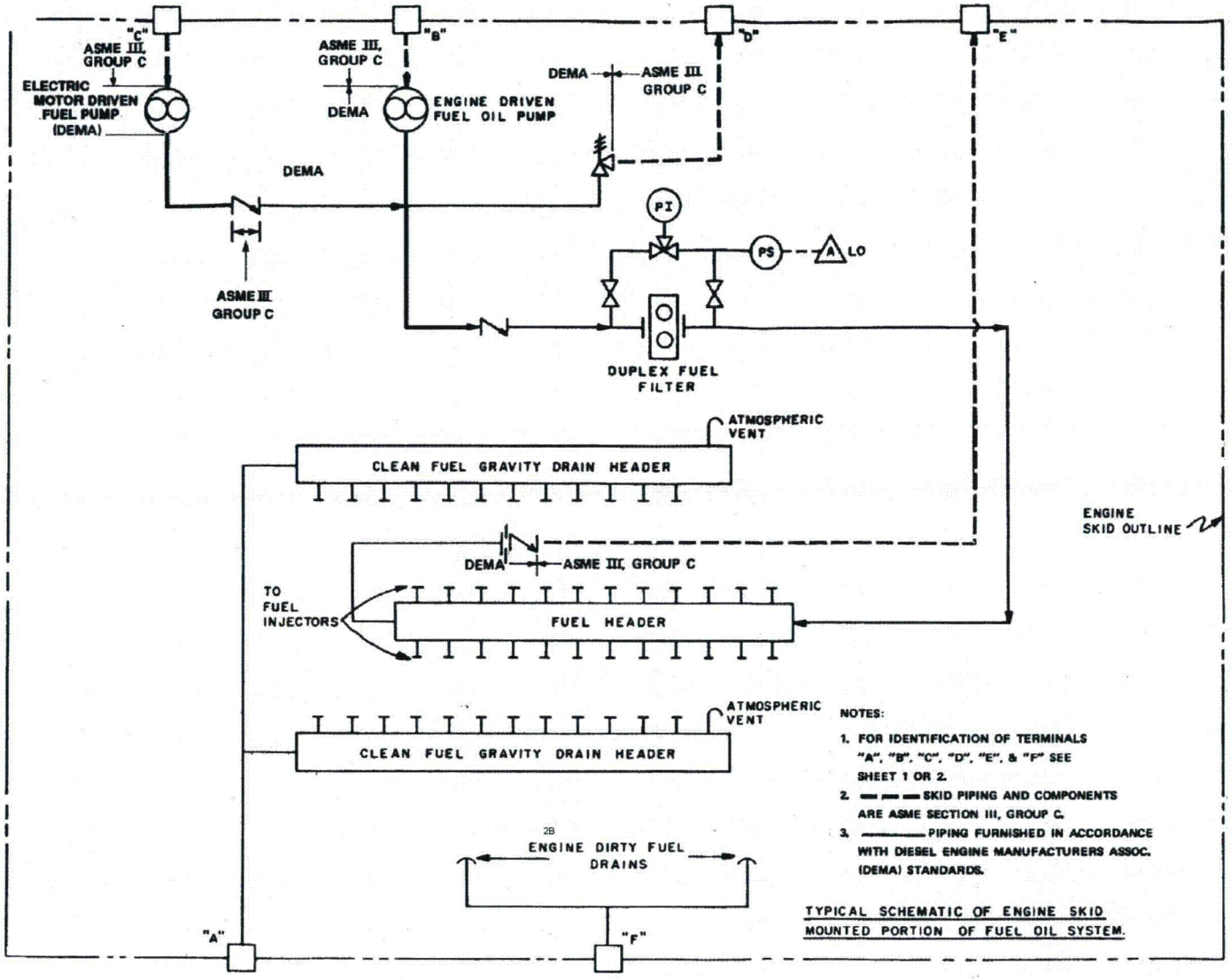
DETROIT EDISON COMPANY DRAWING NO. 6M721N-2049, REV.AV

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-5

DIESEL-FUEL-OIL SYSTEM AND LUBE OIL SYSTEM
DIVISION II - RESIDUAL HEAT REMOVAL COMPLEX
P&ID



NOTES:

1. FOR IDENTIFICATION OF TERMINALS "A", "B", "C", "D", "E", & "F" SEE SHEET 1 OR 2.
2. — — — SKID PIPING AND COMPONENTS ARE ASME SECTION III, GROUP C.
3. ———— PIPING FURNISHED IN ACCORDANCE WITH DIESEL ENGINE MANUFACTURERS ASSOC. (DEMA) STANDARDS.

TYPICAL SCHEMATIC OF ENGINE SKID MOUNTED PORTION OF FUEL OIL SYSTEM.

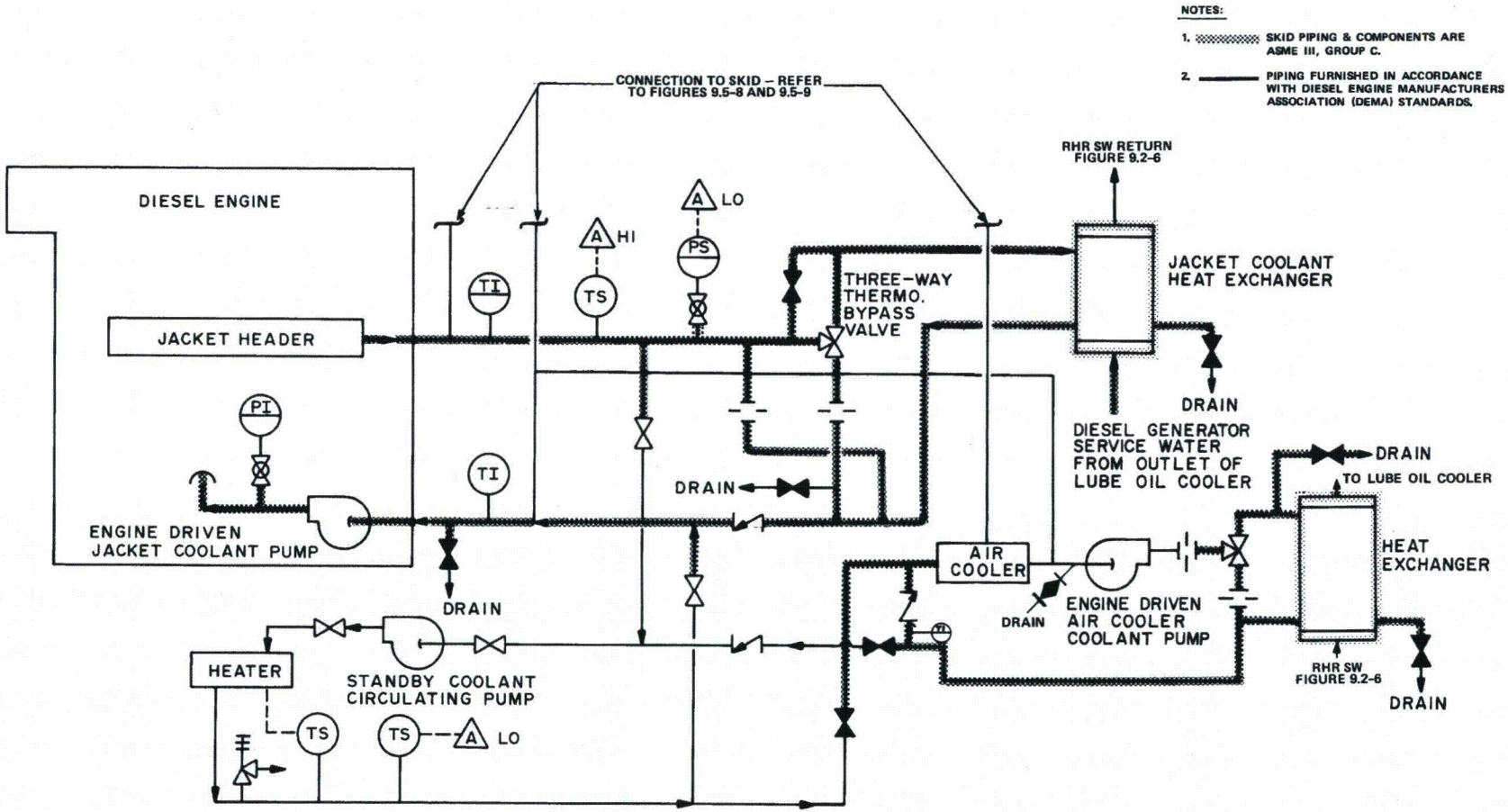
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-6

ENGINE-SKID MOUNTED DIESEL-FUEL-OIL SYSTEM

REV 15 05/08



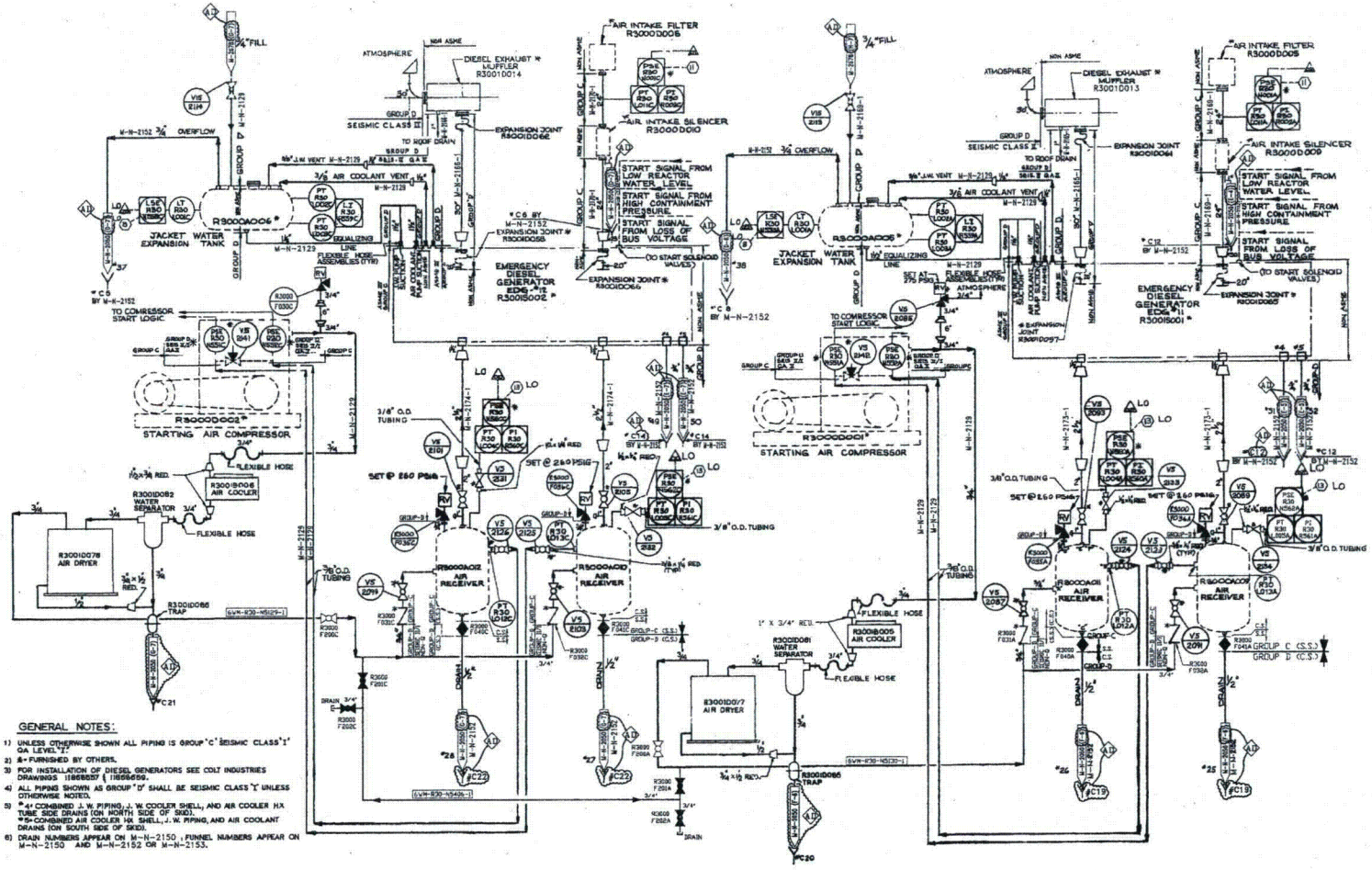
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-7

DIESEL GENERATOR JACKET COOLANT SYSTEM

REV 13 06/05



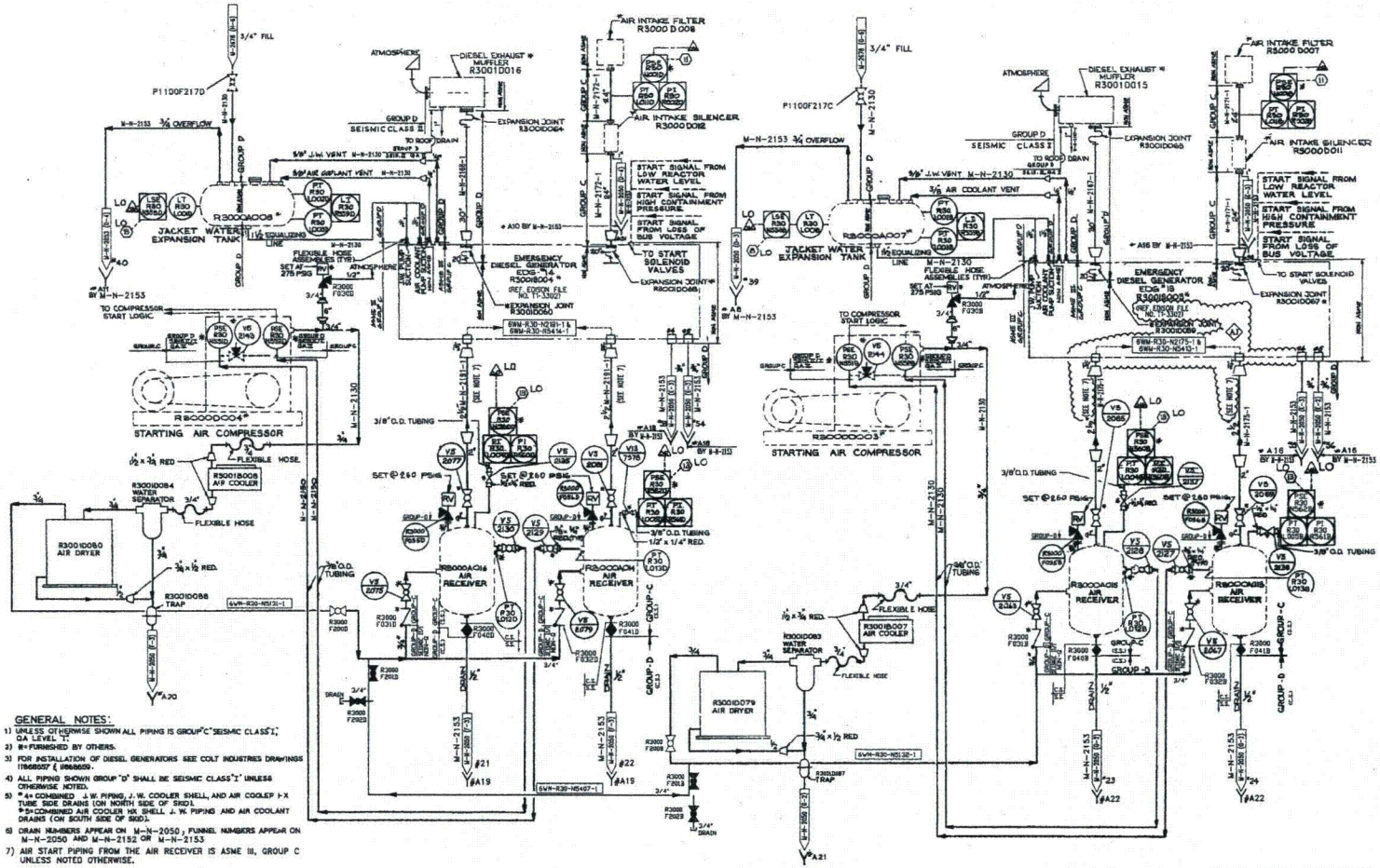
DETROIT EDISON COMPANY DRAWING NO. 6M721N-2046, REV.AD

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-8

DIESEL GENERATOR SYSTEM
DIVISION I - RESIDUAL HEAT REMOVAL COMPLEX
P&ID



DETROIT EDISON COMPANY DRAWING NO. 6M721N-2047, REV.AJ

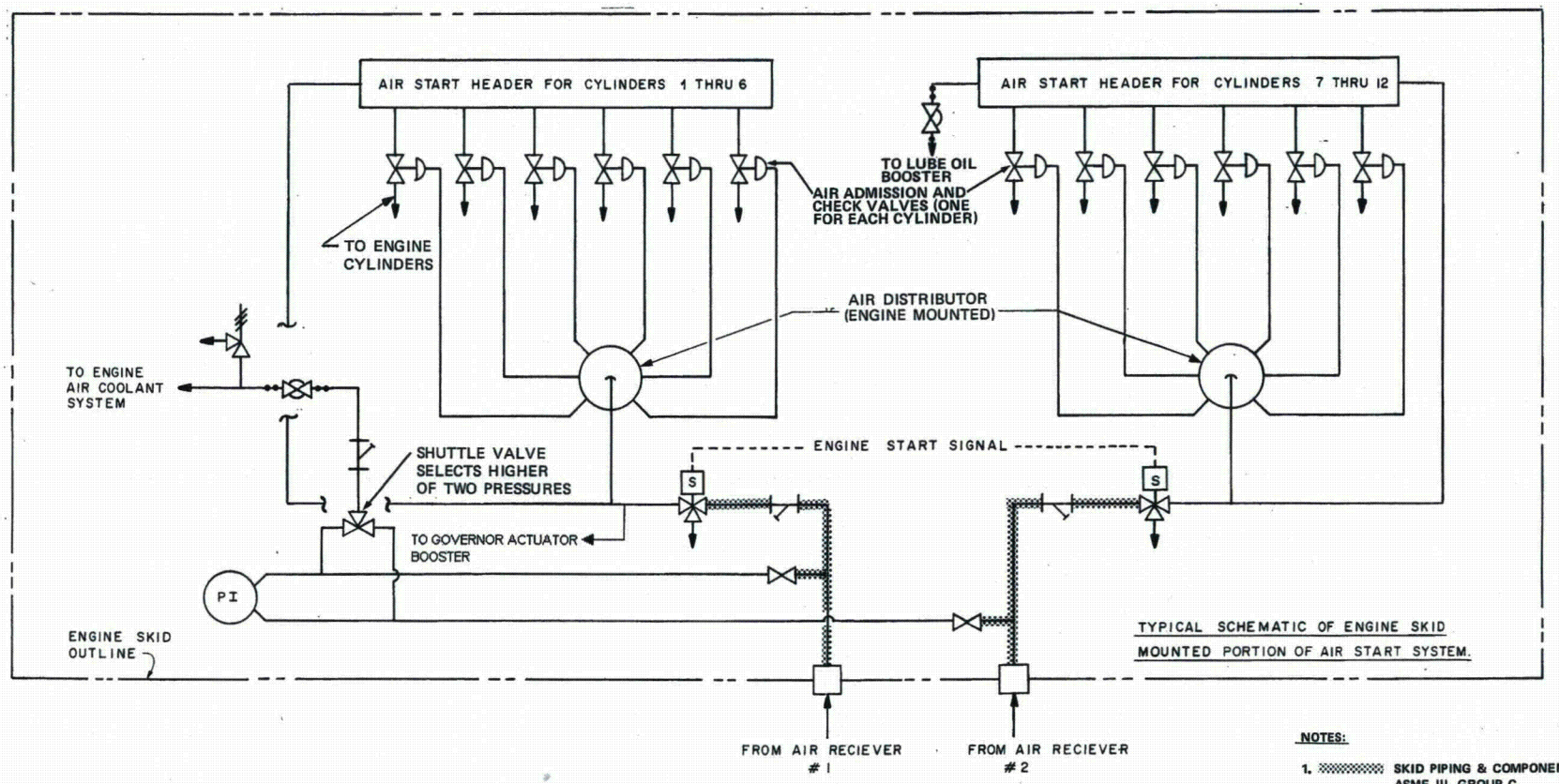
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-9

DIESEL GENERATOR SYSTEM
DIVISION II - RESIDUAL HEAT REMOVAL COMPLEX
P&ID

REV 19 10/14



(SEE FIGURES 9.5-8 AND 9.5-9)

NOTES:

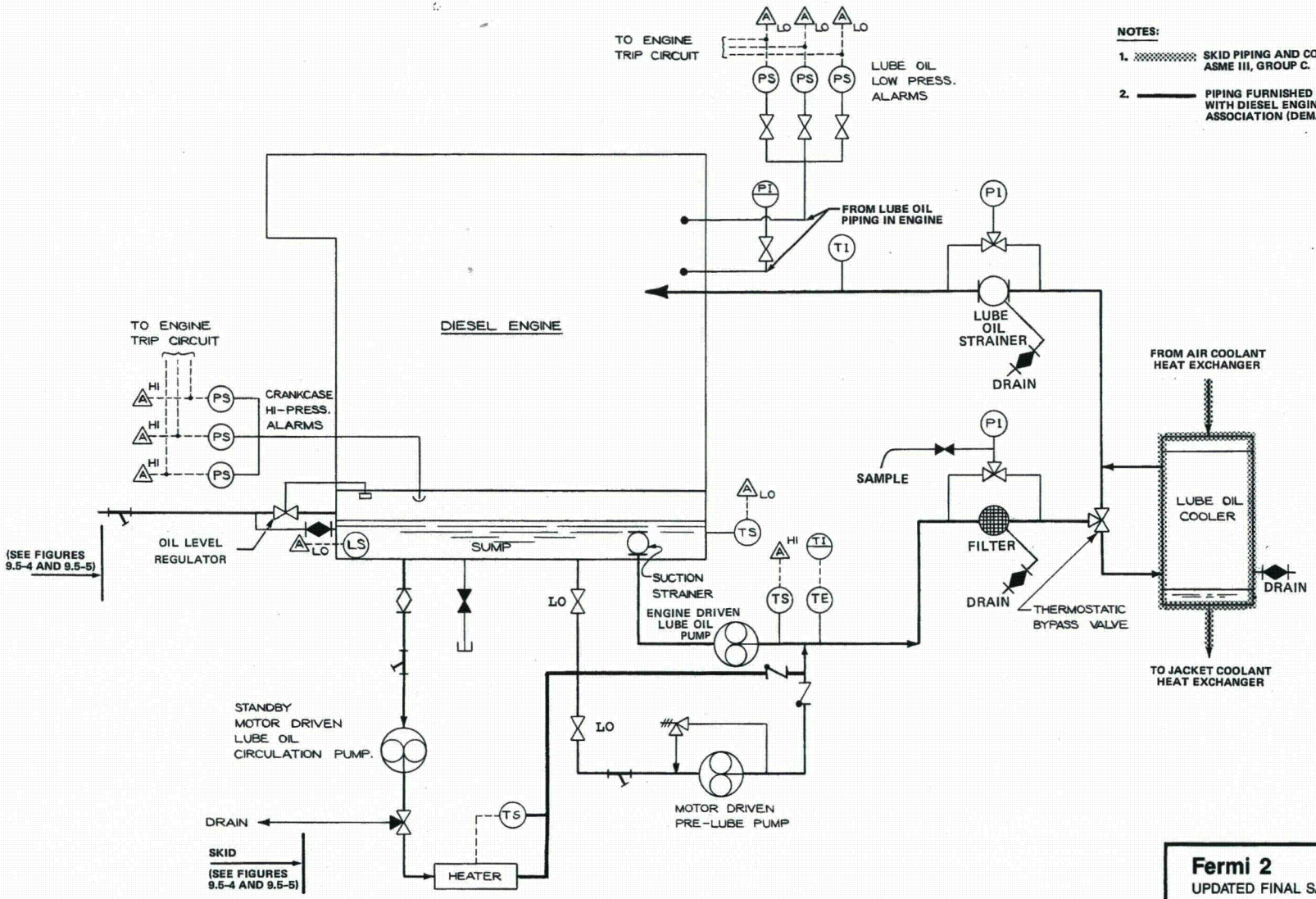
1. SKID PIPING & COMPONENTS ARE ASME III, GROUP C.
2. PIPING FURNISHED IN ACCORDANCE WITH DIESEL ENGINE MANUFACTURERS ASSOCIATION (DEMA) STANDARDS.

Fermi 2
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-10

ENGINE-SKID MOUNTED DIESEL GENERATOR AIR START SYSTEM

REV 11 05/02



Fermi 2
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9.5-11

DIESEL GENERATOR LUBRICATION SYSTEM

REV 9 4/99

9A.1 INTRODUCTION

9A.1.1 Background and Purpose

9A.1.1.1 General

In a letter dated May 3, 1976, the NRC transmitted to Edison a copy of revised Standard Review Plan (SRP) 9.5.1, "Fire Protection," dated May 1, 1976, which included Branch Technical Position (BTP) APCSB 9.5-1. This revision of SRP 9.5.1 contained new guidelines for NRC staff evaluations of fire protection in its review of nuclear power plant construction permit applications docketed after July 1, 1976. The letter stated (1) that to the extent reasonable and practical, the revised SRP will be used by the NRC staff in evaluating fire protection provisions of operating plants, applications currently under review for construction permits and operating licenses, and future applications for operating licenses for plants then under construction; and (2) that the NRC would provide more definitive criteria or acceptable alternatives for the application of SRP 9.5.1 when available.

In a subsequent letter dated September 30, 1976, the NRC transmitted Appendix A to APCSB 9.5-1, which provides for plants docketed prior to July 1, 1976, certain acceptable alternatives to the positions given in SRP 9.5.1. This letter also directed Edison to conduct an evaluation of the fire protection provisions for Fermi 2. The evaluation must include a fire hazards analysis conducted under the technical direction of a qualified fire protection engineer and performed to the level of detail indicated by enclosure 2 to NRC's letter "Supplementary Guidance on Information Needed for Fire Protection Program Evaluation." In addition, the evaluation must provide a detailed comparison of the fire protection provisions proposed for Fermi 2 with the appropriate guidelines in Appendix A to APCSB 9.5-1, which for Fermi 2, are those designated as "plants under construction and operating plants."

As a result of the correspondence, Edison performed a fire protection evaluation of Fermi 2. The fire protection evaluation consisted of performing a fire hazards analysis, doing a point-by-point comparison to Appendix A of APCSB BTP 9.5-1, developing fire protection related drawings, and evaluating the overall Fermi 2 fire protection program.

This evaluation was conducted by Gilbert Associates, Inc., Reading, Pennsylvania, under the technical direction of W. A. Brannen, who is a qualified fire protection engineer. His qualifications include full membership in the Society of Fire Protection Engineers and registration as a Professional Engineer in fire protection in the Commonwealth of Pennsylvania.

The original evaluation report was submitted as Amendment 10 to the original FSAR in November 1977 and subsequently revised and amended in Amendments 39, August 1981; 45, November 1982; 52, December 1983; 58, July 1984; and post OL Revision 1 in March 1985. It presented the results of the fire protection evaluation (fire hazards analysis), the methodology employed, and a description of the shutdown systems of Fermi 2, as well as a point-by-point comparison to Appendix A of APCSB 9.5-1.

Subsequent Appendix R analyses have been performed and have resulted in the submittal of deviations for specific plant fire zones and the design and installation of an alternative

shutdown system. The Fermi 2 safe-shutdown capability and systems are discussed in Sections 9A.3 and 7.5.

During the course of the NRC review, the NRC asked for additional information, which was transmitted in Edison letter EF2-53791, dated June 18, 1981, documenting commitments made by Edison at the fire inspection exit critique of May 15, 1981, and at a meeting in Bethesda, Maryland, on May 27, 1981. Changes to Section 9A.4 described in Edison letter EF2-53791 were incorporated in FSAR Amendment 39.

During 1984, Edison met with the NRC staff several times to resolve staff concerns about the potential consequences of a postulated fire in the Fermi 2 control room. As a result of these meetings, Edison committed to provide an alternative shutdown system that could operate independently of the control center. The basis, the design, and the analysis of this alternative shutdown approach were described in Edison letters to the NRC (EF2-72001 and EF2-71994, dated October 22, 1984, and EF2-72718, dated August 16, 1984). Appropriate information presented in these letters has been incorporated into Section 9A and Subsection 7.5.2.5.

Appendix E, "Safety Evaluation Report on the Fire Protection Program for the Fermi 2 Facility," of Supplement No. 5 to the SER issued March 1985 replaces and supersedes Appendix E of the SER dated July 1981 and SSER 2 dated January 1982. Approval of the Fermi 2 fire protection program is provided in SSER No. 5. Subsequent information and approval are provided in SSER No. 6 dated July 1985.

In the process of updating Section 9A, Generic Letter 86-10 was used as guidance in developing and incorporating Section 9A.6, Fire Protection and Alternative Shutdown System Conditions for Operations.

Since the original Fermi 2 fire hazards analysis, the NRC produced clarification on fire protection features for nuclear power facilities, for example, Generic Letters 81-12, 82-21, 84-09, 85-01, and 86-10. Generic Letter 86-10, "Implementation of Fire Protection Requirements," clarifies such subjects as documentation, deficiency notification, and removal of Fire Protection Limiting Conditions for Operation and Surveillance Requirements from the Technical Specifications. This clarification has been considered in the development of the Fermi 2 Fire Protection Program. Generic Letter 86-10 was used as guidance in developing Section 9A.6, Fire Protection and Alternative Shutdown System Conditions for Operations.

The fire protection system limiting conditions for operation and surveillance requirements have been removed from the Technical Specifications and included in Section 9A.6.

Section 9A.1 presents the results of the fire protection evaluation of Fermi 2. The methodology used and a description of the shutdown systems are presented in Sections 9A.2 and 9A.3, respectively. The fire hazards analysis is presented in Section 9A.4. The point-by-point comparison to Appendix A of APCSB 9.5-1 is provided in Section 9A.5. The fire protection and alternative shutdown system conditions for operations are provided in Section 9A.6.

9A.1.1.2 Documents

The following is a listing of pertinent correspondence with the NRC and of other fire protection program documents. The documents have been incorporated into UFSAR as appropriate.

Letters to the NRC

Date	Number	To	From	Subject
01-28-87	VP-NO-87-0014	NRC	F. E. Agosti	Alternative Shutdown System – Additional Information
12-10-86	GP-86-0014	NRC Region III Keppler	B. R. Sylvia	CTG Diesel Fuel Oil Warmer Installation Clarification
10-14-86	VP-86-0136	NRC Adensam	F. E. Agosti	3L Appendix R Alternate Shutdown Testing
02-20-86	VP-86-0006	NRC Andensam	F. E. Agosti	Deviation Reg-Emergency Lighting
01-21-86	VP-86-0002	NRC Adensam	W. H. Jens	Alternate Shutdown System
01-03-86	VP-85-0221	NRC Adensam	W. H. Jens	Alternate Shutdown System
03-04-85	NE-85-0365	NRC Youngblood	W. H. Jens	Resolution of Certain Fire Protection Issues
12-07-84	EF2-72025	NRC Youngblood	W. H. Jens	Additional Information Concerning Fire Protection
03-07-85	NE-85-0345	NRC Youngblood	W. H. Jens	Request to Revise Draft FERMI 2 Technical Specification 3.3.7.9
02-18-85	EF2-70391	NRC Region III Keppler	W. H. Jens	Additional Fire Protection Information
10-23-85	VP-85-0204	NRC Region III Keppler	W. H. Jens	Amended Final Report of 10 CFR 50.55(e), Item 116 "Potential Deficiency by allowing Freezing of Buried Piping Systems"

Date	Number	To	From	Subject
09-27-84	EF2-72260	NRC Youngblood	W. H. Jens	Additional Information Concerning "Cross-over" Cable Fire Stops and Use of Vinyl Tile Center
10-29-85	VP-85-0202	NRC Region III Keppler	W. H. Jens	Diesel Fuel Oil Warmer
02-04-85	NE-85-0275	NRC Youngblood	W. H. Jens	Additional Fire Protection Information
08-03-84	EF2-72717	NRC Youngblood	W. H. Jens	Submittal...Deviations to Appendix R
10-22-84	EF2-72001	NRC Youngblood	W. H. Jens	Design of Alternate Shutdown Approach
08-16-84	EF2-72718	NRC Denton	W. H. Jens	Alternate Shutdown in the Control Center Complex
10-22-84	EF2-71994	NRC Denton	W. H. Jens	Implementation of Alternative Shutdown at FERMI 2
08-04-84	EF2-69218	NRC Youngblood	W. H. Jens	Transmittal of Fire Protection Information
06-18-85	VP-85-0142	NRC Youngblood	W. H. Jens	Additional Fire Doors and Dampers
01-09-85	NE-85-0030	NRC Youngblood	W. H. Jens	Fire Door Qualification Report

Other Documents

Fire Protection:

Technical Specification	3.3.7.9 Fire Detection Instrumentation
Technical Specification	3.7.7.1 Fire Suppression Systems
Technical Specification	3.7.7.2 Spray and/or Sprinkler Systems
Technical Specification	3.7.7.3 CO_2 Systems
Technical Specification	3.7.7.4 Halon Systems
Technical Specification	3.7.7.5 Fire Hose Stations
Technical Specification	3.7.7.6 Yard Fire Hydrants and Hydrant Hose Houses

Technical Specification 3.7.8 Fire Rated Assemblies

Dedicated Shutdown System Design Review Summary, February 24, 1986.

Supplement No. 5 of the Safety Evaluation Report - March 1985.

Supplement No. 6 of the Safety Evaluation Report - July 1985.

9A.1.2 Applicable Codes

The following National Fire Protection Association (NFPA) codes were used for guidance in the development of the Fermi 2 fire protection program.

NFPA Code	Edition Used
10	1978
12	1977
12A	1977
13	1980
13A	1976
13E	1973
14	1976
15	1979
20	1970
24	1970
30	1977
72E	1974
72D	1975
198	1972

The 1978 edition was used for other NFPA codes not specifically mentioned above or in Subsection 9.5.1.1.5. Certain deviations to the above listed NFPA codes have been evaluated as being acceptable and are discussed in Subsection 9.5.1.

9A.1.3 Fire Protection Program

9A.1.3.1 Objective and Purpose

The Fermi 2 fire protection program defines the requirements and responsibilities for control of the fire protection equipment and activities and is designed to minimize the adverse effects

of fires on safety-related structures, systems, and components and to ensure safe-shutdown capability in the event of a plant fire.

This program has been established to outline the fire protection systems and associated tasks and personnel necessary to perform those tasks to ensure that the fire protection program is effective in minimizing risks associated with fires. Fire protection activities associated with safety-related systems, components, or structures will be conducted in accordance with the provisions of the Operating License.

9A.1.3.2 Description

The fire protection program consists of the following components:

a. Definition of the organizational responsibilities and lines of communication, pertaining to fire protection, between the various positions/organizations

b. Qualification of personnel responsible for fire protection at Fermi 2

c. Composition, duties, and qualifications of the plant fire brigade

d. Establishment and maintenance of the fire protection training program

e. Administrative controls to minimize the amount of combustibles that safety-related areas may be exposed to and the control of potential ignition sources

f. Fire-fighting strategies for safety-related areas

g. Periodic inspection, maintenance, and testing of fire detection and protection systems

h. Training of necessary plant personnel for fire watch duty

i. Assurance that necessary actions are taken to minimize fire risk and repairs are made as soon as practical when fire equipment is taken out of service

j. Procedures that establish a method for design control, procurement, installation, and testing for fire protection in safety-related areas

k. A quality assurance (QA) program so that the requirements for design, procurement, installation, testing, and administrative controls for fire protection in safety-related areas are satisfied

l. The necessary fire protection equipment, communications equipment, and emergency lighting which has been installed in accordance with the fire hazards analysis contained in this appendix.

9A.1.3.3 Organizational Responsibilities

a. The senior onsite nuclear manager is responsible for the operation of Fermi 2 and therefore has overall responsibility for the fire protection program

b. The senior onsite nuclear manager in charge of engineering has been delegated management responsibility for the formulation and effectiveness of the fire protection program

c. Nuclear Engineering is directly responsible for:

1. Having a qualified fire protection engineer within Nuclear Engineering. This engineer assists in the formation, maintenance, and periodic review of the fire protection program
2. Establishing and maintaining the overall fire protection program description
3. Developing and maintaining the fire detection/ protection design and configuration control for onsite facilities and location of the safe-shutdown equipment for fires
4. Reviewing fire protection practices and evaluating design-related sections of insurance inspections
5. Ensuring that the fire protection program associated with safety-related systems, components, and structures conforms to NRC requirements by:
   (a) The performance of fire hazards analyses, and evaluations as required
   (b) The review and evaluation of designs in accordance with current fire codes and standards for applicability to the plant
   (c) The evaluation of operating experience reports (i.e., License Event Reports, Safety Evaluation Reports [SERs], Inspection and Enforcement Bulletins, Circulars, and Notices) for the potential impact on plant fire safety.

d. The Director – Nuclear Production has been delegated the responsibility for:

1. Implementing and coordinating the Fermi 2 fire protection program
2. Having a fire protection specialist
3. Organizing and implementing the plant fire brigade. The fire brigade is composed of a minimum of five Plant personnel and shall be maintained onsite at all times.* The fire brigade shall not include the Shift Manager, the Shift Technical Advisor/Operations Shift Engineer, nor the two other members of the minimum shift crew necessary for safe shutdown of the unit nor any personnel required for other essential functions during a fire emergency. To be a fire brigade member, personnel must first complete the required fire brigade training, rad-worker training, and respirator training, and be physically qualified

* The fire brigade composition may be less than the minimum requirements for a period of time not to exceed 2 hr, in order to accommodate unexpected absences, provided immediate action is taken to fill the required positions.

4. Managing fixed and transient combustibles; flammable and combustible liquids, cutting, welding, and grinding activities, and other ignition sources to minimize associated fire hazards
5. Housekeeping and fire inspection performance
6. Assisting Nuclear Training in development of training programs for the plant fire brigade, fire watch, and site personnel
7. Maintaining, operating, and inspecting fire protection systems, components, and equipment
8. Developing and implementing the fire "Pre-Plans"
9. Developing the maintenance, surveillance, and administrative procedures for the fire protection program.

e. Nuclear Quality Assurance is directly responsible for audits, surveillances, and inspections of the fire protection program including operations, maintenance, and modifications of fire prevention components, equipment, and systems to ensure compliance with procedural and regulatory requirements

f. Nuclear Training is responsible for maintaining the Fire Protection Training Program as follows:
   1. Training both onsite and offsite fire brigade personnel.
   2. Conducting and evaluating required plant fire drills.
   3. Developing plant fire evacuation plans.
   4. Training fire protection inspectors.
   5. Training fire watch personnel.

g. Onsite Review Organization (OSRO) is responsible for review of changes to the Fire Protection Program per Section 17.2.

9A.1.3.4 Drill

The Frenchtown Fire Department will participate with the plant fire brigade in a drill at least once per year. This requirement may be satisfied as part of the Radiological Emergency Response Preparedness Plan program.

9A.1.3.5 Audits

Audits of the fire protection program shall be performed as specified in Section 17.2.

9A.2 METHODOLOGY - FIRE HAZARDS ANALYSIS

9A.2.1 Introduction

A fire hazards analysis of the Fermi 2 fire protection provisions was originally conducted in accordance with Appendix A to Branch Technical Position (BTP) APCSB 9.5-1. The original fire hazards analysis was based on the design as of April 1977. The original fire hazards analysis concentrated on buildings housing shutdown equipment. The objective of the analysis was to determine the potential effects of a fire at a given location within the plant and then to judge whether a fire at a given location would adversely affect the ability to safely shut down the plant. Specific fire hazards in other buildings and areas were evaluated to determine the effect of a fire on the 3-hr-rated walls separating these buildings and areas from the buildings containing safe-shutdown equipment. Where it was determined that a single fire might jeopardize plant safe shutdown, a design change was implemented. The final analysis and conclusions, as presented in Section 9A.4, were based on the design that incorporated these changes. Subsequent revisions have been made to keep the fire hazards analysis current. Subsequent analyses were due to the change in the rule. These analyses were performed to verify Fermi 2 compliance with the new technical requirements of 10 CFR 50, Appendix R, Sections III.G, J, and O. In this effort Edison reassessed the Fermi 2 fire protection program and performed additional safe-shutdown analyses that resulted in the design and installation of the alternative shutdown system and dedicated shutdown panel. Also, Edison requested deviations from specific conditions of Appendix R. The results of the fire protection evaluations and subsequent analyses of Fermi 2 are included in Section 9A.4.

A deviation is a condition which when analyzed/evaluated does not strictly adhere to the rule but does have conditions which provide an equivalent level of protection to that of the requirements.

The deviations of Fermi 2 from Appendix R are addressed in Reference 1. These deviations provide justification that an equivalent level of protection to that of the technical requirements of Section III.G of Appendix R exists for Fermi 2.

At Fermi 2, fire hazards analyses have been and are performed in two phases: the first is that of an information collection process; the second is the actual analysis and effects evaluation.

9A.2.2 Information Collection

Before a fire hazards analysis can be performed, Fermi 2 plant information is obtained such as plant shutdown equipment, inventory of combustibles, structural fire barriers, and existing and planned fire detection/protection equipment. This information is then reviewed and documented in the fire hazards analysis. As required, the information is then incorporated on the fire protection layout drawings, Figures 9A-1 through 9A-18.

9A.2.2.1 Plant Shutdown Equipment

Plant safe-shutdown operation starts with the reactor at normal full power and terminates with the reactor in the cold-shutdown condition with long-term cooling in operation. Plant safe- shutdown equipment is defined as mechanical, electrical, and ventilation equipment,

including instrumentation, controls, and cables, required for the shutdown operation. Shutdown is from the main control room, under normal and abnormal conditions, with certain exceptions. For these exceptions, such as a fire in the control center complex (control room, relay room, and cable spreading room), the plant can be shut down from outside the control room using the alternative shutdown system. Additional information concerning the safe-shutdown sequence is presented in Section 9A.3.

9A.2.2.2 Inventory of Combustibles

The inventory of combustibles and calculation of combustible (fire) loading for all fire zones in the plant is contained in a detailed engineering design calculation. The major types of combustibles inventoried for the fire hazards analysis are petroleum products, electrical insulation, charcoal filters, Thermo-Lag material, and maintenance and operating supplies. The fire loading values (Btu/ft^2) determined in the inventory process are used to calculate the total fire loading of the zone as described in Subsection 9A.2.3.3. The resultant calculated total fire loading for each fire zone is then classified as low, moderate, or high, and this descriptive quantitative term is utilized in the Fire Hazards Analysis in Section 9A.4. These terms are being used as discussed in the Fire Protection Handbook. A low fire load is one that does not exceed an average of 100,000 Btu per square foot of net floor area; a moderate fire load exceeds an average of 100,000 Btu per square foot of net floor area but does not exceed an average of 200,000 Btu per square foot; a high fire load exceeds an average of 200,000 Btu per square foot of net floor area but does not exceed an average of 400,000 Btu per square foot. These terms were developed in British Fire Loading Studies and assume (or allow) even higher load limits in limited isolated areas for each level (low, moderate, or high) but only these average fire load limits are being used for the Fermi 2 Fire Hazards Analysis in order to add conservatism to the analysis.

Petroleum products are defined, for the purposes of the fire hazards analysis, as lubricants and fuel oil. Lubricants are tabulated for all equipment containing 1 gal, or more, of oil. Lubrication of equipment requiring smaller quantities of oil is normally accomplished through sealed bearings or oil/grease cup arrangements that require very small quantities of lubricant. These small quantities are not considered significant to the fire hazards analysis and are not included in specific area/zone fire loadings. Fuel oil for diesel-driven equipment and the auxiliary boiler is discussed in the individual zone analyses.

Transformers inside plant buildings are of dry-type construction and contain no petroleum products.

Electrical insulation consists primarily of cable insulation and jackets. Small quantities of other combustible materials are used in switchgear and control panels. The type of cable insulation used in construction was primarily ethylene propylene. Cables have overall fire-retardant jackets of Neoprene or Hypalon. For purposes of the fire hazards analysis, all cable insulation was assumed to be combustible and to have a heat content of 10,000 Btu/lb (Reference 2). Cables have been type tested in accordance with the flame test of Edison's Specification 3071-80 (Reference 3) and are certified to be of fire-retardant construction. This is equivalent to the IEEE-383 test. Metal cable trays are of either the ladder type without covers or the solid-bottom type with covers (see Subsection 9A.2.3.1.8). Control, instrument, and small power cables installed in trays are random and lie in multiple layers.

Large power cables are installed in a single layer and are spaced. Conduits contain one or more cables. Although some delay in fire propagation through conduits can be expected, no credit is taken for such delay in this evaluation.

Electric Power Research Institute (EPRI) tests have demonstrated that an electrical short will not propagate a fire in the type of cable installed at Fermi 2. Therefore, an exposure fire would be required for propagation of a cable fire. The EPRI test "NP 1881" documents that a minimum of 4 gal of flammable liquid burning for 10 minutes is necessary to cause a cable fire to slowly propagate. In the test, the cable fire self-extinguished after approximately 30 minutes. This indicates the EPR/Hypalon-jacketed cable has a high resistance to fire.

For the fire hazards analysis, cable insulation quantities were estimated using the following procedure:

a. A representative cable size was established for each tray class, based on tray classification (power, control, instrument, etc.)

b. The cable fill percentage per tray was determined from the cable routing database.

c. The insulation quantity was obtained by multiplying the tray length, weight of insulation of the cable size representative of the tray loading and actual tray fill percentage for all areas.

The total insulation weight was obtained through a summation of all trays in the fire zone. The cable tray lengths given in the cable routing database were used rather than measuring the tray length existing in each fire zone. This was a conservative simplifying assumption because the tray numbers do not automatically change where they pass through fire barriers or across fire zones boundaries. Therefore, the full length of the tray is added to the fire zones on both sides of the barrier or boundary. In most areas of the plant, cable in conduit was ignored based on the facts that it is a small percentage of the total cable and that the conservatism in the estimating procedure would offset the cable in conduit.

Insulation in motors is a small quantity in comparison to the quantity of cable insulation. Combustible materials inside instrumentation, control, and relay cabinets mainly consist of cable insulation, bakelite in relay housings, and small quantities of miscellaneous materials.

The Btu content of electrical and instrument cabinets was established based on an investigation of combustibles within several electrical panels at Fermi.

Electrical insulation in motor control centers and switchgear consists mainly of cable insulation. The Btu content was determined by a review of several MCC at Fermi.

Charcoal quantities were estimated based on the size of charcoal filters having comparable flow rates.

Maintenance and operating supplies consist of lube oil, hydraulic fluid, paper, cloth, plastic, and other items required for normal plant operations. In contrast to petroleum products, electrical insulation, and charcoal, which are permanent and are part of the plant design, these combustibles are nonpermanent, may vary with time, and can be moved. For the fire hazards analysis, it is assumed that plant housekeeping procedures will keep nonpermanent combustibles in general plant areas to limited quantities. In those areas where it is known

that maintenance and operating supplies must be maintained, estimates are based on previous operational experience.

For fire hazards analyses performed subsequent to the original, the inventory of combustibles has been and is being addressed in accordance with the National Fire Protection Association (NFPA) "Fire Protection Handbook," latest edition. This document was used to determine the criteria for evaluating additions to the combustible inventory in each zone at Fermi 2.

The purpose of the inventory of combustibles (fire loading/ combustible loading descriptive level) is to provide the evaluating fire protection engineer with an approximation of the quantity of combustible hazards within the fire zone or area being evaluated or analyzed. The combustible loading is just one of several factors considered when performing a fire hazards analysis or evaluation. The fire protection engineer also considers the type of combustible, its use, its location, ignition sources, and fire detection and suppression systems within the given zone. These are more important to the evaluation than is the quantity of combustibles. Therefore, these factors are given greater consideration when performing fire hazards analyses and evaluations for Fermi 2.

When new cables, single or in conduit, are added to the plant, their fire loading values are not added to the fire zone's fire loading value because the fire loading value presented by them is insignificant compared to the existing estimates. Cables in conduit are accepted as not contributing to the fire loading of a fire zone or area.

When significant amounts of combustibles as described above or cable trays are added to a fire zone, the combustible loading is reviewed accordingly and its effects evaluated for the affected fire zones.

9A.2.2.3 Review of Structural Fire Barriers

For the original fire hazards analysis, walls, floors, and ceilings were assigned fire-resistance ratings based on their construction. Door ratings were established to conform with the fire rating of the walls in which they are installed. Each penetration in a designated fire barrier is fire stopped with the appropriately rated firestop. Cable tray penetrations through non-rated walls, floors, and ceilings are fire stopped (see Figures 9A-1 through 9A-18). See Subsection 9A.2.3.1.1 for a discussion on internal seals inside electrical conduits penetrating rated fire barriers.

Subsequent design and analysis ensures that the barriers separating safety-related zones will prevent the propagation of fires.

9A.2.2.4 Existing Fire Detection/Protection Equipment

For the original fire hazards analysis, the following information was reviewed concerning existing fire detection and protection equipment:

a. Type and location of fire detector

b. Configuration of fire protection (water) system

c. Type and location of valving

d. Type, capacity, and location of fire pump

e. Type and location of hose reel

f. Type and location of fire extinguisher

g. Location and configuration of permanently installed water sprinkler or deluge systems

h. Location and configuration of permanently installed gaseous fire suppression systems

i. Type of actuation for fire protection systems.

In addition to the above, sprinkler system densities are taken into account in performing fire hazards analyses and evaluations.

9A.2.2.5 Fire Protection Layout Drawings

Fire protection layout drawings (Figures 9A-1 through 9A-18) have been developed to present information related to the fire hazards analysis. The drawings show each safety-related building, including equipment not required for safe shutdown from a fire, fire barriers within each building, the plant shutdown equipment found within each building, and fire detection and suppression equipment. These drawings support the basis for the fire hazards analysis.

9A.2.3 Fire Hazards Analyses and Evaluations

Following information collection and drawing preparation, the original fire hazards analysis was performed.

Subsequent fire hazards analyses are performed using a similar process plus new considerations that have been learned or identified as requiring evaluation. The steps used to perform these analyses and general considerations are discussed below. The detailed analysis for each fire zone, with results, is presented in Section 9A.4.

9A.2.3.1 Identification of Fire Areas/Zones

To provide a systematic analysis that can be updated in the future, the plant is divided into fire areas in accordance with the definitions of BTP APCSB 9.5-1. The fire areas are: fire area RB, reactor building; fire area AB, auxiliary building; fire area TB, turbine building; and fire area RHR, residual heat removal complex. For analytical purposes, the fire areas have been further subdivided into fire zones. Fire zone boundaries occur at existing physical features of buildings such as floors/ ceilings and walls.

Although certain rooms are enclosed by rated fire walls, floors, and ceilings, which by definition makes them fire areas, they are considered zones or parts of a zone for this analysis.

The analysis, discussed in Section 9A.4, is presented on a building-by-building basis.

9A.2.3.1.1 Fire Barrier Penetrations

Fire barrier penetrations are provided with approved rated seals or have been evaluated via a specific fire hazards analysis.

The acceptability of the relay room stairwell seal design for cable tray crossover penetrations is based on fire tests and engineering analysis. This approach was found acceptable in SSER No. 5.

The conduit fire protection research program final report (Reference 11), submitted to the USNRC in 1987 by the Wisconsin Electric Power Company, provides the acceptance criteria to determine if an internal conduit seal is required for electrical conduits routed through rated fire barriers. This acceptance criteria which has been accepted by the USNRC (Reference 9 and Reference 10) is used at Fermi 2 to determine if and when an internal conduit seal is required for those electrical conduits routed through rated fire barriers. This criteria which evaluates each side of the fire barrier separately, is as follows:

a. Conduits that terminate in junction boxes or other noncombustible closure need no additional sealing

b. Conduits that run through an area but do not terminate in that area need not be sealed in that area

c. Conduits smaller that 2" diameter that terminate 1 foot or greater from the barrier need not be sealed

d. Open conduits of 2" diameter that terminate 3 feet or greater from the barrier need not be sealed

Consequently, electrical conduits which do not meet the criteria outlined above, and are routed through rated fire barriers, are provided with rated internal seals as required.

9A.2.3.1.2 Fire Boundaries

Fermi 2 has fire zones that are not enclosed by 3-hr-rated fire barrier boundaries. The barriers were reviewed by the NRC in 1981 and found to provide an acceptable level of protection, as stated in SSER No. 2.

As part of the 10 CFR 50, Appendix R, deviation submittal (Reference 1), additional information and analyses of these unrated boundaries were provided. SSER No. 5 reaffirms the acceptability of the zone boundaries. The unrated boundaries have unsealed openings such as pipe and duct chases, hatches, and open stairwells. Generally, the unrated boundaries are acceptable for one or more of the following reasons:

a. The Fermi 2 design separates Division I and Division II safe-shutdown cables and equipment in the reactor building

b. The lack of combustible materials in the stairwells and open penetrations

c. The large volume of the reactor building wherein heat can be dissipated

d. The installation of automatic sprinklers in areas considered to present a fire hazard and in areas to prevent fire propagation

e. The administrative control of combustible materials and ignition sources within the plant

f. Early-warning smoke detection provides assurance of prompt fire brigade response

g. Cable tray penetrations are fire stopped at boundaries, thereby eliminating cable trays as a means of fire propagation between zones.

The unrated boundaries are: All Reactor Building floors and ceilings; the walls between Reactor Building Fire Zones 01RB and 02RB, 02RB and 03RB, and 03RB and 04RB, as shown in Figures 9A-2 and 9A-3; and the walls between Auxiliary Building zones 14AB and 15AB and the floor between Auxiliary Building zones 13AB and 15AB.

9A.2.3.1.3 One-Hour Protective Envelope

The 1-hr barrier is composed of 3M fire barrier material. Initially, there were some questions whether the 3M material design and installation configuration met NRC requirements. Subsequently, this fire-retardant material was rated by the Underwriters Laboratories as a 1-hr protective envelope. In Reference 4 submittal justification was demonstrated for the 3M material and the design was found acceptable in SSER No. 5.

The 3M material is being used as a 1-hr protective envelope to protect safe-shutdown cables in specific fire zones as delineated in the fire hazards analysis. Also, it has been installed throughout the plant on cables, conduit, and supports of equipment no longer required to be protected for safe shutdown. Therefore, when it is removed for maintenance purposes, it will not be replaced.

3M material has been added to the Auxiliary Building basement to protect cable trays and supports. This protective envelope has been tested by a nationally recognized testing laboratory and qualified as a 1-hour envelope in accordance with current NRC requirements. In addition, tested fire breaks have been added to trays in the Auxiliary Building Basement to ensure that a postulated fire cannot spread through these cable trays in such a manner as to damage redundant safe shutdown components. The specific areas and cable trays protected are described in the fire hazards analysis.

9A.2.3.1.4 TSI Three-Hour Barrier

Thermo-Lag 330-1 material is not used on site as a fire rated material; rather it is used in the following locations as a nonrated continuous smoke and gas barrier as defined in NFPA 101:

a. As a barrier between the Relay room (Fire Zone 03AB) and the control center northeast stairwell on elevation 613'-6" (also Fire Zone 03AB)

b. As a HVAC chase floor on elevation 613"-6" at column H-11 above the cable tray area (Fire Zone 02AB) on 603'-6"

c. As a HVAC chase floor on elevation 630'-6" in the southwest corner of the cable spreading room above the relay room (Fire Zone 05AB)

9A.2.3.1.5 Fire Doors

Doors in rated barriers are either listed or labeled by a nationally recognized laboratory; or have been evaluated via a specific fire hazards analysis. Fire doors R3-13, T3-6, R1-11, and R1-8 have approved deviations as listed in Section 9A.4 and SSERs No. 5 and No. 6.

In this appendix, as related to fire doors, "A" means the door has a 3-hr fire-resistance rating; "B" means the door has a 1-1/2-hr fire-resistance rating; and "C" means the door has a 3/4 hour fire resistance rating.

9A.2.3.1.6 Fire Dampers

Fire dampers installed in fire barrier boundaries at Fermi 2 are 3-hr rated or have been evaluated via a specific fire hazards analysis. In some instances, there are single 1-1/2-hr dampers, two 1-1/2-hr dampers installed in series, and ganged dampers. These conditions and installations have been evaluated and documented (Reference 7 and SSER No. 5).

The fire dampers have been justified based on manufacturer's tests of similar installations, the negligible fire loading on each side of the barrier of concern, and the installation of early-warning fire detection on each side of the barrier of concern.

For more information on fire dampers installed at Fermi 2, see Subsection 9.5.1.2.

9A.2.3.1.7 12-In. Concrete Block Walls

In certain areas of the auxiliary building, 12-in. concrete block walls have been erected to provide separation from other parts of the building. These walls are removable to facilitate equipment changeout and repairs. Edison has evaluated these walls and considers them equal to a 3-hr barrier. Although a specific rating test does not exist for this design, the 12-in. block wall will prevent any postulated fire from spreading and therefore provides protection equivalent to a 3-hr-rated barrier. (See Reference 3.)

9A.2.3.1.8 Solid-Metal Trays With Covers

Solid-metal trays with solid-metal covers are installed throughout the plant. Generally, these trays contain small instrumentation cables, and the trays are usually sparsely filled. Under such conditions, Edison has taken credit for the solid-metal tray with cover as a mechanism that restricts or eliminates the propagation of a fire. The NRC has accepted this as equivalent to a fire break in cable trays. (See SSER No. 5.)

9A.2.3.2 Review of Shutdown Equipment Within Fire Areas/Zones

A shutdown analysis was originally performed as part of the overall fire protection evaluation. With the issuance of 10 CFR 50, Appendix R, Edison performed other shutdown analyses to assess compliance to the requirements of Appendix R. The original shutdown analysis was used as a starting point. The new analyses determined the circuits that needed protection due to required fire protection separation requirements for redundant and associated circuits and for the prevention of spurious operation. A summary is provided in Section 9A.3.

An important aspect of reviewing shutdown equipment is the consideration of its function and the location of redundant or other equipment capable of performing the same function. In some cases, two or more sets of redundant equipment are located in the same fire zone. When this occurs, it is necessary to evaluate actual separation, barriers, combustibles in the immediate vicinity of the equipment, ignition sources, and fire detection and suppression equipment in the fire zone. In cases where other equipment capable of performing the same function is located in a different fire zone, it is necessary to perform an analysis to demonstrate that the equipment in the fire zone under consideration could be destroyed by a fire without adversely affecting plant shutdown capability.

9A.2.3.3 Calculation of Fire Loading

For the original fire hazards analysis and subsequent analyses, combustible materials located within each fire zone have been listed and the fire loading, in Btu/ft^2, has been calculated, and the current loadings are documented in a detailed engineering design calculation.

This loading, along with the type of combustibles and the anticipated rate of burn, is used to verify the adequacy of existing fire barriers. For fire-barrier ratings as related to heat load (Btu/ft^2), see Table 9A.2-1.

9A.2.3.4 Review of Ventilation Systems

Ventilation equipment required to cool rooms containing plant shutdown equipment is considered safe-shutdown equipment. Ventilation systems have been designed and installed as described in Section 9.4.

9A.2.3.5 Examination of Fire Detection and Suppression

The examination of fire detection and suppression consists of determining how a fire within a fire zone will be detected and extinguished. It is assumed that permanently installed fire-detection, fire-suppression, and fire-fighting equipment will function as designed.

The types of combustibles and their fire loadings are reviewed to determine the type of suppression and detection equipment required to provide early warning and contain or extinguish a fire within the zone. The effect of water on electrical components and safe-shutdown equipment is a consideration in the selection of the design and type of suppression system that was or will be installed at Fermi 2.

9A.2.3.5.1 Fire Detection Systems

Fermi 2 fire detection systems consist of the detectors, associated electrical power supplies, and the annunciator panels. The types of detectors used are: ionization, thermal, infrared, and photoelectric. The fire detection systems provide local and remote audible and visual alarms. The remote alarms are in the main control room. The fire detection systems are installed in areas having safety-related equipment and/or safety-related cables.

The fire detection systems are installed in accordance with NFPA 72D except that a permanent recording device is not installed as required. A deviation was granted in SSER No. 5 based on the fact that the operators continually man the control room and log each fire

alarm received in the control room. Also, control room alarms can only be reset manually at the local fire alarm panel.

Fire detection systems that are used to actuate suppression systems in the reactor/auxiliary building are Class A systems as defined in NFPA 72D. All other redundant safety-related division areas have a cross-zoned Class B detection system.

Edison performed an evaluation of the fire detection system to verify installation with NFPA 72E. The evaluation included assessing detector spacing, location, ceiling types and construction, interferences by heating, ventilation, and air conditioning (HVAC) airflow patterns, and accessibility for testing and maintenance. As a result, some detectors were added in specific areas as described in Reference 7 and a deviation was requested for spacing of the detectors in the torus area. The deviation was approved in SSER No. 5.

Note: Fire detection in the Security Diesel Generator enclosures utilize both infrared and thermal detectors which actuate a FM-200 clean agent system and sends a signal to the security Central Alarm Station which is continually manned.

For more details on the Fermi 2 fire detection systems, see Subsection 9.5.1.2.

9A.2.3.5.2 Fire Protection Systems

Fermi 2 fire protection systems consist of automatic suppression systems including water sprinkler, CO_2, Clean Agent, and Halon systems, the water supply system, yard hydrants, fire pumps, standpipes, and hose stations. For details on these systems, see Subsection 9.5.1.2.

FM-200 Clean Agent extinguishing systems are used in certain areas of Fermi 2. These systems are activated by a NFPA-72 and NFPA-70 compliant fire detection system. These clean agent systems were designed, installed, and tested in accordance with NFPA-2001 requirements.

Halon 1301 total flooding systems are used in certain areas of Fermi 2. These systems are activated by ionization detectors of a Class A fire alarm circuit or photoelectric detectors. These systems were designed and installed using NFPA 12A as guidance.

Hose stations are located throughout the plant. The hose stations were installed using NFPA 14 as guidance. They are equipped with 1-1/2-in. approved lined hose and adjustable pattern fog nozzles. Pressure reducing devices are not installed as required by NFPA-14 at all hose station outlets where the pressure exceeds 100 psig, to reduce the pressure with required flow at the outlet to 100 psig. This is acceptable because the hose stations and fire hose are only used by trained fire brigade members, and adjustable pattern fog nozzles are provided at all hose stations, except for the fifth (refueling) floor of the reactor building where solid stream nozzles are provided. Pressure reducing devices that significantly reduce pressure are provided for hose station outlets on the fifth floor of the reactor building and on floors below the grade floor of 583 ft 6 in., due to excessively high pressure at those hose stations. The reason for utilizing a higher pressure at hose stations is to be able to more effectively fight fires at the ceiling height where cable trays are located. These reducers maintain pressure at the hose at approximately 130 psi. The higher pressure is needed for the hose stream's reach. A fire at ceiling height, 20 to 30 ft, would otherwise be difficult to extinguish. To compensate for the higher pressures, the fire brigade is trained in handling hose streams with higher pressures and signs have been placed on the hose cabinets in safety-related buildings

restricting their use to the fire brigade. General employee training covers the use of and restrictions on the fire hose stations (Reference 8).

9A.2.3.6 Evaluation/Conclusions

An evaluation is performed to determine whether the plant is adequately protected in the event of a design-basis fire within a fire zone. This evaluation is based on all the previously noted information. The primary objective is to determine if a fire will jeopardize plant safe shutdown.

Questions addressed in the fire hazards analysis or evaluation of the safe shutdown fire area/zones are typically the following:

a. Is there safe-shutdown equipment within the fire zone?

b. Can the function be fulfilled by redundant equipment in other fire zones?

c. Is this a single item of equipment or are both divisions of redundant equipment involved in this fire zone?

d. Does the ventilation system contribute to the spread of the fire and/or products of combustion to other fire zones that would be otherwise unaffected?

e. How will a fire in the fire zone be detected?

f. What is the response time of the detection devices or scheme? Is this adequate?

g. How will a fire in the fire area/zone be extinguished?

h. How quickly can the suppression equipment be placed into service and what is its effectiveness? Is this adequate?

i. Can the plant be shut down despite the design-basis fire and fire hazards identified within the fire zone?

If the answer to question i. is YES after all the other questions are addressed, it is concluded that the individual fire zone is adequately protected against fire from the standpoint of plant safe shutdown.

If the answer to question i. based on the preceding analyses is NO, design changes are implemented to ensure that adequate protection is available to allow plant safe shutdown.

9A.2.3.7 Containment of Radioactivity

The reactor, radwaste, and turbine buildings house equipment that normally contains significant concentrations of radioactivity. The methods of containing radioactive leakage and releases within these buildings are as follows:

a. Gaseous activity

Gaseous release or leakage inside the buildings will be retained and controlled within the buildings by their respective ventilation systems. These systems are described in Section 9.4. Radiation monitors are located in the exhaust points. On detection of high radioactivity in the effluents, these monitors actuate an alarm in the main control room and simultaneously trip the ventilation fans and

close the isolation dampers. The consequences of a fire in an area capable of releasing radioactive gases are less severe than the most significant gaseous release from the failure of the offgas system, described in Subsection 15.11.4

b. Liquid activity

Liquid spillage or leakage from equipment within these buildings drains into the respective building floor drain sump. Subsection 9.3.3 provides a description of the floor drain systems in the various buildings. From these sumps, it is pumped to the radioactive waste floor drain collection tank for normal liquid waste processing. Section 11.2 details the handling and containment of liquid radioactive waste. The consequences of a fire in an area capable of releasing radioactive liquids are less severe than the most significant release resulting from failure of the liquid radwaste system described in Subsection 11.2.3.1.

Radioactive liquids and gases are normally contained within piping and process equipment, such as tanks, pumps, demineralizers, filters, and evaporator packages. The major source of radioactivity is process equipment that is located in shielded cubicles having very low fire loadings.

A possible problem resulting from a fire is that water used to fight the fire may become radioactively contaminated. However, such contamination does not result in uncontrolled releases. The fire-fighting water will be contained and controlled in the same manner as spillage or leakage described above.

9A.2 METHODOLOGY – FIRE HAZARDS ANALYSIS

REFERENCES

1. Letter from W. H. Jens, Detroit Edison, to B. J. Youngblood, NRC, Subject: Submittal of Deviations From Staff Interpretations of Fire Protection Features in 10 CFR 50, Appendix R and Justification, dated August 3, 1984 (EF2-72717).
2. American National Standards Institute, 1976. Draft-Generic Requirements for Nuclear Power Plant Fire Protection, ANSI N18.10.
3. Detroit Edison Company, Fermi 2 Project Specification 3071-80, "Special Wire and Cable," March 1972.
4. Letter from W. H. Jens, Detroit Edison, to B. J. Youngblood, NRC, Subject: Qualification of 3M Fire Wrap, dated October 22, 1984 (EF2-72266).
5. Letter from W. H. Jens, Detroit Edison, to B. J. Youngblood, NRC, Subject: Additional Information Concerning "Cross-Over" Cable Fire Stops and Use of Vinyl Tile in the Control Center, dated September 27, 1984 (EF2-72260).
6. Letter from W. H. Jens, Detroit Edison, to B. J. Youngblood, NRC, Subject: Transmittal of Fire Protection Information, dated August 4, 1984 (EF2-69218).
7. Letter from W. H. Jens, Detroit Edison, to B. J. Youngblood, NRC, Subject: Additional Fire Protection Information, dated February 4, 1985 (NE-85-0275).
8. Letter from W. H. Jens, Detroit Edison, to B. J. Youngblood, NRC, Subject: Additional Fire Protection Information, dated February 18, 1985 (EF2-70391).
9. Letter from C. E. McCracken, NRC, to C. W. Fay, Wisconsin Electric Power Company, Subject: Review of Draft Safety Evaluation of Conduit Fire Seal Topical Report for Proprietary Content, dated October 23, 1989.
10. Enclosure to Reference 9, Technical Evaluation Report, Conduit Fire Protection Research Program submitted by Wisconsin Electric Power Company TAC 66623; by Science Applications International Corporation, dated May 12, 1989 under contract NRC-03-87-029, Task 3, SAIC 88/1824.
11. Conduit fire test program final report; prepared by Professional Loss Control, Inc., for the Wisconsin Electric Power Company; dated June 1, 1987. Document number: DTC:TDDATA; DSN: 1797E.

TABLE 9A.2-1 REQUIRED BARRIER RATINGS FOR FIRE LOADINGS[a]

Fire Loading (Btu/ft^2)	Required Barrier Rating
40,000	30 minutes
80,000	1 hr
120,000	1-1/2 hr
160,000	2 hr
200,000	2-1/2 hr
240,000	3 hr

[a] National Fire Protection Association Handbook, 14 Edition, pages 6-81.

9A.3 PLANT SAFE SHUTDOWN

The primary objective of the fire hazards analysis is to evaluate plant design and modifications to ensure the ability to achieve and maintain safe shutdown in the event of a fire in accordance with the fire protection license condition. The safe-shutdown analysis starts with the reactor at normal full power and ends with the reactor in a cold-shutdown condition with long-term cooling in progress, using the residual heat removal (RHR) system.

Safe-shutdown analyses are maintained in controlled engineering documents performed for Fermi 2 to evaluate compliance to 10 CFR 50, Appendix R, Section III.G. These analyses included safe-shutdown capability evaluations and associated circuits of concern, for example, common power supply, common enclosure, spurious operation, and high/low-pressure interfaces. For fires in most of the fire zones, safe shutdown is accomplished from the main control room using one of the divisions of safe shutdown equipment in accordance with the technical requirements of Section III.G.2 of Appendix R. For fires occurring in one of the dedicated shutdown areas of concern (Fire Zones 03AB, 07AB, 08AB, 09AB, 11AB or 13AB), safe shutdown is accomplished from outside the main control room using the alternative shutdown system (including the dedicated shutdown panel) as described in Section 7.5.2.5 in accordance with the technical requirements of Sections III.G.3 and III.L of Appendix R.

Subsection 9A.3.1 outlines the shutdown sequence on which the fire hazards analyses were based. Subsection 9A.3.2 lists the systems required to accomplish plant shutdown. Subsection 9A.3.3 discusses the method of safe-shutdown analysis.

9A.3.1 Shutdown Sequence

9A.3.1.1 Shutdown from the Main Control Room Using One of the Safe Shutdown Divisions

For the fire hazards analysis, the shutdown sequence starts with the detection of a fire of a magnitude such that plant shutdown is required. Depending on the location and magnitude of the fire, the plant may be quickly brought to hot shutdown or tripped by the plant operator. For the fire hazards analysis, it is assumed that plant shutdown is initiated with an automatic or manual scram of the reactor from the main control room. Once a scram is initiated, no further control rod motion is required.

It was also determined that, although fire damage might cause the plant to trip, no fire could negate the ability to manually trip the reactor.

There are two normal offsite ac power sources available as well as two redundant Class 1E power sources. However, for the purpose of the fire hazards analysis, a loss of offsite power is assumed to occur. The emergency diesel generators (EDGs) for the division credited for shutdown are assumed to start and restore the required portions of the emergency onsite electrical system.

It was assumed, for analytical purposes, that control of reactor pressure by the main turbine pressure regulators through the bypass valves to the condenser was lost. Therefore, the reactor was isolated from the normal heat sink and feedwater flow was stopped at the

pressure associated with normal full power. In this condition, reactor pressure is relieved through the safety/ relief valves (SRVs) to the suppression pool.

Additional information pertaining to the safe shutdown systems for main control room shutdowns using one of the normal post-fire shutdown divisions, as well as information related to the safe shutdown analysis are provided in Sections 9A.3.2 and 9A.3.3. Analysis results for applicable fire zones are provided in Section 9A.4.

Manual activation of SRVs and the reactor core isolation cooling (RCIC), the HPCI, or manual activation of SRVs and low pressure coolant injection (RHR or Core Spray) system, brings the reactor to a hot-shutdown condition. During this phase of shutdown, the suppression pool is cooled by operating the RHR system in the suppression pool cooling mode. Reactor pressure is controlled and core decay and sensible heat are rejected to the suppression pool by the HPCI or RCIC turbines or by manually relieving steam pressure through the relief valves. Reactor water inventory is maintained by the high-pressure RCIC or HPCI systems or by the Core Spray or RHR system in conjunction with manual operation of two or more SRVs.

The depressurization, caused by operation of the HPCI or RCIC turbines or manual operation of the relief valves, cools the reactor and reduces its pressure at a controlled rate until the reactor pressure becomes so low that the RCIC or HPCI system discontinues operation. This condition is reached at 50 to 100 psig reactor pressure. The RHR system is then operated in a shutdown cooling mode wherein the RHR system heat exchanger is used to bring the reactor to a cold, low-pressure condition. The cooldown process is ended when long-term decay heat removal operation is established.

For fires in the control center complex and other selected zones, the reactor is tripped in the control room and safe shutdown is completed using the alternative shutdown system described in Subsection 7.5.2.5.

The alternative shutdown system has been designed and installed to meet the technical requirements of 10 CFR 50, Appendix R, Sections III.G.3 and L. This system provides safe-shutdown capability separate and remote from the control center complex and other plant fire zones. The system is used when a fire within the complex or other dedicated shutdown areas of concern is determined to have significantly damaged the safe-shutdown equipment/cabling within these zones. The alternative shutdown system consists of a dedicated shutdown panel (past correspondence with the NRC referred to this panel as the 3L panel) and selected systems that were already installed at Fermi 2. For details on alternative shutdown system capability, including the dedicated shutdown panel, system parameter monitoring, and transfer switches, see Subsection 7.5.2.5.

9A.3.1.2 Shutdown from the Dedicated Shutdown Panel Using the Alternative Shutdown System

As with the control room shutdown described in the previous subsection, the reactor is scrammed from the control room before it is abandoned and a concurrent loss of offsite power is assumed for the limiting analysis. However, the emergency diesels, HPCI, RCIC and multiple SRVs for rapid depressurization may not be available due to fire damage. The Standby Feedwater System, powered by CTG 11-1, or an alternate CTG using the standby diesel generator that provides high pressure RPV makeup and controls for a single SRV are

available on the dedicated shutdown panel to provide RPV pressure control for hot shutdown conditions.

Additional information pertaining to the systems used to support the alternative shutdown system utilizing the dedicated shutdown panel and the related safe shutdown analysis are provided in Sections 9A.3.2, 9A.3.3 and applicable fire zones in Section 9A.4.

9A.3.2 Shutdown Systems

The following table is a summary of the Fermi 2 plant systems required to achieve and maintain safe shutdown following a fire. The entries in the table differentiate whether the given system is used for hot shutdown, cold shutdown, or both. It should be noted that for a specific fire zone, not all of the systems listed in the table are required. For example, the hot shutdown RPV makeup function can be performed by HPCI, RCIC, SBFW, or RHR in conjunction with SRVs. In addition, separate columns are provided for shutdown from the control room using one of the normal post-fire shutdown divisions and for shutdown from outside the control room using the alternative shutdown capability including the dedicated shutdown panel. The list of systems includes both systems that directly provide a post-fire shutdown function such as RPV makeup, as well as systems that are required to support these "front-line" systems. For example, RHR Service Water is required to support the RHR when it is aligned for shutdown cooling during the cold shutdown phase. The Appendix R safe shutdown system, component, cable list, and the basis for inclusion in the safe shutdown analysis are maintained in a controlled design calculation.

ID	System Name	Divisional Shutdown from the Control Room	Dedicated Shutdown from Outside the Control Room
B21	MSIVs (manual closure)	Hot/Cold	Hot/Cold
B21	SRVs	Hot/Cold	Hot/Cold
B21	RPV pressure & level instrumentation	Hot/Cold	Hot/Cold
B31	Recirculation (valve lineup for shutdown cooling)	Cold	Cold
C11	CRD hydraulic control units	Hot/Cold	Hot/Cold
C36	Dedicated Shutdown Panel Controls	NA	Hot/Cold
C36	Dedicated Shutdown Panel Instrumentation	Hot/Cold	Hot/Cold
C36	Dedicated Shutdown Support Systems & Components	NA	Hot/Cold
E11	RHR - suppression pool cooling	Hot	Hot
E11	RHR - low pressure RPV makeup	Hot	Hot

ID	System Name	Divisional Shutdown from the Control Room	Dedicated Shutdown from Outside the Control Room
E11	RHR - shutdown cooling	Cold	Cold
E11-51	RHR Service Water (RHRSW)	Hot/Cold	Hot/Cold
E11-56	RHRSW Cooling Towers	Hot/Cold	Hot/Cold
E21	Core Spray	Hot	NA
E41	High Pressure Coolant Injection (HPCI)-Div 2	Hot	NA
E51	Reactor Core Isolation Cooling (RCIC)- Div 1	Hot	NA
N21/R11/ R32	Standby Feedwater (SBFW), CTG 11-1 and associated BOP ac & dc	NA	Hot/Cold
P44	Emergency Equipment Cooling Water (EECW)	Hot/Cold	Hot/Cold
P45	Emergency Equipment Service Water (EESW)	Hot/Cold	Hot/Cold
P50-02	Control Air for Control Center HVAC air path (dampers)	Hot/Cold	NA
R30/R14/ R16	ESF ac distribution for shutdown equipment	Hot/Cold	Hot/Cold
R30-01	Emergency Diesel Generators (EDGs) & auxiliaries	Hot/Cold	NA
R32	ESF dc system	Hot/Cold	Hot/Cold
T41	Control Center HVAC	Hot/Cold	NA
T41	ESF fan coil units	Hot/Cold	Hot/Cold
T47	Drywell Cooler Fans	NA	Hot/Cold
T49	Drywell Pneumatics	Hot/Cold	NA
X41-03	EDG & EDG Switchgear Room HVAC	Hot/Cold	NA

Systems, components and cables that are vulnerable to causing adverse consequences from hot shorts caused by cable damage have been associated with specific scenarios of concern such as loss of RPV inventory, loss of suppression pool inventory, SRV actuation, etc. Such cables and components that are not associated with the safe shutdown systems listed above are analyzed separately in the safe shutdown analysis as described in Section 9A.3.3.

9A.3.3 Method of Safe-Shutdown Analysis

To maintain a safe-shutdown capability, Fermi 2 was designed and built with the concept of keeping Division I cables and equipment separate from those of Division II. The dividing line is column line 12 for the reactor building. Division I cables and equipment are normally routed and located on the north side while those of Division II are normally on the south side of the line. The auxiliary building was designed differently. Therefore, analyses were performed and protection provided as required. In some instances where Division I and II cables cross over into the opposite division's side of the building and the cables/equipment are within 20 ft of their redundant cables, they are provided with a 1-hr-fire-rated protective envelope, to achieve or maintain 20 ft of separation with no intervening combustibles, or an analysis is performed to show that a loss of the interacting redundant divisional circuit(s) will not affect plant safe-shutdown capability.

An important requirement relevant to the fire hazards analysis is that regarding separation of cables and cable trays. Since most of the safety-related cables are also required for plant shutdown, separation of redundant safety-related cables in cable trays has been evaluated within each fire zone.

Each plant area is systematically evaluated for the ability to achieve and maintain safe shutdown, assuming that all of the equipment and cables within it are subject to fire damage. One of three shutdown strategies, Division 1 shutdown from the control room, Division 2 shutdown from the control room, or dedicated shutdown from outside the control room, is assigned to each. The dedicated shutdown strategy in accordance with the technical requirements of Appendix R Section III.G.3 and III.L is used only when divisional shutdown from the control room is not feasible. In general, these strategies were developed as part of the original plant licensing basis, and provide the framework for the NRC-approved deviations documented in docketed NRC correspondence, the plant SER, and its supplements. The inventory of safe shutdown equipment and cables, including associated circuit cables and equipment, is established, and conflicts between the shutdown strategy and the affected equipment are identified. The resolution of each of these shutdown conflicts is documented in a controlled engineering analysis. Examples of acceptable resolutions include protecting shutdown division cables with fire barriers, evaluating the electrical schematics to show that the electrical fault of concern is not applicable for the fire location being evaluated, use of NRC-approved deviations, or removal of certain fuses during power operation.

For spurious operation due to hot shorts, cables and equipment that can adversely affect safe shutdown systems (e.g., flow diversion paths from cooling systems) are evaluated, as are those that can adversely affect the safe shutdown functions or performance requirements independent of the safe shutdown systems (e.g., loss of RPV isolation or spurious SRV opening). In addition to evaluating single hot shorts between two conductors, the analysis includes any number of conductor-to-conductor shorts with a single cable and cable-to-cable

shorts for any two cables within the area, in accordance with the NRC Regulatory Issue Summary RIS 2004-03 (Reference 1). For the RHR shutdown cooling letdown path high-low pressure interface, the division 2 outboard containment isolation valve is closed and de-energized.

9A.3 PLANT SAFE SHUTDOWN

REFERENCES

1. NRC Regulatory Issue Summary 2004-03, Risk-Informed Approach for Post-Fire Safe Shutdown Associated Circuit Inspections, dated March 2, 2004

9A.4 FIRE HAZARDS ANALYSIS

9A.4.1 Reactor Building

9A.4.1.1 General Description

The reactor building is a multilevel structure, separated from all other buildings by 3-hr-rated fire barriers. For purposes of this fire hazards analysis, the reactor building has been designated as fire area RB. It is bounded on the north, south, and west by outside walls and on the east by the auxiliary building.

The outage building is located four (4) inches south of the south wall of the reactor and auxiliary building. The outage building is of completely noncombustible construction; additionally no safe shutdown systems or equipment are located in this building. The outage building is structurally separated from plant structures, however, nonstructural flashing is attached to both the reactor and auxiliary building to seal and protect the four-inch gap between it and the outage building.

The north, south, and west exterior walls (below the metal siding on elevation 684′–6″) are constructed of at least 18 inches of reinforced concrete which will prevent an exposure fire in the yard area from propagating into the Reactor Building. Except as detailed below, these three walls are 3-hr-rated fire barriers.

The walls of the personnel airlock (on the south side of the reactor building) are constructed of 12 inches of reinforced concrete. The airlock itself, is separated from the yard area by two 1½-hr rated fire doors (R1-6 and R1-7) which together provide a level of protection at least equivalent to a 3-hr-rated fire door. In addition, as demonstrated above, the airlock walls are 3-hr-rated barriers.

The railroad bay pressure resistant door (also on the south side of the reactor building) is not a rated fire door; however, it is constructed of heavy steel channels covered with metal sheeting on both sides. This door is of much more substantial construction than the typical 3-hr-rated fire doors because of its pressure resistance rating. In addition, heat detectors and an automatic sprinkler system are provided in the railroad bay to further ensure that a fire originating outside the plant will not propagate into the reactor building via the railroad bay. These features and combustible loading in the vicinity of both the inside and outside door have been evaluated and found to provide adequate assurance that a fire will not propagate from outside the building or inside the railroad bay airlock into the southwest corner first floor of the reactor building.

The south and west walls of the reactor building contain six (6) removable plug sleeves which are 1-hr-rated penetration seals. These sleeves are either sealed with solid steel plates or contain steel plates with capped pipes and conduits passing through the penetrations from the interior of the reactor building. The sleeve openings on the exterior of the reactor building are closed with steel blind flanges. In addition, the space between these plates is totally devoid of combustible materials. Therefore, although they are not tested and approved seal configurations they are of substantial steel construction and will prevent flame propagation into the reactor building.

The fifth floor of the reactor building (elevation 684'-6") is not being provided with fire rated exterior walls because its three exterior walls are constructed of insulated metal siding which is not a tested and rated construction. However, the siding will protect the fifth floor from the heat and smoke which would be generated from a fire in the yard. The base of the metal-sided walls is 100 feet above the yard grade level - well above any postulated exposure fire in the yard areas adjacent to the reactor building. Therefore, the as-built construction of these walls is sufficient to protect the fifth floor of the reactor building from a fire in the yard area.

The reactor building houses the reactor, reactor drywell and suppression pool, fuel handling equipment and storage pool, and other reactor auxiliary equipment.

With the exception of the drywell, ventilation of the reactor building is provided by the reactor/auxiliary building ventilation system. The drywell cooling system is provided for the drywell. These ventilation systems are discussed briefly in the individual zone descriptions. Additional details for these ventilation systems are presented in Subsections 9.4.2 and 9.4.5.

For purposes of this fire hazards analysis, the reactor building has been divided into 10 Fire Zones as follows:

a. Torus room, Fire Zone 01RB, Elevation 540 ft 0 in.

b. Northeast, northwest, southeast, and southwest basement corner rooms, Fire Zone 02RB, Elevations 540 ft 0 in. and 562 ft 0 in.

c. High pressure coolant injection (HPCI) pump and turbine and control rod drive (CRD) pump rooms, Fire Zone 03RB, Elevations 540 ft 0 in. and 562 ft 0 in.

d. Corridor area, Fire Zone 04RB, Elevations 562 ft 0 in and 564 ft 0 in.

e. First Floor, Fire Zone 05RB, Elevation 583 ft 6 in.

f. Second Floor, Fire Zone 06RB, Elevation 613 ft 6 in.

g. Third Floor, Fire Zone 07RB, Elevation 641 ft 6 in.

h. Fourth Floor, Fire Zone 08RB, Elevation 659 ft 6 in.

i. Fifth Floor, Fire Zone 09RB, Elevation 684 ft 6 in. (including the Auxiliary Building stairwell enclosure and duct space)

j. Drywell, Fire Zone 10RB, Elevation 562 ft 0 in. to 684 ft 6 in.

As discussed in Subsection 9A.3.3, the reactor building Division I cables and equipment are normally routed and located on the north side of the building (north of column line 12) and Division II cables and equipment are normally routed and located on the south side of the building (south of column line 12).

Division I is used to achieve plant safe shutdown when a fire occurs south of column line 12. Division II is used to achieve plant safe shutdown when a fire occurs north of column line 12.

9A.4.1.2 Torus Room, Fire Zone 01RB, El. 540 Ft 0 In.

9A.4.1.2.1 Description

The torus room, shown in Figures 9A-2 and 9A-3, is an octagonally shaped room which extends from the reactor building mat at Elevation 540 ft 0 in. up to Elevation 583 ft 6 in. It is bounded on the north by an outside wall; on the northeast by Fire Zone 02RB; on the east by a below-grade wall up to Elevation 551 ft 0 in. and Fire Zone 04RB thereafter; on the southeast by Fire Zone 02RB; on the south by an outside wall; on the southwest by Fire Zone 02RB; on the west by an outside wall; on the northwest by Fire Zone 02RB; and in the center by the drywell (Fire Zone 10RB), which it surrounds.

This zone houses the suppression pool (torus) and piping and cabling.

The walls (36 in.) and floor of this zone are constructed of reinforced concrete. The ceiling is constructed of 24-in.- reinforced concrete over steel beams. All penetrations through that portion of the ceiling separating this zone from the steam tunnel portion of the turbine building fire area are sealed with non-tested fire seals in the fire rated separation barrier. These seals have been evaluated and provide an adequate assurance that a fire in the Reactor Building Fire Zone 01RB will not propagate through these penetrations into the steam tunnel, or from the steam tunnel to the reactor building. Electrical penetrations through the remainder of the ceiling have fire stops. Division I cables, located in the south portion of the room, are enclosed with a 1-hr-rated fire barrier, as are Division II cables, in the north portion of the room. The doors to the corner rooms are 8-in.-thick steel watertight doors and will stop the propagation of any fire foreseen in the torus room.

Ventilation for this zone is provided by air from the four basement corner rooms (Fire Zone 02RB) abutting the northeast, southeast, southwest, and northwest walls of this zone. Air is drawn through 20 in. x 20 in. wall openings into the torus room and is directly exhausted through ductwork to the main exhaust system.

Divisions I and II redundant cables enter the torus room on the east side and traverse the room toward the west and above the center line of the torus. Division I cables are to the north and Division II cables are to the south.

Balance-of-plant (BOP) cable trays enter and traverse parallel to Divisions I and II cable trays around the torus. On the west side, the BOP trays continue around the torus, encircling the drywell above the torus and linking Divisions I and II with intervening combustibles.

Shutdown equipment located within this zone consists of the following:

a. Suppression pool (torus)

b. Divisions I and II cables

c. Divisions I and II, residual heat removal (RHR), core spray, HPCI, suppression pool instrumentation and reactor core isolation cooling (RCIC) valves, racks or equipment.

Fire detection in the torus area consists of eight ionization smoke detectors that are located adjacent to the exhaust duct grills. These detectors do not conform to the spacing requirements of NFPA 72E (beam pocket criteria). See Subsection 9A.4.1.2.4. The torus

area has an automatic sprinkler system that protects the entire area. This system will protect any exposed structural steel from thermal degradation during any fire condition. The water flow alarm for the sprinkler system transmits signals to the main control room upon actuation. Fire extinguishers and manual water hose stations are located in adjacent Fire Zones.

9A.4.1.2.2 Analysis

Shutdown is achieved from the main control room. Division I is used to achieve plant safe shutdown when a fire occurs south of column line 12. Division II is used to achieve plant safe shutdown when a fire occurs north of column line 12.

There are no protective envelopes required for cables/equipment in this zone.

Redundant valves that are not backed up by functionally redundant equipment in another Fire Zone are spatially separated by more than 20 ft. The other valves, required for shutdown and located within this zone, are backed up by functionally redundant equipment in other Fire Zones.

Cable trays, which present intervening combustibles between redundant cables, have a fire break installed in them or are solid-metal trays with covers to prevent the propagation of fire within them.

Three 12-in. BOP cable trays interconnecting Divisions I and II on the west side are considered intervening combustibles. The trays are OP-016, OC-790 and OK-097. Two, OP-016 and OC-790, have fire breaks installed at about column line 12±3 ft. Cable tray OK-097 is an instrumentation cable tray and is an enclosed solid-metal tray with cover.

The automatic sprinkler system will protect the exposed steel from being adversely affected by a fire in this zone.

Inadvertent operation of the automatic fire suppression equipment will have no adverse effect on shutdown capability. Combustibles within this zone consist primarily of electrical insulation. Total fire loading for this zone is low.

9A.4.1.2.3 Conclusion

The objective for this zone is to prevent a fire from damaging redundant shutdown valves and cable and from spreading to other zones. This objective is achieved through barriers, the provision of fire detection equipment, an automatic sprinkler system, fire breaks in cable trays, and separation of redundant equipment. In addition, fire extinguishers and manual water hose stations are provided in adjacent zones.

9A.4.1.2.4 Deviations

Deviations have been approved for the following:

a. Intervening combustibles, cable trays OP-016, OC-790, and OK-097 based on area-wide sprinklers and fire stops in cable trays OP-016 and OC-790 at about column line 12 and solid-metal tray and cover for OK-097 (Reference 1, SSER No. 5 VI [1])

b. Early-warning fire detectors are not installed in accordance with NFPA 72E based on area with automatic sprinklers, alarms to the main control room, and response by the fire brigade (Reference 1, Reference 2, SSER No. 5, II.D).

9A.4.1.3 Basement Corner Rooms, Fire Zone 02RB, El. 540 Ft 0 In. and 562 Ft 0 In.

9A.4.1.3.1 Description

The basement corner rooms, shown in Figures 9A-2 and 9A-3, consist of four unconnected, triangular-shaped rooms, one of which is located in each corner of the reactor building. Each room is composed of two floors, one at Elevation 540 ft 0 in., the other at Elevation 562 ft 0 in. An open stairwell in each room connects each floor.

The zone houses the RHR pumps (Division I pumps in the northwest corner room, Division II pumps in the southwest corner room), the RCIC pump and turbine, and Division I core spray pumps (northeast corner room), and the Division II core spray pumps (southeast corner room).

Walls surrounding each room of the zone are constructed of 36-in. reinforced concrete. The doors to the torus room are 8-in.-thick steel watertight doors that will stop the propagation of fire.

The floor of the lower elevation is a reinforced-concrete mat. The floor at Elevation 562 ft 0 in. is constructed of reinforced concrete and contains unsealed penetrations and unprotected openings for stairwells and hatches. The ceilings at both elevations are 24-in. reinforced concrete and contain unsealed penetrations and other unprotected openings. Electrical penetrations through the floor and ceiling are provided with fire stops.

Ventilation air enters each room through stairwells from Elevation 583 ft 6 in. (Fire Zone 05RB). Ventilation air leaves each room through wall openings in the walls abutting the torus room (Fire Zone 01RB) on Elevation 540 ft 0 in. Each corner room has a local air-handling unit (emergency equipment room cooler) for cooling the room ambient air.

Shutdown equipment located in this zone consists of the following:

a. RHR pumps and associated valves (Divisions I and II)

b. RHR instrument racks (Divisions I and II)

c. Emergency equipment room coolers (Divisions I and II)

d. RCIC pump and turbine and associated valves (Division I)

e. Instrument racks (Division I and II)

f. Core spray pumps and associated valves (Divisions I and II)

g. Core spray instrument racks (Divisions I and II).

h. 120 V ac distribution panel (Divisions I and II)

Fire detection equipment in this zone consists of an ionization detection system in each room at each elevation. Fire suppression equipment in this zone consists of an automatic sprinkler

system in the northeast room on Elevation 540 ft 0 in. and manual hose and portable fire extinguishers as shown in Figures 9A-2 and 9A-3.

9A.4.1.3.2 Analysis

Shutdown is achieved from the main control room. There is no functionally redundant equipment located in any one room within this zone. Divisions I and II RHR pumps, instrument racks, and associated valves and room coolers are located in separate rooms. Division I RHR equipment is located on Elevation 540 ft 0 in. of the room located in the northwest corner of the building. Division II pumps are located on Elevation 540 ft 0 in. of the room located in the southwest corner of the building. Division II core spray equipment is located on Elevation 540 ft 0 in. of the room located in the southeast corner of the building. Division I core spray equipment is located on Elevation 540 ft 0 in. of the room located in the northeast corner of the building. Functional redundancy for the RCIC pump located in this zone is provided by the HPCI pump located in Zone 3 of this fire area.

Division I will be used to achieve safe shutdown for fires in the southeast and southwest corner rooms and Division II will be used to achieve safe shutdown for fires in the northeast and northwest corner rooms of the zone.

Inadvertent operation of the automatic sprinkler system in the room containing the RCIC pump and turbine will have no adverse effect on shutdown capability.

The oil contained in the RCIC turbine represents a specific fire hazard in this zone due to high operating temperatures of the turbine and related piping.

Combustibles within this zone consist primarily of the following:

a. Electrical insulation

b. Lubricating oil

Total zone fire loading is low, and the fire loading in any one room is low.

9A.4.1.3.3 Conclusion

The objective for this zone is to prevent the spread of a fire in this zone to another zone containing redundant shutdown equipment and/or from damaging redundant shutdown equipment within this zone. Redundant shutdown equipment located within this zone is located in separate rooms, each located in a corner of the building. The ventilation openings to the torus room do not represent a significant potential path for fire spread due to the low fire loading within the rooms. The objective is achieved through barriers, the adequate spatial separation of redundant equipment, and the provision of early-warning detection equipment in each room, and an automatic sprinkler system on the specific fire hazard (RCIC turbine). In addition, manual water hose stations and portable fire extinguishers are provided.

9A.4.1.3.4 Deviations

Deviations have been approved for the following:

a. Installation of partial suppression in the northeast corner room, Elevations 540 ft 0 in. and 562 ft 0 in., based on cables required to achieve a safe shutdown being provided with a 1-hr fire barrier in this zone, fire detection, and low combustible loading (Reference 1, SSER No. 5, VI [13])

b. Lack of suppression in the southeast corner room, Elevations 540 ft 0 in. and 562 ft 0 in., based on low combustible loading and 1-hr fire barriers for cables required to achieve safe shutdown (Reference 1, SSER No. 5, VI [14]).

9A.4.1.4 High Pressure Coolant Injection Pump and Turbine and Control Rod Drive Pump Room, Fire Zone 03RB, El. 540 Ft 0 In. and 562 Ft 0 In.

9A.4.1.4.1 Description

This zone, shown in Figures 9A-2 and 9A-3, consists of two rooms, the HPCI pump and turbine room at Elevation 540 ft 0 in. and the CRD pump room at Elevation 562 ft 0 in. This zone is bounded on the north by a below-grade wall up to Elevation 551 ft and Fire Zone 04RB thereafter; on the east and south by a below-grade wall up to Elevation 551 ft and the auxiliary building above Elevation 551 ft; and on the west by the room containing the Division II core spray pumps (Fire Zone 02RB).

The zone houses the HPCI turbine, pump, and related valves and controls, and an emergency equipment room cooler on Elevation 540 ft 0 in., and the CRD pumps on Elevation 562 ft 0 in.

The walls and ceiling separating this zone from the auxiliary building are constructed of reinforced concrete having a fire-resistance rating of 3 hr. The door to the Division II CS pump room is watertight. The door separating this zone from the auxiliary building is a Class A fire door. Penetrations through the rated walls and the fire-rated portion of the ceiling of the 562 ft 0 in. elevation are sealed to provide a 3-hr fire-resistance rating. The floor at Elevation 540 ft 0 in. is a reinforced-concrete mat. The floor at Elevation 562 ft 0 in. is constructed of reinforced concrete with an unprotected equipment hatch. Electrical cable tray penetrations through the floor between the two elevations are provided with fire stops. Floor drains are provided on both floors.

Ventilation for this zone is provided by the reactor/auxiliary building ventilation system. Air is ducted directly to the CRD pump room and exhausted through ducts from the HPCI pump and turbine room directly to the auxiliary building main exhaust system. The HPCI pump and turbine room has an emergency equipment room cooler for cooling the room ambient air.

Shutdown equipment located in this zone consists of the following:

a. HPCI turbine, pump, and associated valves and instrument rack (Division II)

b. Emergency equipment room cooler (Division II).

No protective envelopes are required for safe-shutdown components in this zone. Fire detection equipment in this zone consists of an ionization detection system at each elevation.

Fire suppression equipment for this zone consists of a partial area automatic sprinkler system for the HPCI turbine and pump room. The hatch and stairwell opening between the two elevations of fire zone 03RB are not protected by automatic sprinklers. Manual hose stations and portable fire extinguishers are provided as shown in Figures 9A-2 and 9A-3.

9A.4.1.4.2 Analysis

Shutdown is achieved from the main control room. All of the equipment and cables in fire zone 03RB are assumed damaged due to a fire. Division I equipment outside this fire zone will be used to achieve safe shutdown for fires in this zone. The RCIC turbine and pump, and the core spray and RHR pumps located in other zones, are functionally redundant to the HPCI turbine, pump, and associated equipment in this zone. A partial area suppression system is provided in the area between the divisions in 04RB.

The lubricating oil in the HPCI turbine represents a specific fire hazard in this zone. This equipment is surrounded by curbing of sufficient height to contain any oil spills. A partial area sprinkler system has been provided for the HPCI turbine and pump room. The sprinkler system is not required for compliance with Appendix R when determining if safe shutdown can be achieved in the event of a fire in 03RB.

Inadvertent operation of the automatic sprinkler system will have no adverse effect on shutdown capability.

Combustibles within this zone consist primarily of the following:

a. Electrical insulation

b. Lubricating oil

Total zone fire loading is low.

9A.4.1.4.3 Conclusion

The objective for this zone is to prevent a fire in this zone from damaging functionally redundant equipment such as RCIC equipment and/or Division I cable located in an adjacent zone. This objective is achieved through the adequate spatial separation of redundant equipment and provision of early-warning detection equipment for the entire zone, a partial area suppression system provided in the area between the divisions in 04RB, and an approved deviation for the intervening combustibles crossing between the divisions in 04RB. In addition, manual hose stations and portable fire extinguishers are provided.

9A.4.1.5 Corridor Area, Fire Zone 04RB, El. 562 Ft 0 In. and 564 Ft 0 In.

9A.4.1.5.1 Description

This zone, shown in Figure 9A-3, consists of a north-south corridor at the Elevation 562 ft 0 in. and an east-west corridor leading to the turbine building at the Elevation 564 ft 0 in. The zone is bounded on the north by the auxiliary building; on the east by the auxiliary and turbine buildings; on the south by the auxiliary building and CRD pump room (Fire Zone 03RB); and on the west by the torus room (Fire Zone 01RB).

The zone houses electrical cables. Divisions I and II cables are all located in the north-south corridor.

The walls, floors, and ceiling separating this zone from the auxiliary and turbine buildings are constructed of reinforced concrete having a fire-resistance rating of 3 hr. The door to the turbine building is a Class A fire door. Penetrations through the rated walls, floors, and ceiling are sealed to provide a 3-hr fire-resistance rating. At the north end of the north-south corridor is a metal pressure-relieving hatch in the ceiling. The hatch is designed for steam venting of a pipe break outside the containment. Because of the light fire loading on each side of the hatch, the partial automatic sprinkler system in this zone, and the availability of manual suppression equipment, the metal hatch provides the necessary fire resistance for the zone.

Ventilation air for this zone is from the reactor/auxiliary building ventilation system. Air is duct exhausted from the zone.

Shutdown equipment located in this zone consists of Divisions I and II cables and a RCIC valve.

No protective envelopes are required for safe-shutdown components in this zone.

Fire detection equipment consists of a photoelectric and ionization detection system. Fire suppression equipment consists of an automatic sprinkler system in the 562-ft corridor, portable fire extinguishers, and manual hose.

9A.4.1.5.2 Analysis

By plant design, the reactor building Division I cables and equipment are normally routed and located on the north side of the building (north of column line 12) and Division II cables and equipment are normally routed and located on the south side of the building (south of column line 12). The RCIC valve is located on the south side of this zone.

Shutdown is achieved from the main control room. Division I will be used to achieve plant safe shutdown for fires on the south side and Division II will be used to achieve plant safe shutdown for fires on the north side of the zone.

Automatic sprinklers are installed in the north-south corridor, (562 ft) in the area of the cable trays (combustible loading for the room is concentrated in this area). There is no automatic sprinkler system in the east-west corridor (combustible loading is insignificant in this area). There are no shutdown cables in the area where automatic sprinkler protection has not been provided.

Cable trays, which present intervening combustibles between redundant cables, have fire breaks installed in them or are solid-metal trays with covers to prevent the propagation of fire. The intervening combustibles in this zone consist of two 12-in. non-Appendix R (non-R) trays (OP-020 and OC-785). Additionally, a 12-in. non-R instrument tray (OK-034) is located approximately 10 ft south of the two 12-in. non-R trays. Since the instrument tray is an enclosed solid-metal tray with cover, it is not considered an intervening combustible. An approximate 10-ft clear space exists between Division II R tray 2K-007 and of the 2 non-R trays. Also, tray 2K-007 is an enclosed solid-metal tray with cover.

All trays run horizontally, which causes a slow-burning fire with smaller heat releases.

These non-R trays represent the only in-situ intervening combustible path between Divisions I and II cables. For a single fire to affect both Divisions I and II cables, a cable tray fire must burn more than 20 ft and must traverse a clear space of approximately 10 ft.

Trays (2) OP-020 and OC-785 have a fire break installed at approximately column line 12 ±5 ft north.

Additional sprinkler heads have been installed below the pipe obstructions to improve sprinkler coverage of the area.

Combustibles located in this zone consist primarily of electrical insulation. The total zone fire loading is low.

9A.4.1.5.3 Conclusion

The objective for this zone is to prevent a fire from affecting both Divisions I and II cables located within this Fire Zone and to prevent a fire from crossing the boundaries of the zone. This is achieved through the provision of an automatic sprinkler system, barriers, fire detection system, portable fire extinguishers, and manual hose.

9A.4.1.5.4 Deviations

Deviations have been approved for the following:

a. Intervening combustibles between redundant trains based on fire stops in trays OP-020 and OC-785 (Reference 1, SSER No. 5, VI[2])

b. Partial automatic sprinklers based on the provisions of additional automatic sprinkler coverage (Reference 1, SSER No. 5, VI[2]).

9A.4.1.6 First Floor, Fire Zone 05RB, El. 583 Ft 6 In.

9A.4.1.6.1 Description

This zone, shown in Figure 9A-4, consists of the large open floor area surrounding the drywell (Fire Zone 10RB), the RHR heat exchanger rooms, railroad bay, drywell access air-lock area, and a partial height equipment room adjacent to and west of the drywell. It is bounded on the north, south, and west by outside walls; and on the east by the auxiliary building and the steam tunnel.

This zone houses the CRD hydraulic controls, RHR heat exchangers, railroad bay, neutron monitoring system (NMS) cabinets, and other auxiliary equipment. The RHR heat exchanger rooms extend up to Elevation 641 ft 6 in.

The walls and ceiling separating this zone from the auxiliary building and the steam tunnel are constructed of reinforced concrete having a 3-hr fire-resistance rating. The door opening between this zone and the steam tunnel is protected by a heavy pressure-resistant metal door. The pressure-resistant door, in combination with the labyrinth access passage, will prevent the spread of a fire from the steam tunnel area to this zone. Penetrations through rated walls and ceiling are sealed to provide 3-hr fire-resistance ratings except for the pressure equalizing line between the steam tunnel and this Fire Zone. The ability of the fire barrier to

perform its function has been evaluated and determined to provide an adequate assurance that a fire in this Fire Zone will not propagate to the steam tunnel. The partial height equipment room is accessible from the south portion of the zone, and is separated from the remainder of the zone by a shield wall and ceiling. The portion of the room boundary north of column 12 has been evaluated to provide adequate separation from the north portion of the Fire Zone. The floor and unrated portion of ceiling of this zone are constructed of reinforced concrete and steel beams, and contain open stairwells, unprotected hatches, pipe chases, and unsealed penetrations. Cable tray penetrations through the floor and unrated portion of ceiling, and unrated walls are provided with fire stops.

Ventilation air for this zone is ducted directly from the reactor/auxiliary building ventilation system and is relieved to the neutron monitoring equipment room and to an area outside the personnel air lock. Air also enters the zone through the stairwells from the floor above and from the RHR heat exchanger rooms through pressure relief dampers.

Shutdown equipment located in this zone consists of the following:

a. RHR heat exchangers (Divisions I and II) and associated valves

b. CRD hydraulic control units (HCUs)

c. Instrument racks and motor control centers (Division I and II)

d. The following valves:

   1. RHR to recirculation inboard isolation valve, E1150F015A (Division I) and B (Division II)

   2. Reactor recirculation extraction to outboard isolation valve, E1150F008

   3. EECW system isolation valves, P4400F601A, P4400F603A (Division I) and P4400F601B, P4400F603B (Division II).

e. 120 V ac distribution panel

f. Standby feedwater and CTG 11-1 supervisory cables

Fire detection equipment in this zone consists of an ionization detection system. Fire suppression equipment consists of an automatic sprinkler system in the railroad bay and manual water hose stations and portable fire extinguishers as shown in Figure 9A-4.

NFPA 13 noncompliances with this sprinkler system include sprinkler protection areas exceeding the limit for ordinary hazard occupancy and sidewall sprinklers around the open equipment hoistway not installed in a staggered arrangement (in addition to those discussed and evaluated in 9.5.1.2.3.3). These noncompliances would not adversely affect the required function of this system because the large safety margin in the water supply hydraulic design calculations would adequately compensate for these and provide the required sprinkler performance. In addition, the exceptionally deep beams would result in partially obstructed discharge patterns for some sprinklers, but the sprinkler system would still prevent any fire or fire effects from traveling any significant distance north or south from the point of origin.

9A.4.1.6.2 Analysis

By plant design, the reactor building Division I cables and equipment are normally routed and located on the north side of the building (north of column line 12) and Division II cables and equipment are normally routed and located on the south side of the building (south of column line 12).

No protective envelope is required for safe shutdown component in this Fire Zone.

Shutdown is achieved from the main control room. Division I will be used to achieve plant safe shutdown for fires on the south side and Division II will be used to achieve plant safe shutdown for fires on the north side of the zone.

Because of a potential high/low-pressure interface (associated circuits), E1150F008 shutdown cooling valve is required to be electrically disabled. The two sets of CRD HCUs, both of which are required for shutdown, are located on opposite sides of the drywell structure. The RHR heat exchangers and related valves are located in separate rooms located on opposite sides of the building. The redundant EECW isolation valves and Division I and II cables located within the zone are separated either by the drywell or steam tunnel structure or are separated spatially by a minimum of 40 ft.

The steel beams installed above the railroad bay area (also known as the truck bay) are evaluated based on the worst case fire in the railroad bay area. This analysis demonstrates that a fire in the truck bay area will not damage the steel beams supporting the Division 1 EECW Heat Exchanger. As a result, fire coating the steel beams in the truck bay area is not required to ensure safe shutdown of the plant during all Appendix R scenarios.

During refueling the railroad bay could represent a possible fire hazard; however, this area is protected by an automatic sprinkler system and a continuous firewatch when a refueling vehicle containing a combustible fuel is parked in the bay.

The automatic sprinkler system is installed in the railroad bay (column A-B, 9-13).

A heat detection system is installed in the railroad bay (column lines A-B, 9-13).

There is a greater than 20 ft separation with no intervening combustibles between Divisions I and II shutdown circuits in the railroad bay within the zone between column lines A-B, 11-13. The drywell and steam tunnel walls provide fire barriers at least equivalent to 3-hr-rated barriers.

Combustibles located within this zone consist primarily of electrical insulation.

The total zone fire loading is low.

9A.4.1.6.3 Conclusion

The objective for this zone is to prevent a fire from affecting both sets of redundant equipment located within this zone, and from spreading to other zones. This objective is achieved through barriers, spatial separation, the location of redundant equipment in separate rooms, the provision of early-warning detection equipment throughout the zone and a partial automatic sprinkler system over the railroad bay, a continuous firewatch when a refueling vehicle containing a combustible fuel is parked in the bay, and low fire loading.

Due to the low fire loading in the areas of both CRD HCUs and the presence of the early-warning detection equipment, it is considered unlikely that the function of the CRD HCUs (i.e., to scram the reactor) would be affected by a fire.

In addition, manual hose and portable fire extinguishers are provided.

9A.4.1.6.4 Deviations

Deviations have been approved for the following:

a. Partial suppression system based on 20-ft combustible free zone on west side of the reactor building at column line 12, high ceilings, and low combustibles (Reference 1, SSER No. 5, VI[3])

b. Lack of 3-hr fire-rated barriers separating redundant equipment based on 20-ft combustible free zone on the west side of the reactor building at column line 12, high ceilings, and low combustibles (Reference 1, SSER No. 5, VI[3]).

c. Non rated doors R1-8 and R1-11 on the first floor reactor building are special-purpose doors constructed of heavy weight, reinforced steel plates and are either blast-resistant (R1-11) or water-tight (R1-8) in addition to providing fire protection. (Reference 1, Reference 3, SSER No. 6, III.B)

9A.4.1.7 Second Floor, Fire Zone 06RB, El. 613 Ft 6 In.

9A.4.1.7.1 Description

This zone, shown in Figure 9A-6, consists of the floor area outside the drywell (Fire Zone 10RB), excluding the RHR heat exchanger rooms, at Elevation 613 ft 6 in.

It is bounded on the north, south, and west by outside walls and on the east by the auxiliary building and the steam tunnel. The west wall of the RHR Heat Exchanger Room on the Reactor Building 2nd Floor provides a three-hour fire barrier between the Division II RHR heat exchanger and the Division I EECW heat exchanger P4400B001A.

This zone houses the reactor water cleanup (RWCU) heat exchangers, phase separators, and pumps; the EECW pumps, heat exchangers, area coolers, makeup tanks and makeup pumps; instrument racks; motor control centers (MCCs); and the H_2-O_2 Division I analyzer and associated test gas cylinders.

The walls separating this zone from the auxiliary building and the steam tunnel are constructed of reinforced concrete having a fire-resistance rating of 3 hr. The door opening leading to the auxiliary building is protected by a Class A fire door. Penetrations through the rated wall are sealed to provide a 3-hr fire-resistance rating. The floor and ceiling are constructed of reinforced concrete and contain open stairwells, unprotected hatches, and unsealed penetrations. Cable tray penetrations through the floor and ceiling are provided with fire stops. Division I shutdown cables within 20 ft of Division II shutdown cables near F-11 are enclosed by a 1-hr-rated fire barrier.

Ventilation air for this zone is provided directly from the reactor/auxiliary building ventilation system supply to the general floor area. Air flows to the RWCU pump rooms,

RHR heat exchanger rooms, water sample station, water sludge discharge pump room, holding area, and RWCU heat exchanger room from the general floor area. Air to or from these areas is controlled by backdraft dampers in the walls. Air in these areas is exhausted to the reactor/auxiliary building ventilation system exhaust. The EECW pump areas have local air-handling units (pump room cooling units) to cool the area ambient air.

Shutdown equipment located in this zone consists of the following:

a. Divisions I and II cables

b. Divisions I and II reactor vessel level and pressure instrument racks

c. Divisions I and II EECW pumps, heat exchangers, pump area cooling units, makeup tanks and makeup pumps, nitrogen tanks (Division I only), EESW to EECW makeup lines, and associated valves and MCCs

d. Divisions I and II drywell monitoring instrument racks

e. Divisions I and II MCCs

f. Divisions I and II core spray and RHR valves

g. Standby feedwater and CTG 11-1 supervisory control cables

h. 120 V ac distribution panel (Division I)

i. Emergency Equipment Room Coolers (Division I and II)

j. Swing bus MCC

k. Drywell pneumatic racks (Division II)

One-hour protective envelopes are required for certain cable trays in this zone.

Fire detection equipment in this zone consists of an ionization detection system. Fire suppression equipment consists of automatic sprinklers over cable trays along the east wall between columns 10 and 12 and on the west side between column lines A and C, at column line 12 and in the area near P4400B001A between columns lines A and B and 9 and 10. In addition, manual water hose stations and portable fire extinguishers are provided as shown in Figure 9A-6.

NFPA 13 noncompliances with the west side sprinklers include some sprinkler locations exceeding the maximum allowable distance below the ceiling, lack of baffles between sprinklers that are less than 6 ft apart, and some sprinklers partially obstructed by supports. These noncompliances do not prevent these west side sprinklers from providing the required fire protection for this area.

9A.4.1.7.2 Analysis

By plant design, the reactor building Division I cables and equipment are normally routed and located on the north side of the building (north of column line 12) and Division II cables and equipment are normally routed and located on the south side of the building (south of column line 12).

Shutdown is achieved from the main control room. Division I will be used to achieve plant safe shutdown for fires on the south side and Division II will be used to achieve plant safe shutdown for fires on the north side of the zone.

No protective envelopes are required for cable routed on the north side of the zone. One-hour protective envelopes are provided for cable trays 1C-033, 1P-038, 1P-040, and 1P-051 when routed on the south side of the zone.

Divisions I and II EECW equipment located within this zone is separated spatially by a minimum distance of approximately 50 ft. In addition, the drywell structure functions as a radiant-energy barrier between the redundant pumps.

The Division I EECW Heat Exchanger P4400B001A is located south of Column 12, above the railroad bay hatch at Column 9 between Columns A and B. The backup Division 1 EECW Heat Exchanger P4400B001C is located slightly north of column line 12 between columns A and B. Fire suppression is provided in these areas. In addition, all Division II conduit located within 20 feet of the Division I heat exchanger P4400B001A is protected with a one-hour protective envelope. The Division II RHR heat exchanger is separated from the Division I EECW heat exchanger P4400B001A by a three-hour fire barrier (RHR Heat Exchanger Room West wall between Columns 9 and 10 at Column B).

The abandoned tubing left within the three hour fire resistant penetration to the auxiliary building is evaluated to show that the seal is adequate for fires in the zone.

Reactor vessel level and pressure instrument racks are separated by the drywell structure.

Drywell monitoring instrument racks are located on opposite sides of the heat exchanger vault.

The RWCU equipment located in this zone contains significant amounts of concentrated radioactivity. This equipment is located in separate shielded cubicles with negligible fire loadings.

There are three non-safe-shutdown trays (OP-037, OC-060, and OK-066), which are routed north-south along column line B. Three cable trays (OP-047, OC-793, and OK-069) traverse the Fire Zone along the east wall near column line F. These trays represent the only intervening combustibles that could propogate a fire between Divisions I and II shutdown circuits on the east and west side respectively.

For a single fire to affect both divisions, a cable tray fire would have to burn a minimum of 35 ft.

On the east side of the reactor building, fire breaks have been installed in cable trays OP-047 and OC-793 approximately 3 ft south of column line 12.

On the west side of the reactor building, fire breaks have been installed in cable trays OP-037 and OC-060 approximately 12 ft south of column line 12.

The two instrument trays, OK-069 and OK-066, are solid-metal trays with covers.

Combustibles located within this zone consist primarily of electrical insulation.

The total zone fire loading is low.

9A.4.1.7.3 Conclusion

The objective for this zone is to prevent a fire from affecting redundant equipment, cable, and instrumentation and from spreading to other zones. This objective is achieved through barriers, early-warning detection equipment, spatial separation between redundant equipment, and low fire loading. Automatic sprinklers are provided in the area with concentrated fire loading of Divisions I and II cable trays and in the areas with the Division I EECW Heat Exchangers. In addition, manual water hose stations and portable fire extinguishers are provided.

9A.4.1.7.4 Deviations

Deviations have been approved for the following:

a. Partial suppression at column line 12 based on intervening open cable trays having fire stops and separation of Divisions I and II cables (north and south) within the zone (Reference 1, SSER No. 5, VI[4])

b. Intervening combustibles in cable trays OP-047, OC-793, OP-037, and OC-060 which are provided with fire stops (Reference 1, SSER No. 5, VI[4]).

9A.4.1.8 Third Floor, Fire Zone 07RB, El. 641 Ft 6 In.

9A.4.1.8.1 Description

This zone, shown in Figure 9A-8, consists of the floor area at Elevation 641 ft 6 in., with the exception of the drywell and fuel storage pool.

It is bounded on the north, south, and west by outside walls and on the east by the auxiliary building.

This zone houses the hydrogen recombiners, contaminated equipment storage area, CRD decontamination and repair area, the fuel storage pool heat exchangers and pumps, and the H_2-O_2 Division II analyzer and test gas cylinders.

Safe shutdown equipment located in this zone consists of the following:

a. Division I and II cables

b. Standby Feedwater cables

The wall separating this zone from the auxiliary building is constructed of reinforced concrete having a fire-resistance rating of 3 hr. Penetrations through rated walls are sealed to provide a 3-hr fire-resistance rating. The floor and ceiling are constructed of 12-in. reinforced concrete and contain open stairwells, unprotected hatches, and unsealed penetrations. Floor penetrations are sealed to provide a 3-hr fire barrier for that portion of the floor in the southeast corner which separates this zone from Zone 8 of the auxiliary building. Cable tray penetrations through the floor and ceiling are provided with fire stops.

Ventilation air for this zone is provided directly from the reactor/auxiliary building ventilation system supply to the general floor area and the area north of the fuel storage pool. Air flows to the contaminated equipment storage area, CRD decontamination and repair area,

and the fuel storage pool heat exchanger and pump room from the general floor area. Air enters these areas through backdraft dampers located in the room walls and is exhausted through ducts to the reactor/auxiliary building ventilation system exhaust. Air exhausted from the contaminated equipment storage and CRD decontamination and repair areas passes through high-efficiency particulate air (HEPA) filters.

Fire detection equipment located in this zone consists of an ionization detection system. Fire suppression equipment consists of manual water hose stations and portable fire extinguishers as shown in Figure 9A-8.

9A.4.1.8.2 Analysis

By plant design, the reactor building Division I cables and equipment are normally routed and located on the north side of the building (north of column line 12) and Division II cables and equipment are normally routed and located on the south side of the building (south of column line 12).

Shutdown is achieved from the main control room. Division I will be used to achieve plant safe shutdown for fires on the south side and Division II will be used to achieve plant safe shutdown for fires on the north side of the zone.

There are no Division I shutdown cables on the west side of the reactor building. Any large openings that communicate with second floor, Division I shutdown cables, are located approximately 50 ft away. Any fire in this area will affect only Division II equipment. Therefore, protection is not necessary.

No protective envelope is required for safe-shutdown components in this zone.

The fuel storage pool heat exchangers and pumps contain significant amounts of concentrated radioactivity. This equipment is located in a separate shielded cubicle with a negligible fire loading.

Vertical cable tray risers are solid-metal trays with covers. These are located at approximately column lines F-13 (trays OP-123, OC-071, and OP-049).

Combustibles located within this zone consist primarily of electrical insulation. The total zone fire loading is low.

9A.4.1.8.3 Conclusion

The objective for this zone is to prevent the spread of a fire in this zone to another Fire Zone. This objective is achieved through barriers, low zone fire loading, and provision of early-warning detection equipment, manual water hose stations, and portable fire extinguishers.

9A.4.1.8.4 Deviations

Lack of a 3-hr barrier separating the next floor based on metal covers on vertical cable trays near column line F-13, no intervening combustibles, and the low combustible loading of the zone (Reference 1, SSER No. 5, VI[5]) .

9A.4.1.9 Fourth Floor, Fire Zone 08RB, El. 659 Ft 6 In.

9A.4.1.9.1 Description

This zone, shown in Figure 9A-9, consists of two floor areas at Elevation 659 ft 6 in. These floor areas are separated by the drywell, the dryer/separator storage pool and the fuel storage pool.

The western portion of the zone is bounded on the north, south, and west by outside walls and on the east by the drywell, dryer/ separator storage pool, and the fuel storage pool. The eastern portion of the zone is bounded on the north and south by outside walls; on the east by the auxiliary building; and on the west by the drywell, dryer/separator storage pool, and the fuel storage pool.

The western portion of the zone houses motor-generator (M-G) sets and oil cooler, dress-out facilities, and RWCU equipment. The eastern portion of the zone houses the standby liquid control system (SLCS).

The walls separating this zone from the auxiliary building are constructed of reinforced concrete having a fire-resistance rating of 3 hr. Penetrations through rated walls are sealed to provide a 3-hr fire-resistance rating. The floor is constructed of reinforced concrete and contains open stairwells, unprotected hatches, and unsealed penetrations. Floor drains are provided and trapped at the collection sumps. The ceiling is also constructed of reinforced concrete and contains unprotected hatches and unsealed penetrations. Cable tray penetrations through the floor and ceiling are provided with fire stops.

Ventilation air is supplied directly to the area around the M-G sets and the storage areas north and east of the fuel storage pool. Air then flows from these areas to the clean area, the RWCU pump room, and the RWCU south and north demineralizer rooms. Air also flows from the clean area to the personnel change area. Supply air to the RWCU holding pump room and demineralizers is controlled by backdraft dampers. With the exception of air exhausted from the area around the M-G sets, exhaust air is ducted to the reactor/ auxiliary building ventilation system exhaust. The M-G set area is locally cooled by air ducted directly to the M-G sets from three recirculating fancoil units.

Safe shutdown equipment located in this zone consists of the following:

a. Division II cables

b. Standby Feedwater cables

c. Division II 480 V ac distribution panel

Fire detection equipment located in this zone consists of an ionization detection system and heat detectors. Fire suppression equipment consists of an automatic sprinkler system in the area of the M-G sets and oil coolers, manual hose, and portable fire extinguishers as shown in Figure 9A-9.

9A.4.1.9.2 Analysis

Reactor water cleanup equipment located in this zone contains significant amounts of concentrated radioactivity. This equipment is located in separate shielded cubicles with negligible fire loadings.

Shutdown is achieved from the main control room. Division I will be used to achieve safe shutdown for fires in the south side and Division II will be used to achieve safe shutdown for fires in the north side of the zone.

Except for Standby Feedwater flow indication cables located in the south side of the zone, there are no Division I or II Appendix R cables or equipment in the zone.

Lubricating oil in the couplings and cooling units of the two M-G sets located in this zone represents a specific fire hazard. This equipment is surrounded by curbing of sufficient height to contain any oil spills.

Combustibles located within this zone consist of the following:

a. Lubricating oil

b. Electrical insulation

c. Ordinary combustibles

The total fire loading for this zone is low.

9A.4.1.9.3 Conclusion

The objective for this zone is to prevent a fire from spreading to another zone. This objective is achieved through barriers, low fire loading in the area of the SLCS, the provision of early-warning detection systems for the entire zone, curbing and an automatic sprinkler system for the M-G sets and oil coolers, and manual hose and portable fire extinguishers.

9A.4.1.10 Fifth Floor, Fire Zone 09RB, El. 684 Ft 6 In.

9A.4.1.10.1 Description

This zone, shown in Figure 9A-10, consists of the floor area at Elevation 684 ft 6 in., including the fuel storage pool, dryer/ separator pool, and decontamination area, along with the Auxiliary Building stairwell enclosure.

The zone is bounded on the north, south, and west by outside walls and on the east by the auxiliary building.

This zone houses the fuel storage pool and associated equipment, dryer/separator pool, and the decontamination area.

The east wall abutting the auxiliary building is constructed of reinforced concrete up to Elevation 701 ft 0 in. and provides a 3-hr-rated fire barrier. Penetrations in rated walls are sealed to provide a 3-hr fire rating. The east wall above Elevation 701 ft 0 in. and the north, south, and west walls are constructed of steel frame and siding. The stairwell leading to the auxiliary building is enclosed by a 3-hr-rated fire barrier to provide separation between the auxiliary building and the reactor building. The floor is constructed of reinforced concrete and contains unprotected hatches and unsealed penetrations. Cable tray penetrations through the floor are fire stopped. The roof is constructed of steel frame and deck with insulation and builtup roofing that conforms to Factory Mutual Class I requirements.

Ventilation air is supplied directly through ducts to the floor area. Air then flows from the floor area to the dryer/separator pool, reactor well, and fuel storage pool. Air is exhausted from these areas through ducts to the reactor/auxiliary building ventilation system exhaust. The elevator machine room fan draws air from the refueling area through the machine room and discharges it back to the refueling area.

Equipment located in this Fire Zone is not required for shutdown.

Safe shutdown equipment located in this zone consists of the following:

a. Division I and II cables

Fire detection equipment located in this zone consists of an infrared detection system. Fire suppression equipment in this zone consists of manual hose with solid stream nozzles and portable fire extinguishers as shown in Figure 9A-10.

The combustible loading in the Auxiliary Building stairwell enclosure is extremely low. In addition future storage of combustibles in this area is not considered for the purpose of this analysis because the storage of combustibles in stairwells is controlled. Based on the extremely low combustible loading in this area, fire detection instrumentation is not installed since it would not be expected to alarm due to the small amounts of smoke/heat that could be produced by a fire in this area. The stairwell contains two (2) Division II cables routed in the same conduit above the 677′-6″ elevation which are required for safe shutdown.

9A.4.1.10.2 Analysis

Shutdown is achieved from the main control room. Division I will be used to achieve safe shutdown for fires on the south side because there are no Appendix R Division I cables located on the south side of this zone. On the north side of this zone, Division II will be used to achieve safe shutdown. There are no Appendix R Division II cables (nor are there Appendix R Division I cables) located on the north side of this zone. Combustibles located in this zone consist primarily of the reactor building and fuel-handling crane and gear box lubricating oil. The total zone fire loading is low.

9A.4.1.10.3 Conclusion

The objective for this Fire Zone is to prevent the spread of a fire in this zone to another Fire Zone. This objective is achieved through low zone fire loading, and the provision of an early-warning detection system and manual hose and portable fire extinguishers.

9A.4.1.11 Drywell, Fire Zone 10RB, El. 562 Ft 0 In. to 684 Ft 6 In.

9A.4.1.11.1 Description

This zone, shown in Figures 9A-3, 9A-4, 9A-6, 9A-8 through 9A-10, consists of a containment vessel in the shape of an inverted light bulb.

The zone is surrounded by reactor building Fire Zones 01RB through 09RB.

This zone houses the reactor pressure vessel (RPV), reactor recirculation pumps, and associated equipment.

The drywell consists of a steel pressure vessel surrounded by reinforced concrete for shielding. External to the drywell vessel but in the Fire Zone above elevation 572 ft. 1 in., the drywell is separated from the concrete biological shield by a gap of approximately 2 inches. The gap is filled with polyurethane foam material. The bottom portion of the shell is totally embedded in concrete, and the transition zone is backed by compacted sand. Access to the drywell is through an air lock located in Zone 4 at Elevation 583 ft 6 in.

Cooling of air within the drywell is provided by 14 fan-coil units located at various elevations within the drywell. These units recirculate and cool the drywell ambient air. Cooling water for these units is normally supplied from the reactor building closed cooling water system (RBCCWS). Under other than normal conditions, cooling water is supplied from the EECW system. Thermocouples located in various drywell areas actuate control room alarms on detection of high temperature.

Shutdown equipment located in this zone consists of the following:

a. Nuclear pressure relief system (NPRS) safety/relief valves (SRVs) B21-F013A, B, C, D, E, F, G, H, J, K, L, M, N, P, and R and instruments

b. Reactor recirculation shutdown cooling to RHR inboard isolation valves E11-F009 and E11-F608

c. Reactor recirculation discharge valves B31-F031A, B31-F031B, B3105F023A and B3105F023B.

d. Division 1 and 2 cables, located in drywell penetrations passing through the drywell gap area.

e. SRV accumulators (Division I and II)

f. Valves (Division I and II)

g. T50 instrumentation (Division I and II)

For maintenance operations, fire suppression equipment, consisting of manual hoses and portable fire extinguishers, is located at the drywell access air lock in Zone 4 at Elevation 583 ft 6 in. The drywell gap area is not provided with either fire detection or automatic suppression. Fire suppression consists of manual hoses located on the first and second floor level.

9A.4.1.11.2 Analysis

The drywell atmosphere is inerted with nitrogen. The concentration of nitrogen is maintained at 97 percent. Oxygen and hydrogen content is monitored. For a more detailed description, refer to Subsection 9.3.6. Fire damage is not assumed to occur under Appendix R Section III.G.2.

Combustibles within this zone consist primarily of the following:

a. Electrical insulation

b. Lubricating oil

c. Polyurethane foam in the drywell gap area

d. Silicone rubber impregnated fiberglass fabric covering permanently installed lead blankets

Because the polyurethane foam is located in the drywell gap outside the steel drywell vessel, the foam does not contribute to the total zone Btu content of the drywell.

Total zone fire loading is low.

If a fire occurs in the drywell gap area, hot shutdown can be maintained using HPCI; cold shutdown can be attained by manual operation of valves in the drywell to achieve shutdown cooling lineup.

9A.4.1.11.3 Conclusion

The objective of this zone is to prevent a fire from occurring. During reactor operation, this is achieved through the maintenance of a nitrogen atmosphere. During maintenance operation, fire suppression equipment is used. Although Division 1 and 2 cables are present in the drywell gap, redundant hot shutdown equipment is not affected by a fire in the gap area. Hot and cold shutdown can be achieved following the assumptions of 10 CFR 50, Appendix R.

9A.4.2 Auxiliary Building

9A.4.2.1 General Description

The auxiliary building is a multilevel structure. For purposes of this fire hazards analysis, the auxiliary building has been designated as fire area AB. It is bounded on the north and south by outside walls; on the east by the turbine building; and on the west by the reactor building.

The outage building is located four (4) inches south of the south wall of the reactor and auxiliary building. The outage building is of completely noncombustible construction; additionally no safe shutdown systems or equipment are located in this building. The outage building is structurally separated from plant structures, however, nonstructural flashing is attached to both the reactor and auxiliary building to seal and protect the four-inch gap between it and the outage building.

The north and south exterior walls are constructed of 24 inches of reinforced concrete which will prevent an exposure fire in the yard area from propagating into the auxiliary building. Except as noted below, these walls are 3-hr-rated fire barriers.

The auxiliary building south wall also contains five (5) non-rated removable plugs filled with at least twelve (12) inches of grout and are acceptable for use as penetration seals in a 3-hr-rated fire barrier based on their construction.

The auxiliary building also contains a sixth removable plug seal. This sleeve has six (6) 1-inch thick steel plates held into the penetration with a locked steel bar such that they are flush with the exterior plane surface of the fire barrier. A seventh 1-inch thick steel plate is bolted into the exterior wall of the auxiliary building. In addition, the eighteen (18) inches between these sets of plates is totally devoid of combustible materials. Therefore, although they are not tested and approved seal configurations they are of substantial steel construction and prevent flame propagation into the auxiliary building.

The metal-sided control center air conditioning intake is located on the south side of the auxiliary building. The base of the air intake is at elevation 643′-6″ while the actual opening into the auxiliary building is a 6′ x 20′ opening at elevation 681′-6″. Since this opening itself is 98′ above grade elevation (583′-6″), an exposure fire threat to the opening itself is not postulated based on the types, amounts, and locations of the combustible materials that could be in close proximity of the air intake either during normal operation or outages. Should the control room operators detect smoke coming into the control center because of a fire in the yard, or receive notification of a fire in the yard, the operators can switch from the air intake on the south side of the auxiliary building to the air intake on the north side of the building. This is done by placing the air conditioning system in the recirculation mode.

The auxiliary building houses reactor auxiliary systems and equipment.

With the exception of the control room, relay room, cable spreading room, standby gas treatment system (SGTS) room, and control center air conditioning equipment rooms, ventilation of the auxiliary building is provided by the reactor/auxiliary building ventilation system. Ventilation for the control room, relay room, cable spreading room, and control center air conditioning equipment room is provided by the control center heating, ventilation, and air conditioning (HVAC) system. These ventilation systems are discussed briefly in the individual Fire Zone descriptions. Additional details for these ventilation systems are presented in Subsections 9.4.1 and 9.4.2.

For the purpose of this fire hazards analysis, the auxiliary building has been divided into the following Fire Zones:

a. Basement, Fire Zone 01AB, Elevations 551 ft 0 in. and 562 ft 0 in.

b. Mezzanine and cable tray area, Fire Zone 02AB, Elevations 583 ft 6 in. and 603 ft 6 in.

c. Relay room, Fire Zone 03AB, Elevation 613 ft 6 in.

d. Switchgear room, Fire Zone 04AB, Elevation 613 ft 8 1/2 in.

e. Cable tunnel, Fire Zone 05AB, Elevation 613 ft 6 in.

f. Second floor, miscellaneous rooms, Fire Zone 06AB, Elevation 613 ft 6 in.

g. Cable spreading room, Fire Zone 07AB, Elevation 630 ft 6 in.

h. Cable tray area, Fire Zone 08AB, Elevation 631 ft 0 in.

i. Control room, Fire Zone 09AB, Elevations 643 ft 6 in. and 655 ft 6 in.

j. Divisions I and II battery rooms, Fire Zone 10AB, Elevation 643 ft 6 in.

k. Miscellaneous rooms, Fire Zone 11AB, Elevation 643 ft 6 in.

l. Switchgear room, Fire Zone 12AB, Elevation 643 ft 6 in.

m. Ventilation equipment area, Fire Zone 13AB, Elevation 650 ft 6 in.

n. Control center ventilation equipment rooms and standby gas treatment rooms, Fire Zone 14AB, Elevation 677 ft 6 in.

o. Ventilation equipment area, Fire Zone 15AB, Elevation 677 ft 6 in.

9A.4.2.2 Basement, Fire Zone 01AB, El. 551 Ft 0 In. and 562 Ft 0 In.

9A.4.2.2.1 Description

The basement, shown in Figure 9A-3, encompasses the entire floor area at Elevation 551 ft 0 in. and the floor area bounding CRD pump room on the east and south at Elevation 562 ft 0 in. The zone is bounded on the north and south by outside walls; on the east by the turbine building; and on the west by the reactor building.

This zone houses Divisions I and II control air equipment and cables. Walls and ceiling separating this zone from the reactor building, turbine building, and other zones of the auxiliary building are constructed of reinforced concrete having a fire-resistance rating of 3 hr. Door openings are protected by Class A fire doors. Penetrations through rated walls and ceilings are sealed to provide 3-hr fire-resistance ratings. Division I and II shutdown cables within 20 ft of the opposite Division's shutdown cables are enclosed with a 1-hr-rated fire barrier or an analysis has been performed to show that loss or misactivation of any interacting redundant divisional circuits does not affect plant safe shutdown. Fire breaks have been installed in trays which contain intervening combustibles in order to ensure that a postulated fire cannot spread through these cable trays in such a manner as to damage redundant safe shutdown components.

Ventilation supply air from the reactor/auxiliary building ventilation system is ducted to both control air equipment areas and to the cable tray space. Exhaust from these spaces is by direct duct connection to an exhaust main passing through these spaces. Both control air equipment areas have local air-handling units for cooling the room ambient air.

Shutdown equipment located in this zone consists of the following:

a. Divisions I and II control air equipment, fan coil units, and associated isolation valves

b. Divisions I and II cable.

For Fire Zone 01AB, Division II is primarily utilized for safe shutdown except for certain Division I areas. Division I is utilized for shutdown between 10-12, and in the southwest corner near G-9.

Fire detection equipment in this zone consists of an ionization detection system. Fire suppression equipment consists of an automatic sprinkler system for floor Elevations 551 ft 0 in. and 562 ft 0 in. and manual water hose stations and portable fire extinguishers as shown in Figure 9A-3.

9A.4.2.2.2 Analysis

Shutdown is achieved from the main control room. Division II cable trays required for shutdown (2C-027, 2C-030, 2C-036, 2P-019, and DC2P-019) are provided with a 1-hr protective envelope when they are within 20 ft of Division I circuits. Division II cable trays 2C-035, 2P-026, and DC2P-026 are partially protected along column line 11. These trays no longer require protection as the Division 1 circuits are protected in this area. Division 1 trays 1P-069, DC1P-069, 1P-024, and 1C-005 are protected between column lines H10 and H13.

The cable tray supports, along the west side, between column lines H12 and H13 are wrapped for their full height. The cable tray supports, along the west side, between column lines H11 and H12 are wrapped to approximately elevation 566'. The cable tray supports, along the west side, between column lines H10 and H11 do not require fire wrap. The cable tray support wrap was evaluated and determined to be required to protect the tray supports from direct flame impingement in the event of a transient combustible fire occurring beneath these trays.

Division II trays 2K-011 and 2K-020 are not protected, between column lines 11 and 12, because these trays are not required since they are in an area where Division I will be used to achieve shutdown.

In areas where Division I is not protected, Division II is used for shutdown.

Intervening combustibles exist between the two shutdown divisions. Between column lines 12 and 13, trays 0C-018, 0C-017, 0C-027, and 0C-028 are provided with fire breaks, and trays 1K-022, 2K-020 and 0K-001 are solid metal bottom trays with covers. Between column lines 10 and 11 trays 0P-005, 0C-018, 0C-017, 0C-027, 0C-028, and 0P-002 constitute intervening combustibles with fire breaks, and tray 1K-022 is a solid metal bottom tray with covers. The empty tray 0P-006 is not an intervening combustible. These fire breaks provide a minimum of 20 feet free of intervening combustibles and therefore meet the requirements for 20 foot separation with no intervening combustibles and with detection and suppression.

At the south end, mezzanine area 562 ft 0 in., of the zone (column line G-H, 9-11) intervening combustibles in the form of cable trays exist within the 20-ft separation zone between the divisions. Cable tray fire breaks have been installed in trays OP-005, OC-017, and OC-018. Cable tray 2K-015 is enclosed within the fire barrier in the vicinity of these breaks and thus is not an intervening combustible.

Specific fire hazards exist in the southeast and northeast portions of the zone where both Divisions I and II cables are concentrated.

The amount of lubricating oil in the control air equipment is not sufficient to allow propagation of a fire between Division I and II equipment through the floor drain system in the zone.

Combustibles located within this zone consist primarily of electrical insulation.

The total zone fire loading is low.

9A.4.2.2.3 Conclusion

The safe-shutdown analysis performed verified that either Division I or II will be available for plant safe shutdown in the event of a fire in this zone. The Division I or II power and control circuits are provided with a 1-hr-rated protective envelope, as listed above, or are separated from the redundant division's unprotected cables by at least 20 ft. Cable tray fire breaks are provided in various Balance of Plant cable trays to provide 20 ft. zones free of intervening combustibles.

9A.4.2.2.4 Deviations

Deviations have been approved for the following: intervening combustibles--based on fire stops in cable trays OP-005, OC-017, and OC-018 at column lines 9 and 11 (Reference 1, SSER No. 5, VI [15]).

9A.4.2.3 Mezzanine and Cable Tray Area, Fire Zone 02AB, El. 583 Ft 6 In. and 603 Ft 6 In.

9A.4.2.3.1 Description

This zone, shown in Figures 9A-4 and 9A-5, is divided into three sections and encompasses two floor elevations, with a common ceiling under Elevation 613 ft 6 in. The first floor elevation is at 583 ft 6 in. and is divided into two sections, a north section and a south section, separated by an extension of the turbine building. The southern section of the zone consists of a cable entry room, which extends partially along the outside of the south wall, and a cable tray area. The northern section of the zone consists of a cable tray area. The mezzanine area, the third section of the zone, is at Elevation 603 ft 6 in. above the turbine building extension. The zone is bounded on the south by an outside wall, except at the cable entry area, where a portion of the zone bounds the reactor building; on the east by the turbine building; on the north by an outside wall; on the west by the reactor building, steam tunnel, and an outside wall at the cable entry area; and is divided by an extension of the turbine building from the 583 ft 6 in. elevation up to the floor of the 603 ft 6 in. elevation.

This zone serves primarily as a cable routing area.

The walls, floor, and ceiling bounding this zone are constructed of reinforced concrete having a fire-resistance rating of 3-hr. Penetrations are sealed to provide 3-hr fire-resistance ratings except for 16 cable tray penetrations in the mezzanine area at the 603 ft 6 in. elevation east wall. These penetrations are open to the enclosed 4-inch gap area between the auxiliary and turbine buildings. Door openings leading to the turbine building extension and between the Divisions I and II cable entry rooms are protected by Class A fire doors. Division II shutdown cables within 20 ft of Division I shutdown cables in the north end of the area are enclosed with a 1-hr-rated fire barrier, as are Division I shutdown cables within 20 ft of Division II shutdown cables in the south end of the area. The equipment hatch in the southern section of the zone is provided with a reinforced-concrete cover.

The HVAC/pipe chase along column H between 10 and 11 extends from the floor opening at elevation 613'-6" to the ventilation equipment area on elevation 677'-6" (Fire Zone 15AB) and is completely devoid of combustibles for is entire 64-foot height. Additionally, the walls of this chase are constructed and sealed as 3-hour rated barriers. Finally, Thermo-Lag material was used to construct the floor of this chase. Given, that as detailed below, automatic sprinkler coverage is provided for the area around the base of this opening and that the combustible loading on the 677'-6" elevation open top of this chase is negligible (reference Section 9A.4.2.16.2), flame propagation via this combustible material free vertical chase is not a credible event. Therefore, the chase itself provides the required separation between auxiliary building Fire Zones 2 and 15. Additionally, the Thermo-Lag material used

to seal the chase at elevation 613'-6" is a nonfire rated smoke and gas barrier. For identification purposes, the chase is considered as being part of Fire Zone 02AB.

Ventilation for this zone is provided by the reactor/auxiliary building ventilation system. Supply air is ducted to each section of the zone. Exhaust air returns unducted from the northern section of the zone to the mezzanine area where air is exhausted through ducts to the auxiliary building main exhaust system. Exhaust air from the southern section of the zone is ducted to the auxiliary building main exhaust system.

Shutdown equipment contained in this zone consists of the following:

a. Divisions I and II cables

b. Offsite power cables affecting CTG 11-1 feed to standby feedwater

Division II cable will be used to achieve plant safe shutdown for fires in the north half of the zone. For fires in the south half of the zone, Division I will be used to achieve plant safe shutdown.

Fire breaks have been installed in cable trays within this zone.

Fire detection equipment in this zone consists of an ionization detection system. Fire suppression equipment consists of an area-wide automatic sprinkler system and selected cable tray protection, manual water hose stations, and portable fire extinguishers as shown in Figures 9A-4 and 9A-5.

NFPA 13 noncompliances with this sprinkler system include sprinkler protection areas exceeding the limit for extra hazard occupancy, spacing between branch lines exceeding the 12 ft limit, sprinklers farther from the wall than the 6 ft limit, sprinkler spray patterns partially obstructed, and discrepancies with cable tray sprinklers (in addition to those discussed and evaluated in 9.5.1.2.3.3). These noncompliances would not adversely affect the required function of this system because the extremely conservative extra hazard occupancy water application density would adequately compensate for these and provide the required sprinkler system performance.

9A.4.2.3.2 Analysis

Shutdown is achieved from the main control room. For this zone, Division I and II cables are routed and located on the north side of the building (north of column line 12) and Division I and II cables are routed and located on the south side of the building (south of column line 12). Where redundant shutdown trains are not separated by more than 20 ft, a 1-hour fire wrap is applied to one division.

The sixteen cable tray penetrations in the east auxiliary building wall Fire Rated Separation Barrier have been analyzed. Credit is taken for the sealed turbine building wall penetrations adjacent to the auxiliary building wall, the metallic cover plates over the seismic gap opening between the buildings and the lack of signifi-cant combustibles or ignition sources in the gap as sufficient barriers to prevent the propagation of fire through the unsealed openings in the auxiliary building wall Fire Rated Separation Barrier.

Cable trays 1K-014, 1K-029, 1K-034, 2C-012 and 2C-030, and conduit JA001-1K (north end) and 1C-006, 1P-045, 1P-041, and DC1P-044 (south end) have been provided with a 1-hr protective envelope.

Because of the intervening combustibles in the form of cable trays, fire breaks have been installed in cable trays OC-617, OC-618, OC-611, OC-614, OC-582, OC-585, OC-640, OC-636, OC-916, OC-570, OC-645, and OC-592, which are located on the north end, Elevation 603 ft 0 in.

Combustibles located within this zone consist primarily of electrical insulation.

The total zone fire loading is moderate.

9A.4.2.3.3 Conclusion

The safe-shutdown analysis performed verified that, for a fire in this zone, plant safe shutdown will be performed using Division II equipment for fires in the north half. For fire in the south half, Division I equipment will be used to achieve plant safe shutdown. The objective for this zone to minimize the potential for the occurrence of a fire and to minimize the spread and damage, should a fire occur, has been achieved through spatial separation of control and instrument components, rated barriers, and the provision of early-warning detection, manual water hose stations, and portable fire extinguishers.

Safe-shutdown capability is protected via the above and provisions of fire breaks and 1-hr protective envelopes as required in the zone.

9A.4.2.3.4 Deviations

Deviations have been approved for the following: intervening combustibles based on area-wide sprinklers, cable tray sprinklers, and fire stops (Reference 1, and SSER No. 5, VI[6]).

9A.4.2.4 Relay Room, Fire Zone 03AB, El. 613 Ft 6 In., 630 Ft 6 In. and 643 Ft 6 In.

9A.4.2.4.1 Description

This zone, shown in Figure 9A-6, consists of the relay room and the control center northeast stairwell located in the northern portion of the building. The zone is bounded on the north by an outside wall; on the east by the turbine building; on the south by Fire Zone 05AB, an extension of the turbine building, and the steam tunnel; and on the west by the reactor building. The relay room is a part of the control center complex.

The zone houses relay cabinets, instrument racks, and cables.

Unless noted below, the walls, floor, and ceiling surrounding this zone are constructed of reinforced concrete having a fire-resistance rating of 3 hr. Penetrations are sealed to provide a 3-hr fire-resistance rating. Door openings are protected by Class A fire doors. The stairwell is enclosed by 3-hr fire-rated walls with a Class A fire door. In the control center stairwell, a 3-hr-rated fire barrier is provided for cables of one division. The access stairway to the cable tray area on Elevation 603'-6" is protected by 3-hr fire walls and a Class A fire door. The barrier wall between the relay room itself and the northeast stairwell is a nonfire rated continuous smoke and gas barrier constructed of Thermo-Lag material. This barrier is used to provide containment as a boundary for the halon suppression system in the relay room.

An HVAC chase is located in the southwest corner of the relay room ceiling which extends up to elevation 654'-0" which is above the control room suspended ceiling (Fire Zone 09AB). There are no combustible materials in this 23-foot vertical chase. The HVAC ducts entering this chase from the relay room are provided with fire and smoke and gas dampers. The 23-foot high walls and the ceiling (at elevation 654'-0") between the existing metal HVAC ducts of this chase are constructed and sealed as 3-hour rated barriers. However, Thermo-Lag material was used in two (2) places to seal around the HVAC ducts in the floor of this chase at elevation 630'-6" as a nonfire rated smoke and gas seal to prevent the escape of discharged halon. Given, as detailed below, that automatic halon suppression is provided for the relay room and that the combustible loading in the control room ceiling is negligible, flame propagation via this combustible material-free vertical chase and out through the metal HVAC ductwork is not a credible event. At this time, it should be noted that NFPA 90 considers metal HVAC ductwork in walls as equivalent to one-hour rated fire barriers. Therefore, this chase provides the required separation between auxiliary building Fire Zones 03AB and 09AB. Additionally, the Thermo-Lag material used to seal the chase at elevation 630'-6" is a nonfire rated smoke and gas barrier. For identification purposes, the chase is considered as being part of auxiliary building Fire Zone 03AB.

Ventilation for this zone is provided by the control center HVAC system. Conditioned air is ducted directly to the relay room. Air is exhausted by ducts from the relay room.

Shutdown equipment located in this zone consists of the following:

a. Division I and II relay panels and termination cabinets

b. Division I and II cables

c. Standby feedwater and CTG 11-1 related cables

Fire detection equipment located in this zone consists of a Class A cross-zoned ionization smoke detection system and a smoke detector in the stairwell. Fire suppression equipment for this zone consists of an automatic Halon system, manual water hose stations, portable fire extinguishers, and a CO_2 hose reel station located outside the room at the south door, as shown in Figure 9A-6.

9A.4.2.4.2 Analysis

Shutdown is achieved from outside the main control room. An alternative shutdown system, independent of the control center complex, has been designed and installed to achieve plant safe shutdown for a fire in this zone.

Cable tray 1K-034 is provided with a 3-hr barrier in the northeast stairwell area.

Inadvertent operation of the automatic Halon system would have no adverse effect on safe-shutdown equipment located in this zone.

Combustibles located in this zone consist primarily of electrical insulation.

Total zone fire loading is moderate.

9A.4.2.4.3 Conclusion

For a fire in this zone, plant safe shutdown will be achieved using the alternative shutdown system.

The objective for this zone is to prevent a fire within the zone from affecting both Divisions I and II equipment and to prevent a fire from crossing the zone's barriers. This objective is achieved through spatial separation, barriers, the provision of an early-warning detection system, an automatic Halon system, manual hose, portable fire extinguishers, and a CO_2 hose reel station.

9A.4.2.4.4 Deviations

There are no deviations for this zone.

9A.4.2.5 Switchgear Room, Fire Zone 04AB, El. 613 Ft 8-1/2 In.

9A.4.2.5.1 Description

This zone, shown in Figure 9A-6, consists of one room located in the southern portion of the building. The zone is bounded on the north by Fire Zone 06AB of this fire area; on the east by the turbine building; on the south by an outside wall; and on the west by the reactor building. Within this zone, a room is constructed to enclose the Division II cables.

The zone houses Division I switchgear and the Division I remote shutdown panel.

The walls, floor, and ceiling of this zone are constructed of reinforced concrete having a fire-resistance rating of 3 hr. Penetrations are sealed to provide 3-hr fire-resistance ratings. The door opening leading to Fire Zone 06AB is protected by Class A fire doors. The stairwell is enclosed by 2-hr-rated fire walls with a Class B fire door. The room containing the Division II cables is enclosed by a 3-hr-rated fire barrier with a Class A fire door.

Ventilation for this zone is provided by the reactor/auxiliary building ventilation system. Air is ducted directly to the switchgear room and exhausted through ducts to the auxiliary building main exhaust system. In addition, the switchgear room contains two local, recirculating-type cooling units.

This zone contains the following shutdown equipment:

a. Division I switchgear
b. Division I and II cable
c. Offsite power cables affecting CTG 11-1 feed to standby feedwater
d. Switchgear room cooling units (Division I)
e. 120 V ac modular power units (Division I and BOP)
f. 130 V dc distribution panel (Division I)

Fire detection equipment located within this zone (including the Division II cable enclosure) consists of an area ionization detection system. Fire suppression equipment consists of a

manual hose and portable fire extinguishers as shown in Figure 9A-6. The manual hose station and CO_2 hose reel are located in Fire Zone 06AB.

9A.4.2.5.2 Analysis

Division II cables and equipment will be used to achieve plant safe shutdown for fires in this zone except for the enclosed room near column line G-9. In this room, Division I equipment and cables are used for safe shutdown.

The abandoned tubing left within the three hour fire resistant penetration to the reactor building is evaluated to show that the seal is adequate for fires in the zone.

Combustibles located within this zone consist primarily of electrical insulation. Total zone fire loading is moderate.

9A.4.2.5.3 Conclusion

The objective for this zone is to prevent a fire in this zone from spreading to other zones and to Division II cable. This objective is achieved through fire barriers between other zones and redundant equipment, an early-warning detection system, a manual hose, portable fire extinguishers, and a CO_2 hose reel.

9A.4.2.6 Cable Tunnel, Fire Zone 05AB, El. 613 Ft 6 In.

9A.4.2.6.1 Description

This zone, shown in Figure 9A-6, consists of one room located in the central portion of this elevation adjacent to the steam tunnel. It is bounded on the north by the relay room (Fire Zone 03AB); on the east and south by Fire Zone 06AB and on the west by the steam tunnel.

This zone serves as a cable routing area for Divisions I, Division II, and BOP cable. The Division I cables are located along the east side of the tunnel while the Division II cables are located along the west wall.

The walls, floor, and ceiling separating this zone from the relay room (Fire Zone 03AB) and the turbine building extension are constructed of reinforced concrete having a fire-resistance rating of 3 hr. Penetrations through rated walls, floor, and ceiling are sealed to provide a 3-hr fire-resistance rating. The door openings leading from the cable tunnel are protected by Class A fire doors. The tunnel is divided by a 3-hr fire-rated gypsum wall that separates Divisions I and II cables.

Ventilation for this zone is provided by the reactor/auxiliary building ventilation system. Air is ducted directly to the cable tunnel and exhausted through ducts to the auxiliary building main exhaust system. Relief air flows unducted from the cable tunnel to the corridor leading to the turbine building. Airflow entering the corridor is controlled by a backdraft damper.

Shutdown equipment located in this zone consists of the following:

a. Division I and II cables

b. Standby feedwater power supply control cables

Fire detection equipment located in this zone consists of an area ionization detection system. Fire suppression equipment located in this zone consists of a manual CO_2 system. Manual water hose stations and portable fire extinguishers are available in adjacent zones, as shown in Figure 9A-6.

9A.4.2.6.2 Analysis

Shutdown is achieved from the main control room. Only Division I and standby feedwater control cables are present in the east cable tunnel. Therefore, Division II will be available for plant safe shutdown in the event of a fire in the east tunnel. Division II circuits are present in the west tunnel. The Division I systems will be used to achieve plant safe shutdown in the event of fire in the west tunnel.

The total quantity of combustibles on both sides of the wall consists primarily of electrical insulation. The resultant fire loading for the west side of the tunnel is high. The east side fire loading is also high.

The inadvertent operation of the CO_2 suppression system will have no adverse effect on the cables.

9A.4.2.6.3 Conclusion

The objective for this zone is to prevent a fire from affecting Divisions I and II cables within the zone and from spreading to another zone. The objective is achieved through the provision of a 3-hr-rated fire barrier, early-warning detection, manual CO_2 suppression equipment, and manual hose and portable fire extinguishers.

9A.4.2.6.4 Deviations

Deviations have been approved for the following: to maintain a 3-hr-rated barrier between redundant divisions and provide a manually actuated CO_2 system. (Reference 1, SSER No. 5, VI [910]).

9A.4.2.7 Second Floor, Miscellaneous Rooms, Fire Zone 06AB, El. 613 Ft 6 In.

9A.4.2.7.1 Description

This zone, shown in Figure 9A-6, consists of the personnel air lock, dress-out area, and corridor space. Generally, it is bounded on the north by the steam tunnel, cable tunnel, and the turbine building extension; on the east by the turbine building extension; on the south by the switchgear room; and on the west by the reactor building and the cable tunnel.

The zone houses instrumentation and control calibration equipment and welding equipment.

The walls, floor, and ceiling separating this zone are constructed of reinforced concrete having a fire-resistance rating of 3 hr. Door openings between this zone and the switchgear room, the turbine building extension, and the reactor building are protected by Class A fire doors. Penetrations through the rated walls, floor, and ceiling are sealed to provide 3-hr fire-resistance ratings.

Ventilation for this zone is provided by the reactor/auxiliary building ventilation system. Air is ducted directly to the personnel change room and the welding equipment area. Exhaust from the personnel change room is ducted directly to the auxiliary building main exhaust system. Relief air flows unducted from the welding equipment area to the personnel change room.

Fire detection equipment located within this zone consists of an ionization detection system. Fire suppression equipment in this zone consists of a manual hose station, a CO_2 hose reel, and portable fire extinguishers as shown in Figure 9A-6.

9A.4.2.7.2 Analysis

Only Division I and BOP instrumentation power supply cables are routed through this zone.

Combustibles located within this zone consist primarily of electrical insulation and protective clothing. The total zone loading is low.

9A.4.2.7.3 Conclusion

Division II will be used to achieve plant safe shutdown for a fire in this zone.

The objective for this Fire Zone is to prevent a fire in this zone from spreading to another Fire Zone. This is accomplished through barriers and provision of an early-warning detection system, and manual hose and portable fire extinguishers.

9A.4.2.8 Cable Spreading Room, Fire Zone 07AB, El. 630 Ft 6 In.

9A.4.2.8.1 Description

This zone, shown in Figure 9A-7, consists of one room. It is bounded on the north by an outside wall; on the east by the turbine building; on the south by the steam tunnel; and on the west by the reactor building. The cable spreading room is a part of the control center complex.

The zone serves as a cable routing area for both Divisions I and II and standby feedwater cables.

Unless otherwise noted below, the walls, floor, and ceiling of this zone are constructed of reinforced concrete with a fire-resistance rating of 3 hr. Penetrations through rated walls, floor, and ceiling are sealed to provide a 3-hr fire-resistance rating. The stairwells are enclosed by 3-hr-rated fire walls with Class A fire doors.

Ventilation for this zone is provided by the control center HVAC system. Conditioned air is ducted to and from the zone.

Shutdown equipment located in this zone consists of both Divisions I and II cables.

Fire detection equipment in this zone consists of two ionization detection systems. One of the detection systems is strictly early warning, with the other a Class A cross-zoned ionization detection system providing automatic actuation of the Halon system. Fire suppression equipment consists of an automatic Halon system, manual fusible link sprinkler system, manual water hose station, and portable fire extinguishers, as shown in Figure 9A-7.

9A.4.2.8.2 Analysis

Shutdown is achieved from outside the control room. The alternative shutdown system, independent of the control center complex, has been designed and installed to achieve plant safe shutdown for a fire in this zone.

No protective envelopes are required in this zone.

Inadvertent operation of the automatic Halon fire suppression system will have no adverse effect on the cables in this zone.

Combustibles within this zone consist primarily of cable insulation. Total zone loading is high.

9A.4.2.8.3 Conclusion

The objective for this zone is to prevent a fire within the zone from affecting both Divisions I and II cables and to prevent a fire from crossing the boundaries of this zone. This objective is achieved through spatial separation, barriers, and the provision of an early-warning detection system, an automatic Halon fire suppression system, manual fusible link sprinkler system, manual water hose station, and portable fire extinguishers.

9A.4.2.9 Cable Tray Area, Fire Zone 08AB, El. 631 Ft 0 In.

9A.4.2.9.1 Description

This zone, shown in Figure 9A-7, consists of one room. It is bounded on the north by the steam tunnel; on the east by the turbine building; on the south by an outside wall; and on the west by the reactor building. The zone serves primarily as a cable routing area for Division II cable. A small amount of Division I cable is routed through this zone.

The walls, floors, and ceiling of this zone are constructed of reinforced concrete having a fire-resistance rating of 3 hr. Penetrations through the walls, floor, and ceiling are sealed to provide 3-hr fire-resistance ratings or have been evaluated to contain an acceptable penetration seal. Penetrations that are not installed in a configuration that provides 3-hr protection are evaluated to be acceptable if the installed detail provides adequate protection to prevent spread of fire across the barrier. The stairwell is enclosed by a 2-hr-rated fire barrier with a Class B fire door.

Ventilation air is provided by the reactor/auxiliary building ventilation system. Supply air is ducted directly to this zone. Exhaust air is ducted to the auxiliary building main exhaust system.

The alternative shutdown system is used to achieve plant safe shutdown for a fire in this zone.

Shutdown equipment located in this zone consists of Divisions I and II and standby feedwater cables.

Fire detection equipment in this zone consists of an ionization detection system. Fire suppression equipment located in this zone consists of an automatic CO_2 system, manual water hose stations, and portable fire extinguishers, as shown in Figure 9A-7.

9A.4.2.9.2 Analysis

Shutdown is achieved from outside the main control room. For a fire in this zone, the alternative shutdown system will be used to bring the plant to a safe-shutdown condition. Conduit RI 005-2P/wireway RI-069 contains circuits required for the alternative shutdown system. When the conduit is routed in the zone, a 1-hr protective envelope has been provided on the circuit/wireway.

Inadvertent operation of the automatic CO_2 fire suppression system will have no adverse effect on the cables.

Combustibles located within this zone consist primarily of cable insulation. Total zone fire loading is low.

9A.4.2.9.3 Conclusion

For a fire in this zone, the alternative shutdown system will be used to achieve plant safe shutdown. The objective for this zone is to prevent a fire within the zone from spreading to another Fire Zone. This objective is achieved through spatial separation, barriers, and the provision of early-warning detection, automatic CO_2 fire suppression, manual water hose stations, and portable fire extinguishers.

9A.4.2.9.4 Deviations

There are no deviations for this zone.

9A.4.2.10 Control Room, Fire Zone 09AB, El. 643 Ft 6 In., 655 Ft 6 In, and 677 Ft 6 In.

9A.4.2.10.1 Description

This zone, shown in Figures 9A-8, 9A-9, and 9A-10 consists of the main control room, office, conference room, kitchen, and lavatory on Elevation 643 ft 6 in.; the computer equipment area on Elevation 655 ft 6 in.; and the small air conditioning room located between columns H-13 to 15 on Elevation 677 ft 6 in. The zone is bounded on the north by an outside wall; on the east by the turbine building; on the south by the turbine building corridor and battery rooms; and on the west by the reactor building.

This zone houses the main control panel, computer, and associated auxiliary equipment.

The outside walls, floor, and ceiling of this zone are constructed of reinforced concrete having a fire-resistance rating of 3 hr. The computer room is cut off from the main control room by a barrier that will prevent the propagation of fire. The remainder of the peripheral rooms to the control room, except for the Shift Supervisor's room, have walls and doors that will prevent a fire from spreading out of the room. Electrical and piping penetrations are sealed to provide the same rating as the fire barrier. Supply and return ducts for control room ventilation are provided with fire dampers at the 3-hr fire barriers. See Fire Zone 13AB and

14AB for a discussion of fire dampers F099, F0100, F0101, and F0102, which interface between the Division II control center HVAC and control rooms. Supply and return ducts for the cable spreading and relay rooms that pass through the control room are not provided with dampers at the floor or ceiling. Door openings leading into the turbine building are protected by 1.5-hr fire doors. The northeast stairwell is enclosed by a 3-hr fire barrier with a Class A fire door. A portion of the ceiling of the northeast stairwell is the underside of the stairwell leading up to the computer equipment area (elevation 655'-6") which has been provided with a 3- hour protective barrier on the underside only. Refer to Subsection 9A.4.2.4.2 for additional details.

Refer to Subsection 9A.4.2.4.1 for a discussion of the HVAC chase between the southwest corner of the relay room on elevation 613'-6" (Fire Zone 03AB) and the area above the control room ceiling. The chase is located at column F-13.

The surface burning characteristics of the glazed block walls, duct insulation, central workstation counters, and ceiling panels in the control room area are rated 25 or less in accordance with the ASTM E-84 test method. The smoke and fuel contribution of the walls, duct insulation, central workstation counters and ceiling panels is also rated 50 or less in accordance with the ASTM E-84 test method. Both the carpeting and counter top meet the criterion requirements for critical radiant heat flux rating and smoke density rating for Class I materials as defined by NFPA standards.

Ventilation for this zone is provided by the control center HVAC system. Conditioned air is ducted directly to and from the control room and associated offices and facilities.

Shutdown equipment located in this zone consists of Division I and II main control board panels, Division I and II cables and standby feedwater cables. The shutdown circuits in the control room are contained within three pairs of cabinets. The control cabinets are mounted on a 4-in.-high concrete pad. The redundant division is contained in the adjacent cabinet. Each set of cabinets is separated from the other sets by several feet. Redundant components in adjacent cabinets are separated from each other by steel panels that have no unsealed penetrations. On the front of the cabinet, the portion below the operating panel is louvered; however, a panel of 1-in.-thick marinite has been fastened on the inside of the panel to close these openings. The annunciator windows are glass for the panels required for shutdown. The heat load and cooling requirements of the panels are satisfied by natural radiative cooling.

Fire detection for the control room is provided by ionization and photoelectric detectors above the drop ceiling and photoelectric detectors in the computer room under-floor area, ionization and/or heat detectors in the peripheral rooms, ionization detectors behind the control room panels below the drop ceiling, ionization detectors within the control boards and continuous manning of the control room (SSER No. 6). Ionization detectors are also located within the central operators consoles, which also provide detection coverage within the adjacent raised floor area. Fire suppression equipment located in this zone consists of an automatic Halon suppression system for the computer room and underfloor area and portable fire extinguishers, as shown in Figures 9A-8 and 9A-9.

The combustible loading in the air conditioning room on elevation 677'-6" (columns H-13 to 15) is extremely low. In addition future storage of combustibles in this area is not considered for the purpose of this analysis because the area is heavily congested with non-combustible

duct work with little floor space. Based on the extremely low combustible loading in this area, fire detection instrumentation is not installed since it would not be expected to alarm due to the small amounts of smoke/heat that could be produced by a postulated fire in this room.

9A.4.2.10.2 Analysis

Shutdown is achieved from outside the main control room. An alternative shutdown system and dedicated shutdown panel independent of the control center complex has been designed and installed to achieve plant safe shutdown for a fire in this zone.

Inadvertent operation of the automatic Halon suppression system in the computer room would have no adverse effect on equipment located in this zone.

Smoke removal from the control room can be accomplished using the control center HVAC system as described in Subsection 9.5.1.2.2. Total fire loading for this zone is low. Total fire loading for this zone is low. Combustibles located in this zone consist of the following:

a. Permanently installed combustibles in the computer room consist primarily of computer wiring insulation and components. In the control room, permanently installed combustibles consist primarily of wiring insulation and components, fire-retardant carpet, counter tops and paper. Paper in this category includes paper in file cabinets and shelves, and chart, recorder, terminal, and plotter paper in use at their respective machines.

b. Anticipated transient combustibles in the computer room consist primarily of paper. The remaining peripheral rooms contain primarily paper, wood, and plastic. The transient combustibles in the main control room are low. Paper not in use will be stored in enclosed metal cabinets.

9A.4.2.10.3 Conclusion

For a fire in the control room, plant safe shutdown will be achieved using the alternative shutdown system and dedicated shutdown panel. The objective for this zone is to minimize the potential for the occurrence of a fire in this zone and, should a fire occur in the zone, minimize the extent of the fire and also to prevent a fire from another zone from spreading into this zone. This objective is achieved through spatial separation of control and instrument components, barriers, and the provision of early-warning detection, automatic Halon suppression in the computer room and computer underfloor area, manual water hose stations, and portable fire extinguishers.

9A.4.2.10.4 Deviations

Deviations have been approved for the following:

a. Installing 1-1/2-hr versus 3-hr-rated fire doors for doors numbered T3-6 and R3-13 based on early-warning detection in the turbine building extension, the Turbine Building low combustible loading in the vicinity of the doors, and the construction of the doors themselves (Reference 3, Reference 2, Appendix E SSER No. 6 III.B)

b. Lack of a fixed suppression system in the control room based on continuous manning of the control room (Reference 1, SSER No. 5-VI [12] and VII).

9A.4.2.11 Divisions I and II Battery Rooms, Fire Zone 10AB, El. 643 Ft 6 In.

9A.4.2.11.1.1 Description

This zone, shown in Figure 9A-8, consists of two rooms. It is bounded on the north by the main control room; on the east and south by Fire Zone 11AB of this fire area; and on the west by the reactor building.

This zone houses the Divisions I and II engineered safety features (ESF) batteries fuse cabinets and cables.

The walls, floor, and ceiling of this zone are constructed of reinforced concrete having a minimum fire-resistance rating of 3 hr. Penetrations are sealed to provide 3-hr-rated fire barriers. The door openings in the south wall are protected by Class A fire doors.

Ventilation for this zone is provided by the reactor/auxiliary building ventilation system. Supply and exhaust are ducted separately to and from each room. Each room is provided with redundant exhaust fans.

The Division I or II batteries contained in these rooms are required for shutdown.

Fire detection equipment located in this zone consists of an area ionization detection system. Fire suppression equipment consists of portable fire extinguishers and manual water hose stations, as shown in Figure 9A-8.

9A.4.2.11.2 Analysis

Shutdown is achieved from the main control room. Divisions I and II batteries located in this zone are separated by a 3-hr fire barrier.

Combustibles in this zone consist primarily of battery cases, electrical insulation, and shock absorbers between batteries. Total zone fire loading is low.

9A.4.2.11.3 Conclusion

The objective for this zone is to prevent a fire in one battery room from spreading to the other battery room and to prevent a fire outside the zone from spreading into the zone. This objective is achieved through barriers, low fire loading, and the provision of early-warning detection, manual water hose stations, and portable fire extinguishers.

9A.4.2.12 Miscellaneous Rooms, Fire Zone 11AB, El. 643 Ft 6 In.

9A.4.2.12.1 Description

This zone, shown in Figure 9A-8, is bounded on the north by the turbine building corridor; on the east by the turbine building; on the south by the Division II switchgear room; and on the west by the battery rooms and reactor building.

This zone houses the reactor protection system (RPS) M-G sets, battery chargers, dc MCCs, and distribution cabinets. The walls, floor, and ceiling of this zone are constructed of reinforced concrete and are rated as 3-hr fire barriers. Penetrations are sealed to provide a fire-resistance rating equivalent to that of the walls, floor, or ceiling in which they are found or have been evaluated to contain an acceptable penetration seal. Penetrations that are not installed in a configuration that provides 3-hr protection are evaluated to be acceptable if the installed detail provides adequate protection to prevent spread of fire across the barrier. The ceiling has a metal hatch cover. The subject steel hatch cover has been evaluated as adequate, as a part of the fire barrier between fire zones 11ABE and 13AB, to prevent the propagation of fire based on the physical configuration of the subject hatch cover in the ceiling/floor, the very low combustible loadings, the fire detection provided in both fire zones, the automatic suppression system provided in Fire Zone 11ABE and the control of transient combustibles in procedures. Door openings are protected by Class B fire doors except in the walls abutting the turbine building corridor and the Division II switchgear room, which have Class A fire doors. Divisions I and II battery chargers are located outside their respective battery rooms on the south side in Fire Zone 11AB. The battery chargers are separated by a 4-in. concrete brick wall with a Class A door installed in it. The wall provides a minimum fire rating of 1-1/2-hr.

Ventilation for this zone is provided by the reactor/auxiliary building ventilation system. Supply air is ducted directly to the battery room air-conditioning unit and circulated through the area or exhausted to the ventilation system.

Shutdown equipment consists of the Divisions I and II battery chargers, dc MCCs, dc distribution cabinets and cables, SRV control cabinets and fan coil units.

Fire detection equipment in this zone consists of two area ionization detection systems. Fire suppression equipment consists of an automatic CO_2 suppression system in the dc MCC room, manual water hose stations, portable fire extinguishers, and a CO_2 hose reel, as shown in Figure 9A-8.

9A.4.2.12.2 Analysis

The Divisions I and II battery chargers and dc distribution cabinets are located in separate rooms.

Division I will be used to achieve plant safe shutdown from the main control room for fires in the west battery charger room.

The alternative shutdown system will be used to achieve plant safe shutdown from outside the control room for a fire in the east side of the zone.

Inadvertent operation of the automatic CO_2 suppression system would have no adverse effect on equipment located in this zone.

Combustibles within this zone consist primarily of electrical insulation. Total zone fire loading is low.

9A.4.2.12.3 Conclusion

The alternative shutdown system is used to achieve plant safe shutdown for a fire in this zone except for the west battery charger room where Division I will be available for shutdown.

The objective for this zone is to prevent a fire within this zone from spreading to another zone. This objective is achieved through barriers and the provision of early-warning detection, an automatic CO_2 suppression system, manual water hose stations, and portable fire extinguishers.

9A.4.2.12.4 Deviations

Deviations have been approved for the following: lack of a 3-hr-rated barrier separating redundant equipment based on a 4-in. solid concrete brick wall with a 3-hr rated door, smoke detection, CO_2 for Division I side, and low combustible loading (less than six cable trays) (Reference 1, SSER No. 5, VI [11]).

9A.4.2.13 Switchgear Room, Fire Zone 12AB, El. 643 Ft 6 In.

9A.4.2.13.1 Description

This zone, shown in Figure 9A-8, consists of one room. It is bounded on the north by Fire Zone 11AB of this fire area; on the east by the turbine building; on the south by an outside wall; and on the west by the reactor building.

The zone houses the Division II switchgear.

The walls, floor, and ceiling are constructed of reinforced concrete having a fire-resistance rating of 3 hr. The door openings in the north wall are protected by Class A fire doors. The door opening at the stairwell is protected by a Class B fire door. Penetrations in the walls, floor, and ceiling are sealed to provide 3-hr-rated fire barriers.

Ventilation for this zone is provided by the reactor/auxiliary building ventilation system. Air is ducted directly to the switchgear room and exhausted through ducts to the auxiliary building main exhaust system. In addition, the switchgear room contains two recirculating-type cooling units.

Shutdown equipment located in this zone consists of the following:

a. Division II switchgear
b. Division I, Division II and standby feedwater cable
c. Switchgear room cooling units (Division II)
d. 120 V ac modular power unit (Division II)
e. 130 V dc distribution panels (Division II)

Fire detection equipment located in this zone consists of an area ionization detection system. Fire suppression equipment consists of manual water hose stations, portable fire extinguishers, and a CO_2 hose reel, as shown in Figure 9A-8.

9A.4.2.13.2 Analysis

Shutdown is achieved from the main control room. Functional redundancy for the Division II switchgear located in this zone is provided by Division I equipment located in another Fire Zone.

Combustibles located within this zone consist primarily of electrical insulation. Total zone fire loading is low.

9A.4.2.13.3 Conclusion

The objective for this zone is to prevent a fire within the zone from spreading to other zones. This objective is achieved through barriers and the provision of an early-warning detection system, manual water hose stations, and portable fire extinguishers.

Division I will be used to achieve plant safe shutdown for a fire in this zone.

No protective envelope is required in this zone.

9A.4.2.14 Ventilation Equipment Area, Fire Zone 13AB, El. 659 Ft 6 In.

9A.4.2.14.1 Description

This zone, shown in Figure 9A-9, consists of one room. It is bounded on the north by the control room Fire Zone 09AB; on the east by the turbine building; on the south by an outside wall; and on the west by the reactor building.

This zone houses the reactor/auxiliary building ventilation system exhaust unit.

The walls surrounding this zone and the floor of this zone are constructed of reinforced concrete having a fire-resistance rating of 3 hr. Penetrations through rated walls and floors are sealed to provide 3-hr fire-resistance ratings. Dampers FO-85 and FO-90 are 1.5-hr-rated dampers while FO-81A and B, FO-82A and B, FO-83A and B, and FO-84A and B are two 1.5-hr-rated dampers in series. These dampers are located in the zone's west and north 3-hr boundary walls but are acceptable because of low fire loading and the presence of fire detection. Fire damper FO-90 is located in a wall separating Fire Zone 13AB from a pipe/HVAC duct chase in the southwest corner. Fire damper FO-85 is located in the wall separating the control room (Fire Zone 09AB) from Fire Zone 13AB. The floor also has a metal hatch cover which will prevent the propagation of fire. The subject steel hatch cover has been evaluated as adequate, as a part of the fire barrier between Fire Zones 11ABE and 13AB, to prevent the propagation of fire based on the physical configuration of the subject hatch cover in the ceiling/floor, the very low combustible loadings, the fire detection provided in both Fire Zones, the automatic suppression system provided in Fire Zone 11ABE and the control of transient combustibles in procedures. The ceiling is constructed of reinforced concrete and contains unprotected hatches and unsealed penetrations, except that all electrical and piping penetrations are sealed to provide a 3-hr fire barrier for that portion of the ceiling separating this zone from Fire Zone 14AB at Elevation 677'-6" and the reactor building southeast access stairs at Elevation 677'-6". Cable tray penetrations are provided with fire stops. A radiant energy shield of 1-hr fire-rating construction has been installed from floor to ceiling on the west side of the room, the southwest corner wall of the northwest

stairwell, south to approximately 3 ft beyond the south end of the Division II testability cabinets.

The pipe chase is a 12-in. concrete block wall (3-hr equivalent). The wall separating the main control room from the fourth floor auxiliary building is reinforced concrete and has a 3-hr fire rating.

The stairwell in the northwest quadrant of the zone is enclosed by a 3-hr-rated barrier with a Class A door that opens to the reactor building's Fire Zone 09AB.

Ventilation for this building area is provided by the reactor/ auxiliary building ventilation system. Supply and exhaust air is ducted to and from this area.

Shutdown equipment in this zone consists of Divisions I and II cables, and Divisions I and II instrument racks.

Fire detection equipment located in this zone consists of an ionization detection system. Fire suppression equipment consists of manual water hose stations and portable fire extinguishers, as shown in Figure 9A-9.

9A.4.2.14.2 Analysis

Shutdown is achieved from outside the main control room. Safe-shutdown capability for the zone is achieved by use of the alternative shutdown system.

Combustibles located within this zone consist primarily of electrical insulation. Total zone fire loading is low.

A radiant energy shield from floor to ceiling has been installed to separate the Divisions I and II equipment from a common heat source.

9A.4.2.14.3 Conclusion

For fires in this zone, the alternative shutdown system will be used to achieve plant safe shutdown.

The objective for this zone is to prevent a fire from spreading to another Fire Zone. This objective is achieved through adequate spatial separation, low fire loading, rated barriers, and the provision of early-warning detection, manual water hose stations(s), and portable fire extinguishers.

9A.4.2.14.4 Deviations

Deviations have been approved for the following:

a. Lack of automatic suppression based on a 1-hr radiant energy shield being installed in front of the cabinet (Reference 1, SSER No. 5 VI [16]).

b. Installation of 1-1/2-hr fire-rated dampers in 3-hr fire-rated barriers based on negligible fuel load and early-warning detection on each side of the barrier (Reference 1, SSER No. 5 III.B).

9A.4.2.15 Control Room Ventilation Equipment Room and Standby Gas Treatment Rooms, Fire Zone 14AB, El. 677 Ft 6 In.

9A.4.2.15.1 Description

This zone, shown in Figure 9A-10, consists of five rooms located in the northern half of Elevation 677 ft 6 in. of the auxiliary building. It is bounded on the north by an outside wall; on the east by the turbine building; on the south by the ventilation equipment room; and on the west by the reactor building.

This zone houses the SGTS charcoal filter units and the control center ventilation equipment.

The walls surrounding this zone are constructed of reinforced concrete. The east and west boundary walls are rated as 3-hr fire barriers. A 1-hr-rated fire barrier with Class A fire doors separates Division I and II air conditioning equipment. A 1-hr-rated fire barrier separates Divisions I and II cables. Penetrations through rated walls are sealed to provide a fire resistance equivalent to the walls in which they are located. The floor is constructed of reinforced concrete and provides a 3-hr fire-rated barrier. Electrical and piping penetrations in the floor are sealed. Ducts are encased by 3-hr-rated fire barriers. Dampers FO-99, FO-100, FO-101, and FO-102 are 1-1/2-hr rated fire dampers. These dampers separate the control room from this zone. The dampers are acceptable because of low fire loading and the presence of fire detection (see SSER No. 5). The ceiling is constructed of reinforced concrete over unprotected steel.

Ventilation for this zone is provided by the control center air conditioning system (CCACS). Conditioned air is supplied through ducts to the control room air conditioning equipment room and by an extension of the duct to the north standby gas treatment room. Exhaust air from the control room air conditioning equipment room is drawn through a return duct opening to the control center air-conditioning units located in the room. Additionally, local cooling and recirculation units in the control room air conditioning equipment room maintain suitable room ambient temperature when the CCACS is operating in the emergency recirculation mode. During operation in the emergency recirculation mode, flows of supply and return air to and from the control center air conditioning equipment room are stopped. There are 1.2 air changes per hour.

A fire in either ventilation equipment room may result in closure of fire damper T4100F903. This damper is located in common ductwork on the discharge of the Division I and Division II CCACS return air fans and is part of the 3-hour fire barrier between the ventilation equipment room and the Control Room. Closure of this damper will result in loss of CCACS return air flow for both divisions and will result in a reduction of cooling air flow to the various ventilation zones served by the CCACS. Once the fire is extinguished, plant procedures have been established to detect closure of fire damper T4100F903 and to manually open it to reestablish the return air flow path. There is sufficient time to open the damper and to start the CCACS Division that did not experience the fire prior to exceeding maximum temperature limits in the zones served by the CCACS.

This zone contains the following shutdown equipment:

a. Division I and II control center air conditioning equipment

b. Divisions I and II control and power cables for control center HVAC fan coil units and drywell pneumatics.

Cable trays 1P-070 and 1C-037 are provided with a 1-hr rated fire barrier within the Division II control center ventilation equipment room when they are within 20 ft of their redundant cables.

Fire detection equipment located within this zone consists of an area ionization detection system. Fire suppression equipment located in this zone consists of an automatic low-pressure CO_2 system for the SGTS charcoal filters, manual water hose stations, and portable fire extinguishers, as shown in Figure 9A-10.

9A.4.2.15.2 Analysis

Shutdown is achieved from the main control room.

Combustibles located within this zone consist primarily of the following:

a. Lubricating oil

b. Charcoal filter material

c. Electrical insulation

Area fire loading is low.

9A.4.2.15.3 Conclusion

Division I will be used to achieve plant safe shutdown for fires in the Division II control center ventilation equipment room and standby gas treatment rooms.

Division I cable trays required for safe shutdown are protected with a 1-hr rated fire barrier when in the Division II control center ventilation equipment room.

Division II will be used to achieve plant safe shutdown for fires in the Division I control center ventilation equipment room.

The objective for this zone is to prevent a fire in the zone from spreading to another Fire Zone and from affecting both Divisions I and II equipment located within the zone. The objective is achieved through fire barriers, low fire loading, and provision of an early-warning detection system, automatic CO_2 fire suppression equipment, manual water hose stations, and portable fire extinguishers.

9A.4.2.15.4 Deviations

Deviations have been approved for the lack of automatic suppression based on 1-hr wrap being provided and low combustible loading (Reference 1, SSER No. 5 VI [9]).

9A.4.2.16 Ventilation Equipment Area, Fire Zone 15AB, El. 677 Ft 6 In.

9A.4.2.16.1 Description

This zone, shown in Figure 9A-10, consists of one room comprising the southern half of Elevation 677 ft 6 in. of the auxiliary building. It is bounded on the north by Fire Zone 14AB; on the east by the turbine building; on the south by an outside wall; and on the west by the reactor building.

The walls surrounding this zone are constructed of reinforced concrete. The east and west bounding walls are rated as 3-hr fire barriers. Penetrations through these walls are sealed to provide 3-hr-rated fire barriers. The door opening leading to the reactor building is protected by a Class A fire door. The floor is constructed of reinforced concrete with unprotected openings. Cable tray penetrations are provided with fire stops. The ceiling is constructed of reinforced concrete over unprotected steel. Ventilation for this zone is provided by the reactor/auxiliary building ventilation system. Supply air is ducted directly to the zone. Exhaust air is ducted to the auxiliary building main exhaust system.

Refer to Subsection 9A.4.2.3.1 for a discussion of the open chase from the mezzanine and cable tray area on the 603'-6" elevation (Fire Zone 02AB) and this area. The opening is located along column H between 10 and 11.

Shutdown equipment located in this zone consists of Divisions I and II HVAC equipment and cables.

Fire detection equipment located in this zone consists of an ionization detection system. Fire suppression equipment located in this zone consists of a manually actuated water flooding system for the charcoal filters, manual water hose stations, and portable fire extinguishers as shown in Figure 9A-10.

9A.4.2.16.2 Analysis

Shutdown is achieved from the main control room. For a fire in this zone, Division II safe shutdown capability is maintained/protected by the installation of isolation devices (fuses) for Division II associated circuits within the zone.

Combustibles located in this zone consist primarily of charcoal filter material and electrical insulation. Total zone fire loading is low.

9A.4.2.16.3 Conclusion

The objective for this zone is to prevent the spread of a fire within this zone to another zone and from affecting both Divisions I and II equipment located within this zone. This objective is achieved through low fire loading and provision of early-warning detection, a manual water flooding system, manual water hose stations, and portable fire extinguishers and isolation devices.

9A.4.2.16.4 Deviations

Deviations have been approved for the lack of automatic suppression based on a 1-hr rated fire barrier, low combustible loading, and charcoal filters having a suppression system(s) (Reference 1, SSER No. 5 VI [7]).

9A.4.3 Residual Heat Removal Complex

9A.4.3.1 General Description

The RHR complex, shown in Figures 9A-13 through 9A-17 inclusive, is a separate reinforced-concrete structure located 230 ft west of the reactor building. The complex is divided at its east-west centerline by a reinforced-concrete wall that has a minimum fire-resistance rating of 3 hr. Each half of the complex contains essentially the same equipment with Division I equipment in the southern portion and Division II equipment in the northern portion of the complex.

Each half of the complex houses a reservoir, cooling tower and service water pump and equipment rooms which comprise the plant's ultimate heat sink. Each half of the complex also houses one set of emergency diesel generators (EDGs), diesel-fuel-oil storage tanks, and switchgear, which are utilized to provide ac power to the plant during a loss of offsite power.

Rated walls, floors, and ceilings are constructed of reinforced concrete having a fire-resistance rating of 3 hr. Doors in rated walls are Class A fire doors. Penetrations in rated walls, floors, and ceilings are sealed.

Floor drains in rooms containing oil are connected to a common manway which is connected by an overflow line to the liquid waste holding pond. Floor drains in other rooms are connected to a different manway which is connected by an overflow line to the circulating water reservoir.

Ventilation for the north diesel generator rooms is provided by outside air drawn by two fans through a louver in the west wall above the 617 ft 0 in. elevation and from there through a motorized outside air damper in the west wall of the fan room at the same elevation. Each diesel room is then supplied by two fans located above the 617 ft 0 in. elevation. Air is relieved through grating in the diesel room ceiling and then through a motorized damper back to the fan room.

Ventilation for the north service water pump room is provided by outside air drawn through a filter plenum by two fans and distributed to the pump room by ductwork along the room's west wall. Room air is relieved through the roof in the northeast and southeast corners of the room. The filter plenums are located at grade along the northeast and southeast corners of the complex.

Ventilation supply air for the north diesel-fuel-oil storage room is drawn by room exhaust fans through an opening in the north CO_2 storage room wall. Exhaust air from the north diesel-fuel-oil storage room is fan exhausted through ducts.

Ventilation for the north CO_2 storage room is provided by continuous exhaust through the space. Exhaust air from the EDG room enters through dampers in the east wall. Exhaust air leaves the room through a damper located in the west wall of the room.

The north switchgear room and ventilation equipment rooms are cooled by outside air. The switchgear room ventilation air is drawn through a filter plenum by two fans and is distributed to the switchgear room by ductwork located along the west wall. This air also supplies the switchgear ventilation equipment room through an outlet in the supply duct main. Air is relieved from the switchgear room through two separate relief openings in the

west wall of the room. One of these openings relieves to the switchgear ventilation equipment room. The second of these openings relieves to an air relief room and the EDG room. Air is relieved from the air relief room through dampers to the outside or to the diesel equipment room for recirculation.

The north ventilation equipment room is ventilated by ducted exhaust air from the diesel-fuel-oil storage tank room.

The north diesel generator air intake filter area is ventilated by outside air drawn through fixed louvers located in the west wall by the switchgear and diesel room ventilation fans. Air flows from the louvers, along the west wall housing the diesel intake filters, to the west wall of the switchgear and diesel room ventilation equipment rooms.

Ducts or openings penetrating rated walls are provided with fire dampers.

Ventilation of the south portion of the RHR complex is the same as that for the north portion of the complex. There are no interconnections between north and south ventilation systems.

Shutdown equipment located in the RHR complex consists of the following Divisions I and II equipment:

a. EDGs and auxiliary equipment

b. EDG fuel-oil storage tanks, day tanks, and transfer pumps

c. RHR service water pumps

d. EESW pumps

e. EDG service water pumps

f. RHR complex ventilation equipment

g. RHR cooling towers

h. Switchgear and MCCs.

Fire detection equipment provided in each half of the RHR complex consists of ionization detection systems for the service water pump rooms, switchgear rooms, and ventilation equipment rooms. Fire suppression equipment consists of an automatic, low-pressure CO_2 system in the EDG rooms, automatic sprinkler systems in the fuel-oil storage tank rooms, and portable fire extinguishers and manual water hoses throughout the complex, as shown in Figures 9A-13 through 9A-15.

NFPA 13 noncompliances with these sprinkler systems include location of sprinklers in excess of the maximum allowable distance below the ceiling and distance between some sprinklers under tanks in excess of the maximum allowable distance for extra hazard occupancies (in addition to those discussed and evaluated in 9.5.1.2.3.3). These noncompliances would not prevent the sprinkler systems from fulfilling their required function of controlling a fire and confining it to the room of origin.

9A.4.3.2 Analysis

Shutdown is achieved from the main control room, using Division I systems for a fire in the north half of the RHR Complex and Division II systems for a fire in the south half of the RHR Complex. Divisions I and II equipment is separated by a 3-hr-rated fire barrier.

Fuel-oil storage within the complex represents a specific fire hazard. Tanks are surrounded by rated walls to contain oil in the event of a tank rupture. In addition, tanks can be remote manually drained. Further details are discussed in Subsection 9.5.4. Fuel oil accounts for the major portion of combustible materials. Other combustibles consist primarily of electrical insulation and lubricating oil. The total fire loading for each half of the complex is greater than the high classification.

Because diesel fuel oil is delivered to the valve station near the northwest corner of the RHR complex at regular intervals, the unlikely possibility exists for a catastrophic failure of one of these delivery trucks resulting in an oil spill fire in close proximity to the RHR complex itself. It should be noted plant personnel escort the truck at all times when it is being driven within the protected area and will provide prompt notification of an oil spill/fire.

The actual exposure fire threat to the RHR complex from an oil spill fire such as described above is very low. The exterior walls are constructed of reinforced concrete with an equivalent fire resistance rating of at least three hours. All openings in the exterior walls above elevation 590′-0″ (which is six feet above grade level and the possible oil spill/fire) are protected by heavy steel plates/doors or are within the reinforced concrete RHR cable vaults. All safety related equipment and cables in the RHR complex are located on or above elevation 590′-0″. Four overflow pipe penetrations are provided below elevation 590′-0″. These openings are not provided with any type of covering. However, there are no combustibles in the RHR complex below the 590′-0″ elevation; thus flame propagation through these openings is not postulated. Finally, any heat postulated to enter the complex via the air intakes or non fire rated penetration assemblies will be quickly dissipated by the HVAC system.

The north side of RHR complex, near a postulated fire at the valve station only contains Division II equipment therefore, no credible exposure to both divisions exists and, Division I equipment would be available for safe shutdown.

Because no other combustible materials are stored or located adjacent to the RHR complex, a diesel fuel oil fire is considered the worst case transient combustible exposure fire that the RHR complex could be postulated to receive therefore, the plant's ability to achieve and/or maintain safe shutdown would not be adversely affected by an exposure fire to the RHR complex.

9A.4.3.3 Conclusion

The objective for the RHR complex is to prevent a fire in one half of the complex from spreading to the other half of the complex. This is accomplished by the rated fire barrier between halves of the complex, existing fire detection and suppression equipment, and the ability to drain fuel oil from the storage tanks to a remote area.

9A.4.4 Radwaste Building

9A.4.4.1 General Description

The radwaste building is structurally part of the turbine building and has, for purposes of this fire hazards analysis, been designated as a single, separate fire area. The building is bounded on the north by an outside wall, on the south and west by the turbine building and office and service building, and on the east by the onsite storage building.

The radwaste building houses the liquid and solid waste processing equipment.

The walls, floor, and ceiling are constructed of reinforced concrete and concrete block. Door openings to the turbine building are equipped with Class A, B, and C fire doors. Penetrations through walls of the turbine building and office service building are sealed to provide a 3-hr barrier. Cable trays passing through floors are fire stopped.

The alternative/dedicated shutdown system panels are located on the second floor of this building.

Shutdown equipment contained in this zone consists of the following:

a. Offsite power cables affecting CTG 11-1 feed to standby feedwater

b. RHR Instrumentation equipment and cable

c. Standby feedwater and CTG 11-1 equipment and cable

Fire detection equipment consists of thermal, photoelectric, and ionization type fire detection instruments throughout the building for early warning. Fire suppression equipment for the radwaste building consists of an automatic sprinkler system for the chemical stores room, the two oil-coalescer rooms, the extruder-evaporator room, the drum-turntable room, the drum-capper room, the drum-transfer-conveyor room (all on the first floor), and the main corridor, the drum-conveyor room, the main corridor west of the drum decontamination room and storage room (both on the third floor); an automatic deluge system for the roof-mounted voltage regulator; Clean Agent extinguishing systems for various administrative areas; and a manual hose and portable fire extinguishers. The radwaste building ventilation system is completely separate from other plant areas or buildings.

9A.4.4.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II systems. The building is separated from the turbine and the office service buildings by 3-hr-rated fire barriers. The fire barrier separating the Radwaste and Turbine Buildings contains class A, B, and C fire doors. The class B fire doors were constructed without windows and in the exact same manner as class A doors; and are therefore considered equivalent to class A doors. The three (3) class C (3/4 hour fire rated) doors are located along column line K at elevation 583'-6" and form part of the separation between the Radwaste Building control room and office area and the Turbine Building. Because the office and control room area is provided with automatic fire detection and the combustible loading on both sides of these doors is low, these doors do not prevent the fire barrier separating the Turbine and Radwaste Buildings from performing its intended design function. Therefore, fire in this building will

not affect plant safe-shutdown capability because of the separation and isolation of plant equipment. This arrangement meets the system interface requirements of BTP-CMEB 9.5-1.

Inadvertent operation of automatic fire suppression systems provided for this fire area will have no adverse effect on the ability to shut down the plant. The floor drain system is contained within the building; therefore, combustible liquid spills cannot travel outside the radwaste building.

Combustibles within the radwaste building have been protected by automatic suppression systems as noted in Subsection 9A.4.4.1.

9A.4.4.3 Conclusion

A fire in the radwaste building will not adversely affect plant shutdown. The 3-hr fire-resistance rating of the walls separating the turbine and the office and service buildings from the radwaste building is adequate, based on the fire hazards and the protection provided for the specific fire hazards in the radwaste building.

9A.4.5 Turbine Building

9A.4.5.1 General Description

The turbine building, which for purposes of this fire hazards analysis includes the steam tunnel and a portion of the auxiliary building at Elevation 583 ft 6 in., comprises one fire area. This fire area is bounded on the north by the radwaste building; on the east by the office and service buildings; on the south by an outside wall; and on the west by the auxiliary building, reactor building, and transformer area.

The west wall of the turbine building is a 3-hr-rated barrier below elevation 679′-6″. This rated barrier serves to protect the turbine building from an exposure fire originating in one of the adjacent oil-filled transformers. In addition, fixed automatic water spray systems are provided for these transformers to reduce their exposure fire hazard. Therefore, the turbine building is adequately protected from a transformer oil exposure fire.

The turbine building houses the turbine generator and related auxiliary equipment. Also located in the turbine building is equipment for the condenser offgas system.

Walls separating the turbine building from other buildings are constructed of reinforced concrete and concrete block. These walls have a 3-hr fire-resistance rating. Doorways in boundary walls separating the turbine building from the auxiliary and reactor buildings are equipped with Class A fire doors. As detailed in Section 9A.4.4.2, doorways in boundary walls separating the turbine building from the radwaste building contain class A, B, and C fire doors. All other penetrations in these boundary walls are sealed to provide 3-hr-rated fire barriers except for the pressure equalizing line between the first floor of the reactor building and this Fire Zone. The ability of the fire barrier to perform its function has been evaluated and determined to provide an adequate assurance that a fire in this Fire Zone will not propagate to the reactor building first floor. Two penetrations in the west wall at approximately 603 ft elevation that contain the Calvert Cable Buses are not sealed with a tested configuration design. However, the lack of combustibles in the area adjacent to and below these openings, the configuration of the Calvert Cable Buses and the rated seals on the

auxiliary building wall have been evaluated and provide adequate assurance that a fire in the turbine building will not propagate through these penetrations into the auxiliary building. The floor penetrations in the steam tunnel are provided with a non-tested configuration in the fire rated separation barrier. These seals have been evaluated and provide an adequate assurance that a fire in the Reactor Building Fire Zone 01RB will not propagate through these penetrations into the steam tunnel, or from the steam tunnel to the reactor building.

Safe shutdown equipment consists of the following:

a. Offsite power cables affecting CTG 11-1 feed to standby feedwater

b. Standby feedwater and CTG 11-1 equipment and cables

c. HPCI and RCIC cables, Division I and Division II

d. RHR instrumentation cables

e. HPCI and RCIC equipment and cables, Division I and Division II, in the TB Steam Tunnel

Fire suppression equipment is provided as follows:

a. Automatic water sprinkler systems for the reactor feed pump turbines and turbine-oil reservoir, main lube-oil reservoir, oil storage and turbine-oil tank rooms, the second floor pipe space, and the equipment hatch area and decontamination room on the first floor

b. Automatic water deluge systems for the hydrogen seal oil unit.

In addition to the above automatic systems, manual fire hoses and portable fire extinguishers are provided.

9A.4.5.2 Analysis

Shutdown is achieved from the main control room. Division II is used to achieve shutdown in the turbine building, except for the steam tunnel. In the turbine building steam tunnel, Division I is used to achieve safe shutdown.

Combustibles within the turbine building are typical for a turbine generator complex. The major fire hazard in this fire area is the large quantity of oil required for turbine bearing lubrication and the oil required for the generator hydrogen seals. This hazard is protected against by the fixed suppression systems noted in Subsection 9A.4.5.1.

Inadvertent operation of automatic fire suppression systems provided for this fire area will have no adverse effect on the ability to shut down the plant.

There are no combustibles in the steam tunnel. The major source of fire in the turbine building is remotely located from the valves in the steam tunnel. This distance, coupled with the fixed fire suppression systems provided, protects against a fire hazard to equipment in the steam tunnel. In addition, both shutdown valves (RCIC and HPCI pump discharge isolation valves) are backed up by the automatic depressurization, LPCI, and core spray systems.

The HWC System introduces hydrogen into the turbine building through supply piping at the north end. This piping is routed along the inner east and north walls of the turbine building, bordering the radwaste building. A barrier installed between the northeast stairwell and the

hydrogen skid assembly will provide protection for personnel using the stairs in the event of a fire. The elevator shaft is enclosed by a 12-inch thick hollow concrete block wall, which will provide protection and prevent the spread of a fire into the shaft. The quantity of hydrogen which could be released into the turbine building in the event of a pipe break will be limited to that amount contained in the 1.5-inch hydrogen piping (between the upstream automatic isolation valve module and the downstream automatic isolation valves on the injection skid; these will all close on detection of high hydrogen levels). These valves are located inside the turbine building, and will isolate the piping in the building from the hydrogen supply facility. Because of the highly flammable nature of the gas, local area monitors are installed above each heater feed pump injection point, at the hydrogen skid assembly, and at the isolation module at the turbine building entrance. The detection of small amounts of hydrogen (about 1% concentration in air) will result in a local alarm at the HWC control panel, and the detection of levels above 2% in air will result in a system trip and isolation. Since the flammability limit is 4% hydrogen in air, the leak detection system should provide isolation before a flammable mixture can result.

9A.4.5.3 Conclusion

A fire emergency in the turbine building would not adversely affect the ability to shut down the plant. The 3-hr fire- resistance rating of the walls separating the auxiliary, reactor, and radwaste buildings from the turbine building is adequate, based on the fire hazards and the protection provided against specific fire hazards in the turbine building.

9A.4.5.4 Deviations

Deviations for the steam tunnel have been approved for the following:

a. Lack of automatic suppression based on negligible fuel load, heat monitoring instrumentation in place of detectors, and 7 ft separation of redundant valves (Reference 1, SSER No. 5 VI[8]).

b. Lack of 20 ft separation (Reference 1, SSER No. 5 VI).

9A.4.6 Office and Service Building

9A.4.6.1 General Description

The office and service building is primarily a single story structure; however, the office portion of this building consists of two stories. For purposes of this fire hazards analysis, the office and service building has been designated as a single fire area. This building is bounded on the north by a portion of the radwaste building and an outside wall; on the east and south by outside walls; and on the west by the turbine building.

Housed within the office and service building are office spaces, locker rooms, kitchen and dining areas, shops, and warehouse space.

The walls separating this building from adjoining buildings are constructed of reinforced concrete. Penetrations in these walls are sealed to provide a fire stop. Doorways to adjoining buildings are equipped with metal doors.

Shutdown cables contained in this area include cables associated with diversion of inventory from the Condensate Storage Tank, which is the source of water for the SBFW pumps.

Fire suppression equipment for this fire area consists of an automatic water pre-action sprinkler system for the warehouse loading dock, an automatic water sprinkler system in the office storage and fill areas, tool crib and warehouse, and manual hose and portable fire extinguishers.

9A.4.6.2 Analysis

Safe shutdown is achieved from the main control room using Division I or Division II systems. Shutdown cables lost are associated with SBFW. The SBFW system is not required for a fire in the Office and Service Building. The building is separated from adjacent buildings by fire barriers. Additionally, the adjacent buildings house no shutdown equipment nor is there shutdown equipment nearby.

Inadvertent operation of automatic fire suppression systems provided for this fire area will have no adverse effect on ability to shut down the plant.

Combustibles within the office and service buildings have not been quantified since they consist primarily of transient materials typical of office and service buildings.

9A.4.6.3 Conclusion

The objective for this fire area is to prevent fire in this building from jeopardizing the ability to shut down the plant. This objective is achieved by adequate separation from shutdown equipment by barriers, use of automatic, partial coverage fire suppression systems, and manual hose and portable fire extinguishers.

9A.4.7 Yard Area

9A.4.7.1 General Description

The yard area, shown in Figure 9A-1, includes the open areas of the plant site not occupied by buildings. Equipment located in this area includes, but is not limited to, the following:

a. Condensate storage tanks
b. Auxiliary boiler fuel-oil storage tank
c. Auxiliary boiler house
d. Transformers
e. Storage facility for hydrogen
f. Underground safety related cable ducts
g. HWC gas supply facility
h. CTG 11-1 and auxiliaries and 120 kV Mat Equipment located at Fermi 1
i. Offsite power cables affecting CTG 11-1 feed to SBFW
j. Egress area between Reactor Building and RHR complex

See the following subsections for individual analyses of each of the above.

9A.4.7.2 Condensate Storage Tanks

9A.4.7.2.1 Description

The condensate storage tanks are located approximately 100 ft east of the services building and approximately 112 ft south of the auxiliary boiler house.

The tanks are located inside a lined diked area which is designed to collect the contents of a tank spill/overflow. The dike around the tanks is a three foot high concrete wall.

These tanks are used as the supply of water for SBFW, HPCI and RCIC. HPCI and RCIC pumps can be supplied from the suppression pool as another source of water. Fire suppression equipment in this portion of the yard area consists of a fire hydrant, supplied from the fire service water system, and manual hose.

9A.4.7.2.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II systems. One of the two condensate storage tanks and associated level instrumentation are used for shutdown operations using HPCI or RCIC. However, should the tanks be damaged as a result of fire, the suppression pool can be used as an alternative water source. SBFW does not have another water source. Safe shutdown for the fires in the yard where these tanks could be damaged does not rely on SBFW.

The three foot high concrete wall surrounding the condensate storage tank (to contain the tank contents) will prevent an exposure fire or the heat from an exposure fire in the yard area adjacent to the storage tanks from affecting the tanks themselves. This includes a postulated oil spill/fire due to a catastrophic failure of an oil truck enroute to the RHR complex. In the case of the oil truck, the concrete walls will prevent the burning oil from getting within 25 feet of the storage tanks. In addition, the oil truck is escorted by plant personnel (while the truck is being driven within the protected area) who will promptly notify the Control Room in the event of an oil spill/fire.

9A.4.7.2.3 Conclusion

The objective for this portion of the yard area is to prevent damage to the condensate storage tanks as a result of fire in nearby equipment or buildings. The minimum spatial separation (approximately 100 ft) between these tanks and nearby buildings is adequate. The objective is achieved by this spatial separation and provision of manual fire protection equipment. Additionally, an alternative source of water is provided through connections between the suppression pool and the RCIC, HPCI, low pressure coolant injection (LPCI), and core spray systems.

9A.4.7.3 Auxiliary Boiler Fuel-Oil Storage Tank

9A.4.7.3.1 Description

The auxiliary boiler fuel-oil storage tank is located approximately 200 ft from the service building and approximately 100 ft north of the auxiliary boiler house.

This tank is above ground and surrounded by a dike; therefore, should leakage occur, it would be contained in the diked area.

This tank is not shutdown equipment.

Fire suppression equipment in this portion of the yard area consists of a fire hydrant, supplied by the fire service water system, and manual hose.

9A.4.7.3.2 Analysis

Since this tank is not required for shutdown operation, functional redundancy is not a consideration. Separation by more than 200 ft between this tank and the condensate storage tanks is adequate.

9A.4.7.3.3 Conclusion

The objective for this portion of the yard is to prevent fire in this area from spreading to buildings housing shutdown equipment. This objective is achieved by a dike surrounding the tank, the remote location of the tank, and the fire hydrant in the vicinity.

9A.4.7.4 Auxiliary Boiler House

9A.4.7.4.1 Description

The auxiliary boiler house is located approximately 90 ft east of the service building and approximately 110 ft north of the condensate storage tanks.

This structure houses the auxiliary boiler. The auxiliary boiler is not required for shutdown.

Fire suppression equipment in this portion of the yard area consists of a fire hydrant, supplied from the fire service water system, and manual hose.

9A.4.7.4.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II systems. Since the auxiliary boiler is not required for safe shutdown, functional redundancy is not a consideration. Separation of this building from other buildings is adequate.

9A.4.7.4.3 Conclusion

The objective of this portion of the yard area is to prevent a fire in the auxiliary boiler house from spreading to other buildings or adversely affecting the condensate storage tanks. This objective is achieved by spatial separation and the fire hydrant in the vicinity.

9A.4.7.5 Transformers

9A.4.7.5.1 Description

Transformers are located in a portion of the yard area adjacent to the west wall of the turbine building and south of the auxiliary building. The main and auxiliary transformers are located in this area, which is surrounded on the north, south, and west sides by a curb to contain any oil leakage from the transformers. Fire barriers are provided between the transformers.

Except for SS #64, none of these transformers are necessary for shutdown operation since required electrical power can be supplied by the EDGs. SS #64 is utilized as part of the SBFW power supply from CTG 11-1 to the SBFW pumps.

Fire suppression equipment for this portion of the yard area consists of automatic deluge systems for the transformers. Fire hydrants, supplied from the fire service water system, and manual hose are also provided.

9A.4.7.5.2 Analysis

Shutdown is achieved from the main control room utilizing either Division I or Division II. SS #64 can affect the ability to power SBFW pumps from the CTG, but SBFW is not necessary for shutdown in the yard area. Since the transformers located in this portion of the yard area are not required for shutdown, functional redundancy is not a consideration. Separation is adequate in light of the fire suppression systems provided.

9A.4.7.5.3 Conclusion

The objective for this portion of the yard area is to prevent a fire spreading from this area to other buildings or yard areas containing shutdown equipment. This objective is achieved by automatic deluge systems, fire hydrants, and a curb around three sides of the area (the turbine building west wall encloses the fourth side).

9A.4.7.6 Hydrogen Storage Facility

9A.4.7.6.1 Description

The hydrogen storage area is located approximately 80 ft south of the turbine building.

Hydrogen is not required for shutdown.

Fire suppression equipment for this area consists of fire hydrants, supplied from the fire service water system, and manual hoses.

9A.4.7.6.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II systems. Spatial separation of this area from buildings containing shutdown equipment is adequate. Additionally, gas storage cylinders in this storage area are oriented to minimize the probability of striking a safety-related building should an explosion occur.

9A.4.7.6.3 Conclusion

The objective is to prevent fire in the hydrogen storage area from causing damage to shutdown equipment in other buildings. This objective is achieved by the remote location of the hydrogen storage area, the orientation of gas storage cylinders away from safety-related buildings, and fire hydrants in the vicinity.

9A.4.7.7 Underground Safety Related Cable Ducts

9A.4.7.7.1 Description

There are two sets of Category I 4160-V ductbanks between the RHR complex and the Reactor/Auxiliary building, with a Division I and Division II ductbank in each set.

The first set of ductbanks was installed during plant construction. These two underground safety related cable ducts run parallel to each other and carry safe shutdown cables between the RHR complex and the Auxiliary Building cable vault. The most northerly duct carries Division II safe shutdown cables while the other carries Division I safe shutdown cables. The cables in each of these ducts are routed in approximately 30 fiber pipes. The spaces between and around these pipes are filled with approximately 3″ of concrete and the entire structure is reinforced with steel.

Each of the ducts is provided with a manhole structure which is also of reinforced concrete construction and an integral part of the duct. The opening which is approximately 30″ in diameter, is covered by a tight fitting malleable iron cover with cast iron ring. These underground ducts are separated by at least 10′ of soil and are covered by at least 2 feet of soil. The top of the manhole structures are approximately one foot below grade and the manhole covers are covered with soil and gravel.

Immediately adjacent to each manhole is a handhole structure, which is physically independent of the manhole structure but it does become part of the underground duct as it ties into it on both sides of the manhole structure. These handholes provide access to communication cables which are separated by concrete from fiber pipes carrying safety related cables.

The second set of ductbanks and associated manholes is installed above the maximum ground water elevation of 576.0 ft with ducts sloped to the manholes, such that circuits contained are not subject to continuous wetting. These are cast-in-place, rectangular reinforced concrete ductbanks, located with the ductbank top approximately six inches below the surface and manhole covers at grade level. The spaces around the ducts are filled with a minimum of five inches of reinforced concrete. The portion of the ductbanks located below the ISFSI Transfer Pad is covered by the two foot thick reinforced concrete roadway and are separated by a minimum of 7'-8" of soil and reinforced concrete. In the balance of the ductbanks, the ducts are covered with a minimum of 12 ½" of reinforced concrete above the ducts and 18" of reinforced concrete along the sides of the outside ducts.

Three manholes are provided in each of the two ductbank runs. The manholes are 8'-0" long x 6'-0" wide (inside dimension) with 18" thick reinforced concrete walls and 16" thick bottom slab/mat. The top of the manholes is at the finished grade elevation. The manhole

covers consist of a 12 ½" thick reinforced concrete removable top slab with two equal 4'-6" x 7'-0" overlapping sections. The manhole cover interface surfaces are provided with joint sealant at the vertical surface and an additional gasket at the horizontal surfaces to avoid the entry of water or other fluids.

The ductbanks rise above grade for a length of approximately six feet in an area of thickened reinforced concrete at the entrance to the RHR cable vaults and for a length of approximately thirteen feet at the entrance to the Reactor/Auxiliary building cable vault. At the Reactor/Auxiliary building entrance, the ducts are covered with eight inches of reinforced concrete and a 1" thick steel plate.

Category I ductbanks from manholes 16946C and 16947C to the RHR complex terminate in RHR cable vaults with 18" thick reinforced concrete walls and 12 ½" thick reinforced concrete roofs. The cable vaults have access openings measuring 2'-6" x 2'-6" and covered with 1 ½" thick steel plate in the north and south walls. The RHR cable vaults are separated by 80 feet. The walls extend 6" below grade, which has a cover of approximately six inches of bituminous pavement. The cable vault floors are gravel to allow drainage.

9A.4.7.7.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II systems. The underground ducts are separated from each other by distance, construction and soil and gravel. A fire involving solid combustibles stored outside the posted area does not pose a threat to the safe shutdown cables within the manholes because of the insulating properties of the soil and gravel or concrete and the fact that most of the heat will be dissipated into the atmosphere. A combustible liquid fire is not a viable threat to cables inside the manholes because the burning liquid will be extinguished due to the absence of oxygen, as it soaks into the soil and gravel over the manhole. The manholes with reinforced concrete slab covers are equipped with barriers on both the vertical and horizontal surfaces to minimize the possibility of liquid entry.

In addition, the top of the manhole structure is a reinforced concrete slab approximately 12" thick and the manhole opening is covered by either a tight fitting iron plate that lays inside of a cast iron ring or a 12 ½" thick reinforced concrete slab in two overlapping sections, provided with sealant and gaskets.

The RHR cable vaults for Division I and Division II cables are separated by 80 feet and are constructed of reinforced concrete, with steel covers for the access openings.

9A.4.7.7.3 Conclusion

The objective is to prevent a fire in the yard area from impacting the safe shutdown cables in manholes 16946 and 16947, manholes 16946A, B, and C and 16947A, B, and C, or the RHR cable vaults, and to prevent a fire in either divisional manhole or cable vault from spreading to a manhole or cable vault of the other division.. These objectives are achieved by the insulating capabilities of soil, gravel, and concrete and by physical separation (location).

9A.4.7.8 HWC Gas Supply Facility

9A.4.7.8.1 Description

The HWC gas supply facility is located approximately 1100 feet northwest of the nearest safety-related structure (RHR Complex).

Neither the HWC system nor the gases at the supply facility are required for safe shutdown.

Fire suppression equipment in the area includes yard area fire hydrants supplied from the fire service water system and manual hoses. The hydrogen supply system contains fire control valves which will isolate the hydrogen supply in the event of a fire.

9A.4.7.8.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II systems. The HWC gas supply facility is located far enough away to prevent fires or explosions from affecting safety-related structures and to prevent the formation of combustible mixtures at safety-related intakes in the event of a release of tank contents without fire or explosion. Therefore, the spatial separation of the gas supply facility from buildings containing safe shutdown equipment is adequate.

9A.4.7.8.3 Conclusion

The objective is to prevent fire in the HWC gas supply facility area from causing damage to shutdown equipment in other buildings. The objective is achieved by the remote location of the gas supply facility and yard area fire hydrants.

9A.4.7.9 CTG 11-1 and Auxiliaries, 120 kV Mat Breakers at Fermi 1

9A.4.7.9.1 Description

At the 120 kV mat area of Fermi 1 and the Fermi 1 building, the CTG 11-1 and auxiliaries and certain breakers are used to provide power to SBFW if offsite power is lost to Fermi 2.

Safe shutdown equipment contained in the 120 kV mat and Fermi 1 zones are as follows:

a. CTG 11-1 and CTG 11-1 starting diesel engine
b. Peaker fuel oil storage tank and delivery system to the CTGs
c. 120 kV offsite breakers, 13.8 kV and 13.2 kV breakers
d. Battery power supplies for the CTG, breakers and supervisory control equipment

Fire suppression equipment for this portion of the yard area consists of automatic CO_2 suppression on the CTG units, fire hydrants and manual hose.

9A.4.7.9.2 Analysis

Shutdown is achieved from the Fermi 2 main control room using either Division I or Division II equipment. Damage to the equipment identified above can affect the power supply to the SBFW pumps, but will not cause loss of power to other divisional shutdown

equipment. Use of SBFW is not required for a fire in the yard zone involving the CTG 11-1 or Fermi 1.

9A.4.7.10 Offsite Power Cables

9A.4.7.10.1 Description

The power cables from the 120 kV mat breakers to SS Transformer #64 are run in underground cable ducts. The power cables from SS Transform #64 run in an underground cable duct into the cable entry vault outside the auxiliary building Fire Zone 02AB, and then in an enclosed cable bus along the outside of the auxiliary building until it enters the Division 1 Switchgear Room (Fire Zone 04AB). This power train of cables provides power from CTG 11-1 to the SBFW pumps if offsite power is lost.

The power cables from SS Transformer #65 run in an enclosed cable bus along the outside of the turbine building and the auxiliary building until it enters the Division 2 Switchgear Room (Fire Zone 12AB). The offsite power feed from the 345 kV Mat and SS Transformer #65 are not credited for required or system shutdown.

9A.4.7.10.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II. SBFW is not required for shutdown for fires in the yard that damage either SS Transformer #64 or the enclosed cable bus outside the buildings.

9A.4.7.11 Egress Area between Reactor Building and RHR Complex

9A.4.7.11.1 Description

In the process of shutting down the plant due to a fire using the alternative dedicated shutdown system, the operators cross the yard area to the RHR complex.

9A.4.7.11.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II systems. The yard area is lighted for safeguard purposes but is not battery-backed. However, backup power is available from the combustion turbine generator (CTG 11-1 or an alternate CTG using the standby diesel generator) which supplies power for alternative shutdown. An analysis showed that the CTG can provide power for the yard lights required for shutdown without adversely affecting plant safe-shutdown capability.

9A.4.7.11.3 Deviations

Justification for a deviation from the technical requirements of Section III.J of Appendix R has been documented in a deviation approval request letter dated February 20, 1986, for yard lighting from CTGs versus 8-hr battery packs (Reference 4).

9A.4.8 General Service Water Pump House

9A.4.8.1 General Description

The general service water (GSW) pump house consists of a metal-clad steel building founded on a reinforced-concrete intake structure. This structure is located on the west shore of Lake Erie, south of the main group of plant buildings.

This structure houses the circulating water makeup pumps, GSW pumps, and associated mechanical and electrical equipment. Also housed in this structure are the two fire service pumps. One fire service pump is diesel-engine driven; the other, electric-motor driven.

The diesel-engine driven fire service pump is located in a cubicle surrounded by a 3-hr-rated barrier. The doorways between the diesel-engine-driven pump cubicle and the remaining floor area of this building are equipped with Class A fire doors. The roof of this building satisfies Factory Mutual Class I requirements.

No shutdown equipment is located within the GSW pump house.

Fire suppression equipment for the GSW pump house consists of an automatic water sprinkler system for the diesel-engine-driven fire service pump cubicle, manual hose, and portable fire extinguishers.

9A.4.8.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II systems. The electric-motor-driven and diesel-engine-driven fire service pumps are redundant. Separation of these pumps is accomplished by enclosure of the diesel-engine-driven fire service pump within a 3-hr-rated fire barrier. The electric-motor-driven fire service pump is separated from other equipment by a minimum distance of approximately 15 ft.

The diesel-driven fire service pump fuel-oil tank represents the only significant concentration of combustible material. This tank is located outside, at grade, adjacent to the north wall of the building housing the fire service pumps.

9A.4.8.3 Conclusion

The objective for the GSW pump house is to prevent fire from damaging both fire service pumps. The objective is achieved through location of the diesel-engine-driven fire service pump within a 3-hr-rated fire barrier, the provision of an automatic sprinkler system for protection of this pump, and the outdoor location of the fuel-oil tank.

9A.4.9 Office Building Annex and Technical Support Center

9A.4.9.1 General Description

The technical support center (TSC) is described in Subsection 7.8.1. The remainder of the building is a two-story steel frame office service building. This portion of the building houses office space and a computer room.

No shutdown equipment is located within the office building.

Fire detection equipment consists of an ionization detection system.

Fire suppression for the office building annex consists of an automatic Halon extinguishing system for the computer room and portable extinguishers.

In addition to the suppression systems listed above, an automatic sprinkler system is installed in the TSC's records room.

9A.4.9.2 Analysis

Shutdown is achieved from the main control room using Division I or Division II systems. No shutdown equipment is jeopardized by a fire in the annex portion of the office building. Inadvertent operation of the automatic fire suppression system will have no adverse effect on ability to shut down the plant.

Combustibles within the office portion have not been qualified since they consist primarily of transient materials typical of an office building.

9A.4.9.3 Conclusion

The objective for this area is to prevent fire in this building from jeopardizing the ability to shut down the plant. This objective is achieved by spatial separation from necessary safety systems.

9A.4.10 Onsite Storage Building

This building is described in Section 11.7.

9A.4.11 Outage Building

9A.4.11.1 General Description

The outage building is primarily a two story structure; however, a one story breezeway connects the turbine building with the outage building. For the purpose of fire hazard analysis, the outage building is designated as a single fire area. The outage building is a free standing structure located four inches south of the reactor and auxiliary buildings.

The outage building contains a radiation protection control point area and access into the Plant Radiologically Restricted Area (RRA), as well as lunch room and rest room facilities.

The building is of completely noncombustible construction. The walls separating this building from the safety-related areas of the plant are constructed of reinforced concrete and contain fire rated doors.

No shutdown equipment is located within the outage building. The drywell pneumatic valves and connection lines are located in the yard between the reactor building and the one-story breezeway connecting the turbine building and the outage building.

Fire suppression equipment for this structure consists of a fire hydrant, supplied by the fire service water system, and manual hose. Fire detection is also provided in the outage building.

9A.4.11.2 Analysis

Shutdown is achieved from the main control room using Division I or Division II systems. No shutdown equipment is jeopardized by a fire in the outage building. The building is separated by reinforced concrete walls and fire rated doors from the safety-related areas of the plant.

Combustibles within the outage building have not been quantified since they consist primarily of transient materials consistent with lunchrooms, offices, and protective clothing storage areas.

9A.4.11.3 Conclusion

The object for this zone is to prevent fire from spreading to buildings housing shutdown equipment. This objective is achieved by the reinforced concrete walls and fire rated doors between the outage building and the safety-related areas of the plant.

9A.4.12 ISFSI Equipment Storage Building

9A.4.12.1 General Description

The Independent Spent Fuel Storage Installation (ISFSI) equipment storage building is located just north of the 345 KV switchyard, approximately 158 feet west of the RHR Complex.

This structure houses the equipment (e.g. – the Vertical Cask Transporter) required for ISFSI cask loading campaigns when not in use and also provides part-time office space and functions as an ISFSI crew briefing/turnover meeting area. This structure is not required for shutdown.

Fire suppression equipment in this structure consists of a wet pipe sprinkler system, supplied from the fire service water system and portable fire extinguishers.

9A.4.12.2 Analysis

Shutdown is achieved from the main control room using either Division I or Division II systems. Since the ISFSI equipment is not required for safe shutdown, functional redundancy is not a consideration. Separation for this building from other buildings is adequate.

9A.4.12.3 Conclusion

The objective is to prevent a fire in the ISFSI equipment storage building from spreading to other buildings and jeopardizing the ability to shut down the plant. This objective is achieved by spatial separation from necessary safety systems.

9A.4 FIRE HAZARDS ANALYSIS

REFERENCES

1. Letter from W. H. Jens, Detroit Edison, to B. J. Youngblood, NRC, Subject: Submittal of Deviations From Staff Interpretations of Fire Protection Features in 10 CFR 50, Appendix R and Justification, dated August 3, 1984 (EF2-72717).
2. Letter from W. H. Jens, Detroit Edison, to B. J. Youngblood, NRC, Subject: Additional Fire Protection Information, dated February 4, 1985 (NE-85-0275).
3. Letter from W. H. Jens, Detroit Edison, to B. J. Youngblood, NRC, Subject: Additional Clarification Concerning Fire Doors and Fire Detectors, dated June 18, 1985 (VP-85-0142).
4. Letter from F. E. Agosti, Detroit Edison, to E. G. Adensam, NRC, Subject: Deviation Request - Emergency Lighting, dated February 20, 1986 (VP-86-0006).

9A.5 POINT-BY-POINT COMPARISON

This section contains a point-by-point comparison with Appendix A to NRC Branch Technical Position APCSB 9.5-1, dated August 23, 1976.

Position For Plants Under Construction and Operating Plants	EF-2 Response
Positions	
a. Overall Requirements of Nuclear Plant Fire Protection Program	
1. Personnel	
Responsibility for the overall fire protection program should be assigned to a designated person in the upper level of management. This person should retain ultimate responsibility even though formulation and assurance of program implementation is delegated. Such delegation of authority should be to staff personnel prepared by training and experience in fire protection and nuclear plant safety to provide a balanced approach in directing the fire protection programs for nuclear power plants. The qualification requirements for the fire protection engineer or consultant, who will assist in the design and selection of equipment, inspect and test the completed physical aspects of the system, develop the fire protection program, and assist in the fire-fighting training for the operating plant should be stated. Subsequently, the FSAR should discuss the training and the updating provisions such as fire drills provided for maintaining the competence of the station firefighting and operating crew, including personnel responsible for maintaining and inspecting the fire protection equipment.	Fermi 2 has agreed to implement the fire protection program contained in the staff supplemental guidance, "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance," dated August 29, 1977, including (1) fire protection organizations (2) fire brigade training (3) control of combustibles (4) control of ignition sources (5) fire-fighting procedures.
The fire protection staff should be responsible for: (a) Coordination of building layout and systems design with fire area requirements, including consideration of potential hazards associated with postulated design basis fires, (b) Design and maintenance of fire detection, suppression, and extinguishing systems, (c) Fire prevention activities, (d) Training and manual fire-fighting activities of plant personnel and the fire brigade. (NOTE: NFPA 6 - Recommendations for Organization of Industrial Fire Loss Prevention, contains useful guidance for organization and operation of the entire fire loss prevention program.)	

Position For Plants Under Construction and Operating Plants	EF-2 Response
2. Design Bases	
The overall fire protection program should be based upon evaluation of potential fire hazards throughout the plant and the effect of postulated design basis fires relative to maintaining ability to perform safety shutdown functions and minimize radioactive releases to the environment.	Section 9A.4 (Fire Hazards Analysis) provides this comparison. Likewise, plant emergency procedures are based on maintaining the plant in a safe condition.
3. Backup	
Total reliance should not be placed on a single automatic fire suppression system. Appropriate backup fire suppression capability should be provided.	In areas where automatic suppression systems are provided, adequate manual suppression equipment, including fire-hose stations and/or portable fire extinguishers, is available.
4. Single-Failure Criterion	
A single failure in the fire suppression system should not impair both the primary and backup fire suppression capability. For example, redundant fire water pumps with independent power supplier and controls should be provided. Postulated fires or fire protection system failures need not be considered concurrent with other plant accidents or the most severe natural phenomena. The effects of lightning strikes should be included in the overall plant fire protection program.	The fire suppression systems satisfy this requirement and are described in Position E.
5. Fire Suppression Systems	
Failure or inadvertent operation of the fire suppression system should not incapacitate safety related systems or components. Fire suppression systems that are pressurized during normal plant operation should meet the guidelines specified in APCSB Branch Technical Position 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment."	Failure or inadvertent operation of any fire suppression system will not incapacitate more than one division of safety-related systems or components. Analysis of fire protection piping failures was included in the moderate energy piping break evaluation, UFSAR Subsection 3.6.2.3.
6. Fuel Storage Areas	
Schedule for implementation of modifications, if any, will be established on a case-by-case basis.	The fire protection system as described in the FSAR in the fuel storage areas is operational
7. Fuel Loading	
Schedule for implementation of modifications, if any, will be established on a case-by-case basis.	The Fermi 2 Fire Protection System as described in UFSAR Subsection 9.5.1 and in this appendix in safety-related areas is operational.
8. Multiple-Reactor Sites	
On multiple-reactor sites where there are operating	N/A

Position For Plants Under Construction and Operating Plants	EF-2 Response
reactors and construction of remaining units is being completed, the fire protection program should provide continuing evaluation and include additional fire barriers, fire protection capability, and administrative controls necessary to protect the operating units from construction fire hazards. The superintendent of the operating plant should have the lead responsibility for site fire protection.	
9. Simultaneous Fires	
Simultaneous fires in more than one reactor need not be postulated, where separation requirements are met. A fire involving more than one reactor unit need not be postulated except for facilities shared between units.	N/A
b. Administrative Procedures, Controls and Fire Brigade	
1. Administrative procedures consistent with the need for maintaining the performance of the fire protection system and personnel in nuclear power plants should be provided. Guidance is contained in the following publications: NFPA 4 - Organization for Fire Services NFPA 4A - Organization for Fire Department NFPA 6 - Industrial Fire Loss Prevention NFPA 7 - Management of Fire Emergencies NFPA 8 - Management Responsibility for Effects of Fire on Operations	Fermi 2 has agreed to implement the fire protection program contained in the staff supplemental guidance, "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance," dated August 29, 1977, including: (1) fire protection organizations (2) fire brigade training (3) control of combustibles (4) control of ignition sources (5) fire-fighting procedures.
NFPA 27 Private Fire Brigades	NFPA codes containing information on the above topics were used for guidance.
2. Effective administrative measures should be implemented to prohibit bulk storage of combustible materials inside or adjacent to safety related buildings or systems during operation or maintenance periods. Regulatory Guide 1.39, "Housekeeping Requirements for Water-Cooled Nuclear Power Plants," provides guidance on housekeeping, including the disposal of combustible materials.	
3. Normal and abnormal conditions or other anticipated operations such as modifications (e.g., breaking fire stops, impairment of fire detection and suppression systems) and refueling activities should be reviewed by appropriate levels of management and appropriate special actions and procedures such as fire watches or temporary fire barriers implemented to assure adequate fire protection and reactor safety. In particular:	

Position For Plants Under Construction and Operating Plants	EF-2 Response

(a) Work involving ignition sources such as welding and flame cutting should be done under closely controlled conditions. Procedures governing such work should be reviewed and approved by persons trained and experienced in fire protection. Persons performing and directly assisting in such work should be trained and equipped to prevent and combat fires. If this is not possible, a person qualified in fire protection should directly monitor the work and function as a fire watch.

(b) Leak testing, and similar procedures such as air flow determination, should use one of the commercially available aerosol techniques. Open flames or combustion generated smoke should not be permitted.

(c) Use of combustible material, e.g., HEPA and charcoal filters, dry ion exchange resins or other combustible supplies, in safety related areas should be controlled. Use of wood inside buildings containing safety related systems or equipment should be permitted only when suitable noncombustible substitutes are not available. If wood must be used, only fire retardant treated wood (scaffolding, lay down blocks) should be permitted. Such materials should be allowed into safety related areas only when they are to be used immediately. Their possible and probable use should be considered in the fire hazard analysis to determine the adequacy of the installed fire protection systems.

4. Nuclear power plants are frequently located in remote areas, at some distance from public fire departments. Also, first response fire departments are often volunteer. Public fire department response should be considered in the overall fire protection program. However, the plant should be designed to be self-sufficient with respect to fire fighting activities and rely on the public response only for supplemental or backup capability.

5. The need for good organization, training and equipping of fire brigades at nuclear power plant sites requires effective measures be implemented to assure proper discharge of these functions. The guidance in Regulatory Guide 1.101, "Emergency Planning for Nuclear Power Plants," should be followed as applicable.

Position For Plants Under Construction and Operating Plants	EF-2 Response
(a) Successful fire fighting requires testing and maintenance of the fire protection equipment, emergency lighting and communication, as well as practice as brigades for the people who must utilize the equipment. A test plan that lists the individuals and their responsibilities in connection with routine tests and inspections of the fire detection and protection systems should be developed. The test plan should contain the types, frequency and detailed procedures for testing. Procedures should also contain instructions on maintaining fire protection during those periods when the fire protection system is impaired or during periods of plant maintenance, e.g., fire watches or temporary hose connections to water systems.	
(b) Basic training is a necessary element in effective fire fighting operation. In order for a fire brigade to operate effectively, it must operate as a team. All members must know what their individual duties are. They must be familiar with the layout of the plant and equipment location and operation in order to permit effective fire fighting operations during times when a particular area is filled with smoke or is insufficiently lighted. Such training can only be accomplished by conducting drills several times a year (at least quarterly) so that all members of the fire brigade have had the opportunity to train as a team, testing itself in the major areas of the plant. The drills should include the simulated use of equipment in each area and should be preplanned and post-critiqued to establish the training objective of the drills and determine how well these objectives have been met. These drills should periodically (at least annually) include local fire department participation where possible. Such drills also permit supervising personnel to evaluate the effectiveness of communications within the fire brigade and with the on scene fire team leader, the reactor operator in the control room, and the off-site command post.	
(c) To have proper coverage during all phases of operation, members of each shift crew should be trained in fire protection. Training of the plant fire brigade should be coordinated with the local fire department so that responsibilities and duties are delineated in	

Position For Plants Under Construction and Operating Plants	EF-2 Response
advance. This coordination should be part of the training course and implemented into the training of the local fire department staff. Local fire departments should be educated in the operational precautions when fighting fires on nuclear power plant sites. Local fire departments should be made aware of the need for radioactive protection of personnel and the special hazards associated with a nuclear power plant site.	
(d) NFPA 27, "Private Fire Brigade" should be followed in organization, training, and fire drills. This standard also is applicable to the inspection and maintenance of firefighting equipment. Among the standards referenced in this document, the following should be utilized: NFPA 194, "Standard for Screw Threads and Gaskets for Fire Hose Couplings," NFPA 196, "Standard for Fire Hose," NFPA 197, "Training Standard on Initial Fire Attacks," NFPA 601, "Recommended Manual of Instructions and Duties for the Plant Watchman on Guard." NFPA booklets and pamphlets listed on page 27-11 of Volume 8, 1971-72 are also applicable for good training references. In addition, courses in fire protection and fire suppression which are recognized and/or sponsored by the fire protection industry should be utilized.	

Position For Plants Under Construction and Operating Plants	EF-2 Response
c. Quality Assurance Program	
Quality assurance (QA) programs of applicants and contractors should be developed and implemented to assure that the requirements for design, procurement, installation, and testing and administrative controls for the fire protection program for safety-related areas as defined in this Branch Position are satisfied. The program should be under the management control of the QA organization. The QA program criteria that apply to the fire protection program should include the following:	The Quality Assurance Program for Plant Operation governs all activities which may affect safety-related structures, systems, and components at the plant. This program is described in Section 17.2 (QAPD) In view of the fact that safety-related structures, systems, and components are protected by the fire protection systems, portions of the Quality Assurance Program for Plant Operation are designed to ensure that fire protection in safety-related areas is maintained through requirements on design, procurement, installation, testing, and administrative controls. The QA program is under the management control of the Nuclear Quality Assurance (NQA) Department. The NQA Department verifies that the fire protection program incorporates suitable requirements and is acceptable to the senior onsite nuclear manager and also verifies its effectiveness through review, surveillance, and audits. All portions of the fire protection program that impact safety-related areas of the plant are programmatically defined in the Fermi Conduct Manuals and meet the guidtance as addressed in Appendix A of NRC Branch Technical Position APCSB 9.5-1 with the following stipulation. The fire protection system was not originally designed to be safety related.
1. Design Control and Procurement Document Control	
Measures should be established to assure that all design-related guidelines of the Branch Technical Position are included in design and procurement documents and that deviations there from are controlled.	These measures are part of the QA Program.
2. Instructions, Procedures and Drawings	
Inspections, tests, administrative controls, fire drills and training that govern the fire protection program should be prescribed by documented instructions, procedures or drawings and should be accomplished in accordance with these documents.	These items have been developed in accordance with the Fermi Conduct Manuals.

Position For Plants Under Construction and Operating Plants	EF-2 Response
3. Control of Purchased Material, Equipment and Services	
Measures should be established to assure that purchased material, equipment and services conform to the procurement documents.	This item is included in the QA Program.
4. Inspection	
A program for independent inspection of activities affecting fire protection should be established and executed by, or for, the organization performing the activity to verify conformance with documented installation drawings and test procedures for accomplishing the activities.	This item is included in the QA Program.
5. Test and Test Control	
A test program should be established and implemented to assure that testing is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. The tests should be performed in accordance with written test procedures; test results should be properly evaluated and acted on.	The test program is developed according to the requirements of the QA Program. The test results are reviewed by NQA through inspections, surveillances, or audits.
6. Inspection, Test and Operating Status	
Measures should be established to provide for the identification of items that have satisfactorily passed required tests and inspections.	These measures are part of Edison's tagging system and are part of the QA Program.
7. Non-Conforming Items	
Measures should be established to control items that do not conform to specified requirements to prevent inadvertent use or installation.	These measures are part of Edison's tagging system and are part of the QA Program.
8. Corrective Action	
Measures should be established to assure that conditions adverse to fire protection, such as failures, malfunctions, deficiencies, deviations, defective components, uncontrolled combustible material, and nonconformances are promptly identified, reported and corrected	This item is included in the QA Program.

Position For Plants Under Construction and Operating Plants	EF-2 Response
9. Records	
Records should be prepared and maintained to furnish evidence that the criteria enumerated above are being met for activities affecting the fire protection program.	Fire protection records are being maintained for this purpose according to the requirements of the QA Program.
10. Audits	
Audits should be conducted and documented to verify compliance with the fire protection program including design and procurement documents; instructions; procedures and drawings; and inspection and test activities.	Audits conducted by the NQA Department include the fire protection program.
d. General Guidelines for Plant Protection	
1. Building Design	
(a) Plant layouts should be arranged to:	The fire hazards analysis (Section 9A.4) identifies the fire areas and the safe-shutdown equipment within each area.
(1) Isolate safety related systems and	
(2) Separate redundant safety related systems from each other so that both are not subject to damage from a single fire hazard. Alternatives:	
(a) Redundant safety related systems that are subject to damage from a single fire hazard should be protected by a combination of fire retardant coatings and fire detection and suppression systems, or (b) a separate system to perform the safety function should be provided.	Locations where redundant systems are exposed to a single fire hazard are identified in the fire hazards analysis (Section 9A.4). Adequate fire protection is provided for these areas.
(b) In order to accomplish 1(a) above, safety related systems and fire hazards should be identified throughout the plant. Therefore, a detailed fire hazard analysis should be made. The fire hazards analysis should be reviewed and updated as necessary. Additional fire hazards analysis should be done after any plant modification.	See the fire hazards analysis, Section 9A.4.
(c) Alternative guidance for constructed plants is shown in Section E.3, "Cable Spreading Room."	

	Position For Plants Under Construction and Operating Plants	EF-2 Response
(d)	Interior wall and structural components, thermal insulation materials and radiation shielding materials and sound-proofing should be noncombustible or listed by a nationally recognized testing laboratory, such as Factory Mutual or Underwriters Laboratory, Inc. for flame spread, smoke and fuel contribution of 25 or less in its use configuration (ASTM E-84 Test, "Surface Burning Characteristics of Building Materials").	Plant structural components satisfy thie criterion or have approved deviations.
(e)	Metal deck roof construction should be noncombustible (see the building materials directory of the Underwriters Laboratory, Inc.) or listed as Class I by Factory Mutual System Approval Guide. Where combustible material is used in metal deck roofing design, acceptable alternatives are (i) replace combustibles with non-combustible materials, (ii) provide an automatic sprinkler system, or (iii) provide ability to cover roof exterior and interior with adequate water volume and pressure.	All metal deck roof construction is noncombustible and is listed as Class I by the Factory Mutual System Approval Guide.
(f)	Suspended ceilings and their supports should be of noncombustible construction. Concealed spaces should be devoid of combustibles. Adequate fire detection and suppression systems should be provided where full implementation is not practicable.	Plant areas satisfy these criteria.
(g)	High voltage - high amperage transformers installed inside buildings containing safety related systems should be of the dry type or insulated and cooled with non-combustible liquid. Safety related systems that are exposed to flammable oil filled transformers should be protected from the effects of a fire by: (i) replacing with dry transformers or transformers that are insulated and cooled with noncombustible liquid; or (ii) enclosing the transformer with a three-hour fire barrier and installing automatic water spray protection.	Inside transformers are dry type.

	Position For Plants Under Construction and Operating Plants	EF-2 Response
(h)	Buildings containing safety related systems, having openings in exterior walls closer than 50 feet to flammable oil filled transformers should be protected from the effects of a fire by: (i) closing of the opening to have fire resistance equal to three hours (ii) constructing a three-hour fire barrier between the transformers and the wall openings; or (iii) closing the opening and providing the capability to maintain a water curtain in case of a fire.	Outdoor oil-filled transformers are within 50 ft of openings in the turbine building wall. Transformers are adequately protected by fixed automatic water spray systems. A solid metal door is provided for the turbine building west wall
(i)	Floor drains, sized to remove expected fire fighting water flow should be provided in those areas where fixed water fire suppression systems are installed. Drains should also be provided in other areas where hand hose lines may be used if such fire-fighting water could cause unacceptable damage to equipment in the area. Equipment should be installed on pedestals, or curbs should be provided as required to contain water and direct it to floor drains. (See NFPA 92M, "Waterproofing and Draining of Floors.") Drains in areas containing combustible liquids should have provisions for preventing the spread of fire throughout the drain system. Water drainage from areas which may contain radioactivity should be sampled and analyzed before discharge to the environment. In operating plants or plants under construction, if accumulation of water from the operation of new fire suppression systems does not create unacceptable consequences, drains need not be installed.	Floor drains are designed to remove the expected fire-fighting water flow from areas where fixed fire suppression systems are installed or where fire hose may be used. Equipment is installed on pedestals. Drains in areas containing combustible liquids are designed to prevent the spread of fire throughout the drain system. Water drainage from areas that may contain radioactivity is collected in the floor drain collection tank for normal liquid waste. Subsection 9.3.3 of the UFSAR describes the floor drain system in all the buildings. Section 11.2 of the UFSAR describes the handling and processing of liquid radioactive waste.

Position For Plants Under Construction and Operating Plants	EF-2 Response
(j) Floors, walls and ceilings enclosing separate fire areas should have minimum fire rating of three hours. Penetrations in these fire barriers, including conduits and piping, should be sealed or closed to provide a fire resistance rating at least equal to that of the fire barrier itself. Door openings should be protected with equivalent rated doors, frames and hardware that have been tested and are approved by a nationally recognized laboratory. Such doors should be normally closed and locked or alarmed with alarm and annunciation in the control room. Penetrations for ventilation system should be protected by a standard "fire door damper" where recognized. (Refer to NFPA 80, "Fire Doors and Windows.") The fire hazard in each area should be evaluated to determine barrier requirements. If barrier fire resistance cannot be made adequate, fire detection and suppression should be provided, such as: (i) water curtain in case of fire, (ii) flame retardant coatings, (iii) additional fire barriers.	The fire hazards analysis identifies the fire barriers and determines the requirements for maintaining their integrity. As detailed in Section 9A.4, door openings are protected with equivalent rated doors, frames, and hardware that have been tested and approved by a nationally recognized laboratory. Such doors are normally closed and alarmed with alarm and annunciation in the control room (a continuously manned location), or checked daily, or alarmed with annunciation to Security (a continuously manned location), or locked and checked weekly, all of which are acceptable monitoring methods described in Branch Technical Position CMEB 9.5-1, Revision 2. Penetrations for ventilation systems are protected by fire dampers where deemed necessary as a result of the fire hazards analysis. Electrical conduits penetrating rated fire barriers are provided with internal seals unless they meet the criteria of 9A.2.3.1.1 for not requiring internal seals for fire.
2. Control of Combustibles	
(a) Safety related systems should be isolated or separated from combustible materials. When this is not possible because of the nature of the safety system or the combustible material, special protection should be provided to prevent a fire from defeating the safety system function. Such protection may involve a combination of automatic fire suppression, and construction capable of withstanding and containing a fire that consumes all combustibles present. Examples of such combustible materials that may not be separable from the remainder of its system are: (1) Emergency diesel generator fuel oil day tanks (2) Turbine-generator oil and hydraulic control fluid systems (3) Reactor coolant pump lube oil system	The fire hazards analysis identifies these hazards and the protection afforded.

	Position For Plants Under Construction and Operating Plants	EF-2 Response
(b)	Bulk gas storage (either compressed or cryogenic), should not be permitted inside structures housing safety-related equipment. 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 safety related systems or equipment. (Refer to NFPA 50A, "Gaseous Hydrogen Systems.")	Bulk gas is stored in outside areas. A fire or explosion will not adversely affect any safety-related systems or equipment.
	Care should be taken to locate high pressure gas storage containers with the long axis parallel to building walls. This will minimize the possibility of wall penetration in the event of a container failure. Use of compressed gases (especially flammable and fuel gases) inside buildings should be controlled. (Refer to NFPA 6, "Industrial Fire Loss Prevention.")	High-pressure gas storage containers will be located with the long axis parallel to the adjacent safety-related building wall.
(c)	The use of plastic materials should be minimized. In particular, halogenated plastics such as polyvinyl chloride (PVC) and neoprene should be used only when substitute non-combustible materials are not available. All plasticmaterials, including flame and fire retardant materials, will burn with an intensity and BTU production in a range similar to that of ordinary hydrocarbons. When burning, they produce heavy smoke that obscures visibility and can plug air filters, especially charcoal and HEPA. The halogenated plastics also release free chlorine and hydrogen chloride when burning which are toxic to humans and corrosive to equipment.	Plastic materials throughout the plant are negligible.
(d)	Storage of flammable liquids should, as a minimum, comply with the requirements of NFPA 30, "Flammable and Combustible Liquids Code."	NFPA 30 was used as a guideline for storage of flammable liquids.
3.	Electric Cable Construction, Cable Trays and Cable Penetrations	
(a)	Only non-combustible materials should be used for cable tray construction.	Cable trays are of non-combustible metal construction.
(b)	See Section F.3 for fire protection guidelines for cable spreading rooms.	

	Position For Plants Under Construction and Operating Plants	EF-2 Response
(c)	Automatic water sprinkler systems should be provided for cable trays outside the cable spreading room. Cables should be designed to allow wetting down with deluge water without electrical faulting. Manual hose stations and portable hand extinguishers should be provided as backup. Safety related equipment in the vicinity of such cable trays, that does not itself require water fire protection, but is subject to unacceptable damage from sprinkler water discharge, should be protected from sprinkler system operation or malfunction. When safety related cables do not satisfy the provisions of Regulatory Guide 1.75, all exposed cables should be covered with an approved fire retardant coating and a fixed automatic water fire suppression system should be provided.	Automatic water sprinkler systems will be provided in areas of concentrated cable loading of redundant channels in accordance with the fire hazards analysis. Manual hose stations and portable hand extinguishers are provided as backup. Potential water damage will be considered where water sprays are used. Safety-related and balance-of-plant (BOP) cables are in compliance with IEEE 383/1974 for flame-retardant cable. This standard is referenced in Regulatory Guide 1.75. As addressed in UFSAR Subsection A.1.75, the noncompliance with Regulatory Guide 1.75 is in the identification of associated circuits only. (NOTE: For Exceptions, See Section 8.3.1.4.2)
(d)	Cable and cable tray penetration of fire barriers (vertical and horizontal) should be sealed to give protection at least equivalent to that fire barrier. The design of fire barriers for horizontal and vertical cable trays should, as a minimum, meet the requirements of ASTM E-119, "Fire Test of the Building Construction and Materials, "including the hose stream test, Where installed penetration seals are deficient with respect to fire resistance, these seals may be protected by covering both sides with an approved fire retardant material. The adequacy of using such material should be demonstrated by suitable testing.	Cable penetrations in fire barriers are sealed with silicone foam consistent with fire barrier fire resistance requirements.
(e)	Fire breaks should be provided as deemed necessary by the fire hazards analysis. Flame or flame retardant coatings may be used as a fire break for grouped electrical cables to limit spread of fire in cable ventings. (Possible cable derating owing to use of such coating materials must be considered during design.)	Fire breaks are provided where electrical cables penetrate walls and floors. Also, fire breaks are installed in cable trays of intervening combustibles. Instrument cable trays are enclosed solid-metal trays with covers which serve as radiant energy barriers.

	Position For Plants Under Construction and Operating Plants	EF-2 Response
(f)	Electric cable constructions should as a minimum pass the current IEEE No. 383flame test. (This does not imply that cables passing this test will not require additional fire protection.) For cable and plants under construction that do not meet the IEEE No. 383 flame test requirements, all cables must be covered with an approved flame-retardant coating and properly derated.	Safety-related and BOP cable* satisfies Edison Specification 3071-80 flame test requirements. This specification required a flame test setup on both ladder and solid bottom trays at a horizontal/vertical joint. The test used a 120,000 Btu, 14-in. wheel-type propane burner with a contact flame at 1500°F. Trays were loaded with a single layer of cable spread 1/2 diameter apart. On the ladder tray, the fire could not be self-propagating nor could the cable fail electrically after 5 minutes. On the solid bottom tray, the fire could not be self-propagating after 10 minutes of burner operation. In December 1988, Detroit Edison Specification 3071-080 was revised to require flame tests in accordance with IEEE 383-1974.
(g)	To the extent practical cable construction that does not give off gases while burning should be used. Applicable to new cable installations.	New cables will satisfy Edison Specification 3071-80 test requirements. (NOTE: For Exceptions, See Section 8.3.1.4.2)
(h)	Cable trays, raceways, conduit, trenches, or culverts should be used only for cables. Miscellaneous storage should not be permitted, nor should piping for flammable or combustible liquids or gases be installed in these areas. Installed equipment in cable tunnels or culverts, need not be removed if they present no hazard to the cable runs as determined by the fire hazards analysis.	This criterion is satisfied.
(i)	The design of cable tunnels, culverts and spreading rooms should provide for automatic or manual smoke venting as required to facilitate manual fire fighting capability.	The cable spreading areas are not provided with automatic or manual smoke venting. A low-pressure carbon dioxide system or Halon system is installed to provide extinguishment prior to generation of any appreciable amount of smoke. Portable fans would be used to exhaust smoke from affected areas.
(j)	Cables in the control room should be kept to the minimum necessary for operation of the control room. All cables entering the control room should terminate there. Cables should not be installed in floor trenches or culverts in the control room. Existing cabling installed in concealed floor and ceiling spaces should be protected with an automatic total flooding halon system.	Cables in the control room come from the cable spreading area and terminate in control panels, consoles, or equipment. However, some cabling is installed in the concealed floor of the computer area. An automatic Halon suppression system is provided for the protection of the concealed floor and the computer room.

Position For Plants Under Construction and Operating Plants	EF-2 Response
4. Ventilation	
(a) The products of combustion that need to be removed from a specific fire area should be evaluated to determine how they will be controlled. Smoke and corrosive gases should generally be automatically discharged directly outside to a safe location. Smoke and gases containing radioactive materials should be monitored in the fire area to determine if release to the environment is within the permissible limits of the plant Technical Specifications. The products of combustion which need to be removed from a specific fire area should be evaluated to determine how they will be controlled.	Ventilation for critical areas is evaluated in Sections 9A.2 and 9A.4 of this report. Areas having potential for release of radioactive material are also outlined. Monitoring of radioactive contamination is discussed in UFSAR Subsection 12.2.4.
(b) Any ventilation system designed to exhaust smoke or corrosive gases should be evaluated to ensure that inadvertent operation or single failures will not violate the controlled areas of the plant design. This requirement includes containment functions for protection of the public and maintaining habitability for operations personnel.	No systems are designed solely for smoke removal. Existing ventilation systems that would be used for smoke removal satisfy these criteria.
(c) The power supply and controls for mechanical ventilation systems should be run outside the fire area served by the system.	The power supply and controls for the mechanical ventilation systems used to cool redundant safe-shutdown equipment have been run in the same area as the applicable equipment. These controls satisfy the separation requirements
(d) Fire suppression systems should be installed to protect charcoal filters in accordance with Regulatory Guide 1.52, "Design Testing and Maintenance Criteria for Atmospheric Cleanup Air Filtration."	Charcoal filters are protected with manual deluge or carbon dioxide suppression systems.
(e) The fresh air supply intakes to areas containing safety related equipment or systems should be located remote from the exhaust air outlets and smoke vents of other fire areas to minimize the possibility of contaminating the intake air with the products of combustion.	Fresh air supply intakes are remotely located with respect to exhaust air outlets. Thus the possibility of contaminating the intake air with the products of combustion is minimized.

	Position For Plants Under Construction and Operating Plants	EF-2 Response
(f)	Stairwells should be designed to minimize smoke infiltration during a fire. Staircases should serve as escape routes and access routes for fire fighting. Fire exit routes should be clearly marked. Stairwells, elevators and chutes should be enclosed in masonry towers with minimum fire rating of three hours and automatic fire doors at least equal to the enclosure construction, at each opening into the building. Elevators should not be used during fire emergencies. Where stairwells or elevators cannot be enclosed in three hours fire rated barrier with equivalent fire doors, escape and access routes should be established by a pre-fire plan and practiced in drills by operating and fire brigade personnel.	Some of the stairwells are enclosed. (See the fire protection layout drawings attached to this report.) Stairwells serve as escape routes and access routes for fire fighting. Escape and access routes will be established by pre-fire plan and will be practiced in drills by operating and fire brigade personnel.
(g)	Smoke and heat vents may be useful in specific areas such as cable spreading rooms and diesel fuel oil storage areas and switchgear rooms. When natural-convection ventilation is used, a minimum ratio of 1 sq. foot of venting area per 200 sq feet of floor area should be provided. If forced-convection ventilation is used, 300 CFM should be provided for every 200 sq feet of floor area. See NFPA No. 204 for additional guidance on smoke control.	Natural convection heat venting of 1 ft^2 per 200 ft^2 is used in the turbine room floor area. Forced convection ventilation is provided in all other areas with a minimum design of one air change per hour. The control center smoke purge mode provides 250 cfm per 200 ft^2 floor area for the cable spreading room.

Position For Plants Under Construction and Operating Plants	EF-2 Response
(h) Self-contained breathing apparatus, using full face positive pressure masks, approved by NIOSH (National Institute for Occupational Safety and Health - approval formerly given by the U.S. Bureau of Mines) should be provided for fire brigade, damage control and control room personnel. Control room personnel may be furnished breathing air by a manifold system piped from a storage reservoir if practical. Service or operating life should be a minimum of one-half hour for the self-contained units. At least two extra air bottles should be located onsite for each self-contained breathing unit. In addition, an onsite 6-hour supply of reserve air should be provided and arranged to permit quick and complete replenishment of exhausted supply air bottles as they are returned. If compressors are used as a source of breathing air, only units approved for breathing air should be used. Special care must be taken to locate the compressor in areas free of dust and contaminants.	The plant will use full-face positive-pressure breathing masks, approved by NIOSH. Masks will be available for the fire brigade, damage control, or other control room personnel. The plant breathing air system provides a manifold on the south wall of the control room which will supply breathing air to five connection points. Each self-contained breathing unit will have at least two extra fully charged bottles onsite at all times. The plant will have an onsite air compressor for charging the breathing air bottles.
(i) Where total flooding gas extinguishing systems are used, area intake and exhaust ventilation dampers should close upon initiation of gas flow to maintain necessary gas concentration. (See NFPA 12, "Carbon Dioxide Systems," and 12A, "Halon 1301 Systems.")	Where required, ventilation dampers close on actuation of gaseous extinguishing systems to maintain the necessary gas concentration.
5. Lighting and Communication Lighting and two way voice communication are vital to safe shutdown and emergency response in the event of fire. Suitable fixed and portable emergency lighting and communication devices should be provided to satisfy the following requirements:	
(a) Fixed emergency lighting should consist of sealed beam units with individual 8-hour minimum battery power supplies.	Fixed emergency lighting with 8-hr battery power supplies is provided for the control room, safety-related equipment areas, and means of egress except in the yard area route to the residual heat removal (RHR) complex where yard security lights are used to provide a lighted pathway.
(b) Suitable sealed beam battery powered portable hand lights should be provided for emergency use.	Automatically operated, sealed-beam battery-powered lights and sealed-beam battery-powered portable hand lights will be provided for emergency use.

Position For Plants Under Construction and Operating Plants	EF-2 Response
(c) Fixed emergency communication should use voice powered head sets at preselected stations.	Emergency communications capability is provided by telephones, public address systems, and radio communications equipment powered from redundant power sources.
(d) Fixed repeaters installed to permit use of portable radio communication units should be protected from exposure to fire damage.	Repeater stations are installed to improve the quality of radio communication. Loss of a particular repeater will not result in a loss of communication capability in the area adjacent to the repeater.

e. Fire Detection and Suppression

1. Fire Detection

(a) Fire detection systems should as a minimum comply with NFPA 72D, "Standard for the Installation Maintenance and Use of Proprietary Protective Signaling Systems." Deviations from the requirements of NFPA 72D should be identified and justified.	Fire detection systems were installed using NFPA 72D as guidance. No recorder is provided in the main control room. This deviation has been approved because adequate records are kept.
(b) Fire detection system should give audible and visual alarm and annunciation in the control room. Local audible alarms should also sound at the location of the fire.	Plant fire detectors will alarm in the control room on the fire protection control panel that will designate general fire location (detector subpanels). Local alarms will sound at the sub-panels that will pinpoint individual room and/or detector location.
c) Fire alarms should be distinctive and unique. They should not be capable of being confused with any other plant system alarms.	Fire alarms will be distinctive and unique and should not be confused with any other plant system alarms.
(d) Fire detection and actuation systems should be connected to the plant emergency power supply.	Fire detection and actuation systems are connected to the plant emergency power supply.

2. Fire Protection Water Supply Systems

(a) An underground yard fire main loop should be installed to furnish anticipated fire water requirements. NFPA 24 - Standard for Outside Protection - gives necessary guidance for such installation. It references other design codes and standards developed by such organizations as the American National Standards Institute (ANSI) and the American Water Works Association (AWWA). Lined steel or cast iron pipe should be used to reduce internal tuberculation. Such tuberculation deposits in an unlined pipe over a period of years can significantly reduce water flow through the	The underground yard fire main loop was installed using NFPA 24 for guidance. Subsection 9.5.1.2.1 of the UFSAR gives a detailed description of the system. Underground carbon steel pipe is coated, wrapped and provided with cathodic protection. Above-ground pipe is carbon steel. Flushing is accomplished using Fire hydrants. No means for treatment is available. Sectional control valves (post indicator valves) are provided to isolate portions of the fire main for maintenance or repair without shutting down the entire system. Position indicators are provided with the sectional control valves. Branch lines outside the protected area

	Position For Plants Under Construction and Operating Plants	EF-2 Response
	combination of increased friction and reduced pipe diameter. Means for treating and flushing the systems should be provided. Approved visually indicating sectional control valves, such as Post Indicator Valves, should be provided to isolate portions of the main for maintenance or repair without shutting off the entire system. Visible location marking signs for underground valves is acceptable. Alternative valve position indicators should also be provided.	include coated, wrapped and cathodically protected carbon steel, cement lined ductile iron, asbestos-cement and poly vinyl chloride pipe.
	The fire main system piping should be separate from service or sanitary water system piping. For operating plants, fire main system piping that can be isolated from service or sanitary water system piping is acceptable.	The fire main system piping is connected to the general service water system. Isolation valves are provided.
(b)	A common yard fire main loop may serve multi-unit nuclear power plant sites, if cross-connected between units. Sectional control valves should permit maintaining independence of the individual loop around each unit. For such installations, common water supplies may also be utilized. The water supply should be sized for the largest single expected flow. For multiple reactor sites with widely separated plants (approaching 1 mile or more), separate yard fire main loops should be used. Sectionalized systems are acceptable.	N/A
(c)	If pumps are required to meet system pressure or flow requirements, a sufficient number of pumps should be provided so that 100% capacity will be available with one pump inactive (e.g., three 50% pumps, two 100% pumps). The connection to the yard fire main loop from each fire pump should be widely separated, preferably located on opposite sides of the plant. Each pump should have its own driver with independent power supplies and control. At least one pump (if not powered from the emergency diesels) should be driven by non-electrical means, preferably diesel engine. Pumps and drivers should be located in rooms separated from the remaining pumps and equipment by a minimum three-hour fire wall. Alarms indicating pump running, driver availability, or failure to start should be provided in the control room.	Two fire pumps (2500 gpm at 150 psig; one diesel driven and one electric motor driven) are provided for the plant. Connections to the yard fire main loop are 2.68 ft apart. The diesel-driven fire pump is separated from the electric-motor-driven fire pump by a 3-hr-rated fire barrier in the general service water pump house. Alarms indicating pump running, driver availability, and failure to start are provided in the control room.

	Position For Plants Under Construction and Operating Plants	EF-2 Response
	Details of the fire pump installation should as a minimum conform to NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps."	The fire pump installation conforms to the intent of NFPA 20, except for certain deviations, with supporting justifications, identified in section 9.5.1.2.3.2.
(d)	Two separate reliable water supplies should be provided. If tanks are used, two 100% (minimum of 300,000 gallons each) system capacity tanks should be installed. They should be so interconnected that pumps can take suction from either or both. However, a leak in one tank or its piping should not cause both tanks to drain.	Water supply is from Lake Erie.
	The main plant fire water supply capacity should be capable of refilling either tank in a minimum of eight hours. Common tanks are permitted for fire and sanitary or service water storage. When this is done, however, minimum fire water storage requirements should be dedicated by means of a vertical standpipe for other water services.	N/A
(e)	The fire water supply (total capacity and flow rate) should be calculated on the basis of the largest expected flow rate for a period of two hours, but not less than 300,000 gallons. This flow rate should be based (conservatively) on 1,000 gpm for manual hose streams plus the greater of: (1) all sprinkler heads opened and flowing in the largest designed fire area; or (2) the largest open head deluge system(s) operating.	The maximum flow demand is estimated to be less than 1500 gpm to the most remote deluge system, plus 500 gpm for manual hose streams. A single pump is designed to operate at 150 percent of rated capacity and provide 3750 gpm. The capabilities of the Diesel Fire Pump and diesel engine driver are described in section 9.5.1.2.3.2.
(f)	Lakes or fresh water ponds of sufficient size may qualify as sole source of water for fire protection, but require at least two intakes to the pump supply. When a common water supply is permitted for fire protection and the ultimate heat sink, the following conditions should also be satisfied:	Lake Erie is the source of fire service water.
	(1) The additional fire protection water requirements are designed into the total storage capacity; and	N/A
	(2) Failure of the fire protection system should not degrade the function of the ultimate heat sink.	N/A
(g)	Outside manual hose installation should be sufficient to reach any location with an effective hose stream. To accomplish this	Fire hydrants are located not more than 300 ft apart around the perimeter of the plant. The lateral to each fire hydrant is provided with a

Position For Plants Under Construction and Operating Plants	EF-2 Response
hydrants should be installed approximately every 250 feet on the yard main system. The lateral to each hydrant from the yard main should be controlled by a visually indicating or key operated (curb) valve. A hose house, equipped with hose and combination nozzle, and other auxiliary equipment recommended in NFPA 24, "Outside Protection," should be provided as needed but at least every 1,000 feet.	valve. The system is designed so that the sectional control valves (post-indicator valves) can isolate one, two, or three fire hydrants. Selected fire hydrants are provided with hose houses which contain 250 ft of 2-1/2 in. hose, 200 ft of 1-1/2 in. hose, combination fog nozzle, and auxiliary equipment, as deemed necessary.
Threads compatible with those used by local fire departments should be provided on all hydrants, hose couplings and standpipe risers.	The thread size used on hydrants, hose couplings, and standpipe risers is compatible with the Frenchtown Township Fire Department.
3. Water Sprinklers and Hose Standpipe Systems	
(a) Each automatic sprinkler system and manual hose station standpipe should have an independent connection to the plant underground water main. Headers fed from each end are permitted inside buildings to supply multiple sprinkler and standpipe systems. When provided, such headers are considered an extension of the yard main system. The header arrangement should be such that no single failure can impair both the primary and backup fire protection systems.	Underground connections are provided to various buildings to supply standpipe and sprinkler systems as shown on Figure 9A-1. Headers fed from both ends are not provided in the buildings. In the reactor/auxiliary building, two connections (feeds) are provided from the plant underground water main. All standpipes are fed from one connection; all sprinkler systems are fed from the other connection. Isolation valves are provided to separate the primary (automatic) sprinkler systems from the secondary (standpipe) systems.
Each sprinkler and standpipe system should be equipped with OS&Y (outside screw and yoke) gate valve, or other approved shut off valve, and water flow alarm. Safety related equipment that does not itself require sprinkler water fire protection, but is subject to unacceptable damage if wetted by sprinkler water discharge should be protected by water shields or baffles.	Each sprinkler and standpipe system is equipped with an OS&Y gate valve. Each sprinkler system is equipped with a water flow alarm. Standpipe systems are equipped with a water flow alarm. Safety-related equipment has been protected from water damage.
(b) All valves in the fire water systems should be electrically supervised. The electrical supervision signal should indicate in the control room and other appropriate command locations in the plant. (See NFPA 26, "Supervision of Valves.") When electrical supervision of fire protection valves is not practicable, an adequate management supervision program should be provided. Such a program should include locking valves open with strict key control; tamper proof seals; and periodic, visual check of all valves.	Shutoff valves controlling sprinkler and deluge systems are electrically supervised and actuate alarms in the control room or other normally manned security area. Sectional and divisional valves of the underground fire main and major valves inside the building will be locked open. Routine fire inspection by the plant operations engineer delegate will check valve positions, status, and seals.

	Position For Plants Under Construction and Operating Plants	EF-2 Response
(c)	Automatic sprinkler systems should as a minimum conform to requirements of appropriate standards such as NFPA 13, "Standard for the Installation of Sprinkler Systems," and NFPA 15, "Standard for Water Spray Fixed Systems."	Sprinkler systems throughout the plant were installed using NFPA 13 and/or NFPA 15 for guidance. Certain noncompliances to NFPA 13 have been evaluated in accordance with Generic Letter 86-10 and are referenced in section 9.5.1.1.2.
(d)	Interior manual hose installation should be able to reach any location with at least one effective hose stream. To accomplish this, standpipes with hose connections equipped with a maximum of 75 feet of 1-1/2 inch woven jacket lined fire hose and suitable nozzles should be provided in all buildings, including containment, on all floors and should be spaced at not more than 100-foot intervals. Individual standpipes should be at least 4-inch diameter for multiple hose connections and 2-1/2-inch diameter for single hose connections. These systems should follow the requirements of NFPA No. 14 for sizing, spacing and pipe support requirements (NELPIA).	Hose reels are provided throughout the plant as indicated on the fire protection layout drawings. Fire hose is approved 1-1/2 in. lined hose. Individual standpipes are 4-in.-diameter for multiple hose connections and 2-1/2-in.-diameter for single hose connections. NFPA 14 was used for guidance for sizing, spacing, and pipe supports.
	Hose stations should be located outside entrances to normally unoccupied areas and inside normally occupied areas. Standpipes serving hose stations in areas housing safety-related equipment should have shutoff valves and pressure-reducing devices (if applicable) outside the area.	Hose stations are mainly located outside entrances to normally unoccupied areas. Shutoff valves are provided at each hose station where required. Pressure-reducing devices are provided on the 5th floor of the reactor building and below grade, 583 ft 6 in., due to excessive system pressure. Since fog nozzles, which act as effective pressure-reducing devices, are used throughout the remainder of the plant and since fire brigade members who use the hose stations are trained to use the higher outlet pressures in excess of 100 psi, pressure-reducing devices are not provided elsewhere.
(e)	The proper type of hose nozzles to be supplied to each area should be based on the fire hazard analysis. The usual combination spray/straight-stream nozzle may cause unacceptable mechanical damage (for example, the delicate electronic equipment in the control room) and be unsuitable. Electrically safe nozzles should be provided at locations where electrical equipment or cabling is located.	All areas are provided with adjustable pattern fog nozzles, except for the refueling floor, which has solid stream nozzles. Personnel are adequately trained to make proper use of hose stations.
(f)	Certain fires such as those involving flammable liquids respond well to foam suppression. Consideration should be given to use of any of the available foams for such	There are no major flammable liquid hazards in the plant. Areas involving combustible liquids are adequately protected with a sprinkler or deluge system.

Position For Plants Under Construction and Operating Plants	EF-2 Response
specialized protection application. These include the more common chemical and mechanical low expansion foams, high expansion foam and the relatively new aqueous film forming foam (AFFF).	
4. Halon Suppression Systems	
The use of Halon fire extinguishing agents should as a minimum comply with the requirements of NFPA 12A and 12B, "Halogenated Fire Extinguishing Agent Systems-Halon 1301 and Halon 1211." Only UL or FM approved agents should be used.	NFPA 12A was used for guidance for the Installation of Halon systems.
In addition to the guidelines of NFPA 12A and 12B, preventative maintenance and testing of the systems, including check weighing of the Halon cylinders should be done at least quarterly. Particular consideration should also be given to:	Liquid level measurement of the cylinders and testing of the system will conform to the fire protection conditions for operation, Section 9A.6.
(a) minimum required Halon concentration and soak time (b) toxicity of Halon (c) toxicity and corrosive characteristics of thermal decomposition products of Halon.	Consideration will be given to items (a), (b), and (c).
5. Carbon Dioxide Suppression Systems	
The use of carbon dioxide extinguishing systems should as a minimum comply with the requirements of NFPA 12, "Carbon Dioxide Extinguishing Systems."	Carbon dioxide systems are provided for protection of certain cable tray areas outside the control center complex, the EDG rooms, and SGTS charcoal filters. The carbon dioxide systems are designed using NFPA Standard 12 for guidance.
Particular consideration should also be given to: (a) minimum required CO_2 concentration and soak time; (b) toxicity of CO_2; (c) possibility of secondary thermal shock (cooling) damage; (d) offsetting requirements for venting during CO_2 injection to prevent over-pressurization versus sealing to prevent loss of agent; (e) design requirements from over-pressurization; and (f) possibility and probability of CO_2 systems being out-of-service because of personnel safety consideration. CO_2 systems are disarmed whenever people are present in an area so protected. Areas entered frequently (even though duration time for any visit is short) have often been found with CO_2 systems shut off.	Consideration has been given to items (a) through (f).

Position For Plants Under Construction and Operating Plants	EF-2 Response
6. Portable Extinguishers	
Fire extinguishers should be provided in accordance with guide lines of NFPA 10 and 10A, "Portable Fire Extinguishers, Installation, Maintenance and Use." Dry chemical extinguishers should be installed with due consideration given to cleanup problems after use and possible adverse effects on equipment installed in the area.	Portable fire extinguishers are provided using NFPA 10 as guidance.
F. Guidelines for Specific Plant Areas	
1. Primary and Secondary Containment	
(a) Normal Operation	
Fire protection requirements for the primary and secondary containment areas should be provided on the basis of specific identified hazards. For example: a. Lubricating oil or hydraulic fluid system for the primary coolant pumps b. Cable tray arrangements and cable penetrations c. Charcoal filters	
Fire suppression systems should be provided based on the fire hazards analysis. Fixed fire suppression capability should be provided for hazards that could jeopardize safe plant shutdown. Automatic sprinklers are preferred. An acceptable alternate is automatic gas (Halon or CO_2) for hazards identified as requiring fixed suppression protection. An enclosure may be required to confine the agent if a gas system is used. Such enclosure should not adversely affect safe shutdown, or other operating equipment in containment. Automatic fire suppression capability need not be provided in the primary containment atmospheres that are inerted during normal operation. However, special fire protection requirements during refueling and maintenance operations should be satisfied as provided below.	The fire hazards analysis outlines the protection for containment areas.

Position For Plants Under Construction and Operating Plants	EF-2 Response
(b) Refueling and Maintenance	
Refueling and maintenance operations in containment may introduce additional hazards such as contamination control materials, decontamination supplies, wood planking, temporary wiring, welding and flame cutting (with portable compressed fuel gas supply). Possible fires would not necessarily be in the vicinity of fixed detection and suppression systems. Management procedures and controls necessary to assure adequate fire protection are discussed in Section 3a. In addition, manual fire fighting capability should be permanently installed in containment. Standpipes with hose stations, and portable fire extinguishers, should be installed at strategic locations throughout containment for any required manual fire fighting operations. Equivalent protection from portable systems should be provided if it is impractical to install standpipes with hose stations. Adequate self-contained breathing apparatus should be provided near the containment entrances for fire fighting and damage control personnel. These units should be independent of any breathing apparatus or air supply systems provided for general plant activities	It is impractical to provide a standpipe system inside the plant Mark I containment. During refueling, portable extinguishers and self-contained breathing apparatus will be located outside primary containment and portable extinguishers will be located inside containment at various work locations. Hose stations with hose reels are located nearby in the reactor building.
2. Control Room	
The control room is essential to safe reactor operation. It must be protected against disabling fire damage and should be separated from other areas of the plant by floors, walls and roofs having minimum fire resistance ratings of three hours.	The control room is separated from other areas of the plant by fire rated floor, walls, and ceiling. Section 9A.4 discusses fire-resistance ratings of these barriers and outlines the protection for the control room.
Control room cabinets and consoles are subject to damage from two distinct fire hazards: (a) Fire originating within a cabinet or console; and (b) Exposure fire involving combustibles in the general room area	
Hose stations adjacent to the control room with portable extinguishers in the control room are acceptable.	A hose station is provided adjacent to the control room. Fire extinguishers are provided adjacent to or in the control room.
Nozzles that are compatible with the hazards and equipment in the control room should be provided for the manual hose station. The nozzles chosen should satisfy actual fire fighting needs, satisfy electrical safety and minimize physical damage to electrical equipment from hose stream impingement.	Adjustable pattern fog nozzles are provided. Personnel are trained in their safe use.

Position For Plants Under Construction and Operating Plants	EF-2 Response
Fire detection in the control room cabinets, and consoles should be provided by smoke and heat detectors in each fire area. Alarm and annunciation should be provided in the control room. Fire alarms in other parts of the plant should also be alarmed and annunciated in the control room.	Ionization detectors are provided in the ceiling of the room as well as in the control room cabinets and consoles. Additional protection is outlined in the fire hazards analysis. Fire alarms in other plant locations are annunciated and actuate alarms in the control room.
Breathing apparatus for control room operators should be readily available. Control room floors, ceilings, supporting structures, and walls, including penetrations and doors, should be designed to a minimum fire rating of three hours. All penetration seals should be air tight.	Breathing apparatus for the control room operators will be readily available in the control room. Control room floors, ceiling, supporting structures, and walls, including penetrations and doors, are fire rated as discussed in Section 9A.4. All penetration seals will be airtight.
Manually operated ventilation systems are acceptable.	The ventilation system will automatically be placed in the smoke purge mode by confirmed activation of the Halon system in the cable spreading room or relay room. The smoke purge mode can also be manually initiated.
Cables should not be located in concealed floor and ceiling spaces. If such concealed spaces are used, however, they should have fixed automatic total flooding halon protection. All cables that enter the control room should terminate in the control room. That is, no cabling should be simply routed through the control room from one area to another.	The concealed space beneath the computer room subfloor will be provided with a Halon system.
3. Cable Spreading Room	
(a) The preferred acceptable methods are:	
(1) Automatic water system such as closed head sprinklers, open head deluge, or open directional spray nozzles.	The cable spreading room is protected by an automatic Halon system.
Deluge and open spray systems should have provisions for manual operation at a remote station; however, there should also be provisions to preclude inadvertent operation. Location of sprinkler heads or spray nozzles should consider cable tray sizing and Arrangements to assure adequate water coverage. Cable should be designed to allow wetting down with deluge water without electrical faulting. Open head deluge and open directional spray systems should be zoned so that a single failure will not deprive the entire area of automatic fire suppression capability. The use of foam is acceptable, provided it is of a type capable of being delivered by a sprinkler or deluge system, such as an Aqueous Film Forming Foam (AFFF).	In addition, a manually actuated automatic sprinkler system is installed for backup capability.

Position For Plants Under Construction and Operating Plants	EF-2 Response
(2) Manual hoses and portable extinguishers should be provided as backup.	Manual hose and portable fire extinguishers are provided.
(3) Each cable spreading room of each unit should have divisional cable separation, and be separated from the other and the rest of the plant by a minimum three-hour rated fire wall (refer to NFPA 251 or ASTM E-119 for fire test resistance rating).	Section 9A.4 discusses the fire rating of barriers
(4) At least two remote and separate entrances are provided to the room for access by fire brigade personnel; and	Two remote entrances are provided to the room. (See Figure 9A-7.)
(5) Aisle separation provided between tray stacks should be at least three feet wide and eight feet high.	Aisles 3 ft wide and 8 ft high are not provided.
(b) For cable spreading rooms that do not provide divisional cable separation of a(3), in addition to meeting a(1), (2), (4), and (5) above, the following should also be provided:	Cable separation has been provided adequately to permit safe plant shutdown in case of a fire in the cable spreading room. See Subsection 9A.4.2.8.
(1) Divisional cable separation should meet the guidelines of Regulatory Guide 1.75, "Physical Independence of Electric Systems."	
(2) All cabling should be covered with a suitable fire retardant coating.	
(3) As an alternate to a(1) above, automatically initiated gas systems (Halon or CO_2) may be used for primary fire suppression, provided a fixed water system is used as a backup.	
(4) Plants that cannot meet the guidelines of Regulatory Guide 1.75, in addition to meeting a(1), (2), (4), and (5) above, an auxiliary shutdown system with all cabling independent of the cable spreading room should be provided.	
4. Plant Computer Room	
Safety related computers should be separated from other areas of the plant by barriers having a minimum three-hour fire resistant rating. Automatic fire detection should be provided to alarm and annunciate in the control room and alarm locally. Manual hose stations and portable water and halon fire extinguishers should be provided.	Plant computers are not safety related.

Position For Plants Under Construction and Operating Plants	EF-2 Response
5. Switchgear Rooms	
Switchgear rooms should be separated from the remainder of the plant by minimum three-hour rated fire barriers to the extent practicable. Automatic fire detection should alarm and annunciate in the control room and alarm locally. Fire hose stations and portable extinguishers should be readily available.	Safety-related switchgear rooms are separated from the remainder of the plant by walls, floors, and ceilings which have fire-resistant barriers. (See Section 9A.4, which discusses the fire rating of the barriers.) Automatic fire detection devices, which actuate alarms and annunciate in the control room, are provided. Fire hose and portable fire extinguishers are readily available.
Acceptable protection for cables that pass through the switchgear room is automatic water or gas agent suppression. Such automatic suppression must consider preventing unacceptable damage to electrical equipment and possible necessary containment of agent following discharge.	
6. Remote Safety Related Panels	
The general area housing remote safety related panels should be provided with automatic fire detectors that alarm locally and alarm and annunciate in the control room. Combustible materials should be controlled and limited to those required for operation. Portable extinguishers and manual hose stations should be provided.	Areas housing remote safety-related panels are provided with automatic fire detectors that alarm in the control room. Combustible materials are controlled in these areas. Manual fire suppression equipment is provided for these areas. The fire hazards analysis details these areas.
7. Station Battery Rooms	
Battery rooms should be protected against fire explosions. Battery rooms should be separated from each other and other areas of the plant by barriers having a minimum fire rating of three hours inclusive of all penetrations and openings. (See NFPA 69, "Standard on Explosion Prevention Systems.") Ventilation systems in the battery rooms should be capable of maintaining the hydrogen concentration well below 2 vol. % hydrogen concentration. Standpipe and hose and portable extinguishers should be provided.	The battery rooms are separated from other areas by at least 1-1/2 hr fire-resistance-rated walls, floors, and ceiling. The fire hazards analysis outlines the protection provided for these areas. The ventilation system will maintain the hydrogen concentration well below 2 percent by volume. Portable fire extinguishers and a hose reel are provided.
Alternatives:	
(a) Provide a total fire rated barrier enclosure of the battery room complex that exceeds the fire load contained in the room.	
(b) Reduce the fire load to be within the fire barrier capability of 1-1/2 hours.	
OR	
(c) Provide a remote manual actuated sprinkler	

Position For Plants Under Construction and Operating Plants	EF-2 Response
system in each room and provide the 1-1/2 hour fire barrier separation.	
8. Turbine Lubrication and Control Oil Storage and Use Areas	
A blank fire wall having a minimum resis-tance rating of three hours should separate all areas containing safety related systems and equipment from the turbine oil system. When a blank wall is not present, open head deluge protection should be provided for the turbine oil hazards and automatic open head water curtain protection should be provided for wall openings.	N/A
9. Diesel Generator Areas	
Diesel generators should be separated from each other and other areas of the plant by fire barriers having a minimum fire resistance rating of three hours.	Emergency diesel generators of opposite divisions are separated by a 3-hr fire barrier.
When day tanks cannot be separated from the diesel-generator one of the following should be provided for the diesel generator area:	Day tanks are separated from the diesel generator by 3-hr fire barrier walls. The day tanks are also protected by a wet pipe sprinkler system.
(a) Automatic open head deluge or open head spray nozzle system(s)	
(b) Automatic closed head sprinklers	
(c) Automatic AFFF that is delivered by a sprinkler deluge or spray system	
(d) Automatic gas system (Halon or CO_2) may be used in lieu of foam or sprinklers to combat diesel generator and/or lubricating oil fires.	
10. Diesel Fuel Oil Storage Areas	
Diesel fuel oil tanks with a capacity greater than 1100 gallons should not be located inside the buildings containing safety related equipment. They should be located at least 50 feet from any building containing safety related equipment, or if located within 50 feet, they should be housed in a separate building with construction having a minimum fire resistance rating of three hours. Buried tanks are considered as meeting the three hour fire resistance requirements. See NFPA 30, "Flammable and Combustible Liquids Code," for additional guidance.	Diesel fuel-oil tanks are separated from the EDG by construction having a 3-hr fire-resistance rating. The fire hazards analysis (Section 9A.4) discusses the diesel fuel storage room fire protection.

Position For Plants Under Construction and Operating Plants	EF-2 Response
When located in a separate building, the tank should be protected by an automatic fire suppression system such as AFFF or sprinklers. In operating plants where tanks are located directly above or below the diesel generators and cannot reasonably be moved, separating floors and main structural members should, as a minimum, have fire resistance rating of three hours. Floors should be liquid tight to prevent leaking of possible oil spills from one level to another. Drains should be provided to remove possible oil spills and fire fighting water to a safe location. One of the following acceptable methods of fire protection should also be provided: (a) Automatic open head deluge or open head spray nozzle system(s) (b) Automatic closed head sprinklers; or (c) Automatic AFFF that is delivered by a sprinkler system or spray system	
11. Safety Related Pumps	
Pump houses and rooms housing safety related pumps should be protected by automatic sprinkler protection unless a fire hazards analysis can demonstrate that a fire will not endanger other safety related equipment required for safe plant shutdown. Early warning fire detection should be installed with alarm and annunciation locally and in the control room. Local hose stations and portable extinguishers should also be provided.	The fire hazards analysis outlines fire protection for safety-related pumps.
Equipment pedestals or curbs and drains should be provided to remove and direct water away from safety related equipment.	Equipment is installed on concrete pads. Adequate water drainage is provided.
Provisions should be made for manual control of the ventilation system to facilitate smoke removal if required for manual fire fighting operation.	Smoke removal will be provided by portable fans, if required.
12. New Fuel Area	
Hand portable extinguishers should be located within this area. Also, local hose stations should be located outside but within hose reach of this area. Automatic fire detection should alarm and annunciate in the control room and alarm locally. Combustibles should be limited to a minimum in the new fuel area. The storage area should be provided with a drainage system to preclude accumulation of water. The storage configuration of new fuel should always be so maintained as to preclude criticality for any	Manual suppression equipment, such as hose stations and portable fire extinguishers, is provided. Automatic fire detection is provided.

Position For Plants Under Construction and Operating Plants	EF-2 Response
water density that might occur during fire water application.	
13. Spent Fuel Pool Area	
Protection for the spent fuel pool area should be provided by local hose stations and portable extinguishers. Automatic fire detection should be provided to alarm and annunciate in the control room and to alarm locally.	Manual suppression equipment, such as hose stations and portable fire extinguishers, is provided. Automatic detection is provided.
14. Radwaste Building	
The radwaste building should be separated from other areas of the plant by fire barriers having at least three-hour ratings. Automatic sprinklers should be used in all areas where combustible materials are located. Automatic fire detection should be provided to annunciate and alarm in the control room and alarm locally. During a fire, the ventilation systems in these areas should be capable of being isolated. Water should drain to liquid radwaste building sumps. Acceptable alternative fire protection is automatic fire detection to alarm and annunciate in the control room, in addition to manual hose stations and portable extinguishers consisting of hand held and large wheeled units.	Except as noted in section 9A.4.4.2, the radwaste building is separated from the turbine building by fire barriers having a 3-hr fire-resistance rating. For a discussion of the onsite storage building, see Section 11.7 of the UFSAR. Automatic sprinklers are provided as discussed in Subsection 9A.4.4. Automatic fire detection annunciates and alarms in the control room. The ventilation system can be isolated during a fire. Water drains to building sumps.
15. Decontamination Areas	
The decontamination areas should be protected by automatic sprinklers if flammable liquids are stored. Automatic fire detection should be provided to annunciate and alarm in the control room and alarm locally. The ventilation system should be capable of being isolated. Local hose stations and hand portable extinguishers should be provided as backup to the sprinkler system.	No significant quantity of flammable liquids is stored in the decontamination areas. Automatic fire detection alarms and annunciates in the control room. Hose stations and portable extinguishers are provided.
16. Safety Related Water Tanks	
Storage tanks that supply water for safe shutdown should be protected from the effects of fire. Local hose stations and portable extinguishers should be provided. Portable extinguishers should be located in nearby hose houses. Combustible materials should not be stored next to outdoor tanks. A minimum of 50 feet of separation should be provided between outdoor tanks and combustible materials where feasible.	Subsection 9A.4.7 of the fire hazards analysis outlines the protection for this area.

Position For Plants Under Construction and Operating Plants	EF-2 Response
17. Cooling Towers	
Cooling towers should be of noncombustible construction or so located that a fire will not adversely affect any safety related systems or equipment. Cooling towers should be of non-combustible construction when the basins are used for the ultimate heat sink or for the fire protection water supply. Cooling towers of combustible construction, so located that a fire in them could adversely affect safety related systems or equipment should be protected with an open head deluge system installation with hydrants and hose houses strategically located.	Residual heat removal cooling towers are of noncombustible construction. Circulating water cooling towers are located such that a fire will not affect safety related equipment.
18. Miscellaneous Areas	
Miscellaneous areas such as records storage areas, shops, warehouses, and auxiliary boiler rooms should be so located that a fire or effects of a fire, including smoke, will not adversely affect any safety related systems or equipment. Fuel oil tanks for auxiliary boilers should be buried or provided with dikes to contain the entire tank contents.	The record storage areas, shops, outage building and warehouse are separated from safety-related systems or equipment by fire barriers. Therefore, fire or smoke would not affect safety-related systems or equipment. The fuel-oil tank for the auxiliary boiler is provided with a dike.
G. Special Protection Guidelines	
1. Welding and Cutting, Acetylene-Oxygen Fuel Gas Systems	
This equipment is used in various areas throughout the plant. Storage locations should be chosen to permit fire protection by automatic sprinkler systems. Local hose stations and portable equipment should be provided as backup. The requirements of NFPA 51 and 51B are applicable to these hazards. A permit system should be required to utilize this equipment. (Also refer to 2f herein.)	Storage of welding and cutting acetylene-oxygen gas bottles will be in the warehouse areas protected by automatic sprinklers. A permit system is used to control open flames in the plant as explained previously in Section B.3(a).
2. Storage Areas for Dry Ion ExchangeResins	
Dry ion exchange resins should not be stored near essential safety related systems. Dry unused resins should be protected by automatic wet pipe sprinkler installations. Detection by smoke and heat detectors should alarm and annunciate in the control room and alarm locally. Local hose stations and portable extinguishers should provide backup for these areas. Storage areas of dry resin should have curbs and drains. (Refer to NFPA 92M, "Waterproofing and Draining of Floors.")	Dry ion exchange resins will be stored in the warehouse which is removed from safety-related areas and protected by an automatic wet pipe sprinkler system. The warehouse area is also provided with a fire detector system that provides local and control room alarms. Local hose stations and portable extinguishers are provided in the warehouse as backup to the sprinkler system. A curb and drain system is not necessary in the warehouse as the entire area is sprinkled.

Position For Plants Under Construction and Operating Plants	EF-2 Response
3. Hazardous Chemicals	
Hazardous chemicals should be stored and protected in accordance with the recommendations of NFPA 49, "Hazardous Chemicals Data." Chemicals storage areas should be well ventilated and protected against flooding conditions since some chemicals may react with water to produce ignition.	Minor amounts of hazardous chemicals may be stored in the laboratory or shop areas. NFPA 49, "Hazardous Chemicals Data," is used as a guideline for storage. Portable extinguishers and hose stations are provided in these areas.
4. Materials Containing Radioactivity	
Materials that collect and contain radioactivity such as spent ion exchange resins, charcoal filters, and HEPA filters should be stored in closed metal tanks or containers that are located in areas free from ignition sources or combustibles. These Materials should be protected from exposure to fires in adjacent areas as well. Consideration should be given to requirements for removal of isotopic decay heat from entrained radioactive materials.	Materials that collect and contain radioactivity are stored in the radwaste area until processed. Spent resins are stored (wet) in the phase separator tanks until processed. Spent charcoal filter material and HEPA filters will be stored in metal containers in the radwaste bailed waste storage room. This room removes the material from other areas of the radwaste building. This area is provided with fire detectors.

9A.6 FIRE PROTECTION CONDITIONS FOR OPERATION

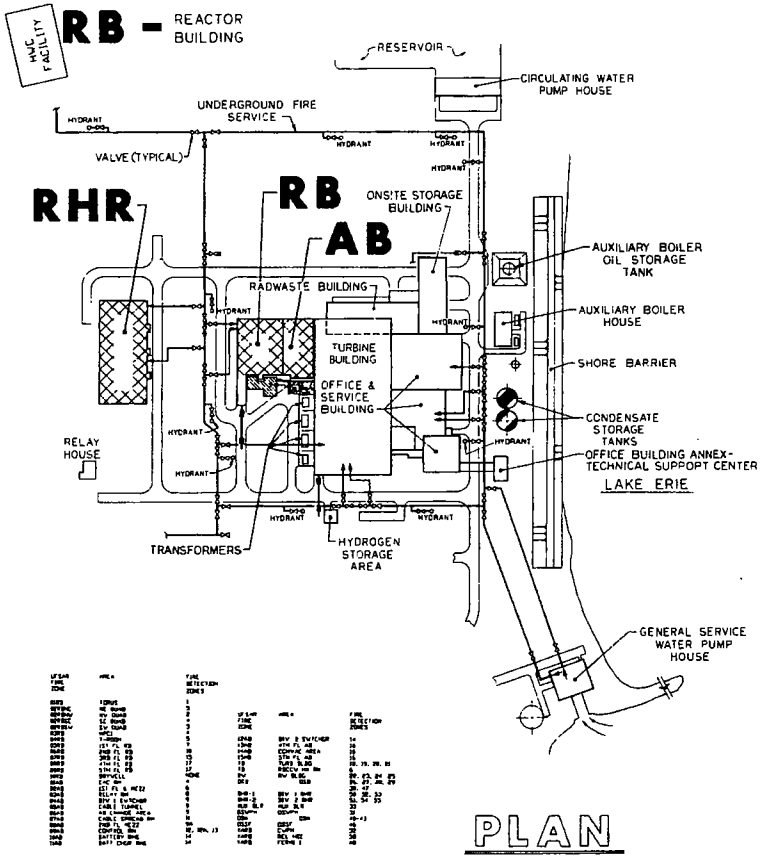
The Fire Protection Conditions For Operation portion of Appendix 9A is in the Technical Requirements Manual.

FIRE AREA CODES

AB – AUXILIARY BUILDING

RHR – RESIDUAL HEAT REMOVAL COMPLEX

RB – REACTOR BUILDING



PLAN

LEGEND

N GN

19° - 18' - 30"

1. WALL DESIGNATIONS:
   - FIRE AREA/ZONE BOUNDARIES (NON-RATED)
   - FIRE RATED SEPARATION (TECH. SPEC.) BARRIER (APPLICABLE TO AB, RB & RHR BLDGS ONLY)
   - FIRE RATED BARRIER
   - CONTINUOUS FROM FLOOR TO CEILING
   - (HEIGHT ABOVE FLOOR) NOT CONTINUOUS FROM FLOOR TO CEILING

1A FLOOR DESIGNATION
   - FIRE RATED SEPARATION (TECH. SPEC.) BARRIER

2. DOORS:
   - CLASS (A) 3 HOUR, (B) 1½ HOUR, (R) BLAST RESISTANT, (W) WATER TIGHT
   - WIRE GATES (G)

3. SHUTDOWN EQUIPMENT *

4. CABLE TRAYS/SAFETY RELATED
   - (1) (1) DIVISION I
   - (2) (2) DIVISION II

5. FLOOR OPENINGS:
   - CLEAR OPENING
   - CONCRETE HATCH
   - CHECKERED PLATE HATCH
   - METAL PLATE HATCH
   - STEEL HATCH BOX W/LEAD & CONC. SHIELDING BLOCKS INSIDE

6. SHUTDOWN DAMPERS

7. SHUTDOWN VALVES

8. HOSE REELS:
   - (HOSE LENGTH 100') CO_2 HOSE REEL
   - HC HOSE CABINET

9. FIRE SUPPRESSION SYSTEMS:
   - WATER
   - CARBON DIOXIDE
   - H HALON
   - P CLEAN AGENT

10. FIRE EXTINGUISHERS:
   - H HALON
   - DC DRY CHEMICAL
   - W WATER PRESSURE
   - CO_2 CARBON DIOXIDE
   - F FOAM

11. FIRE DETECTION SYSTEMS:
   - IONIZATION DETECTOR*
   - HEAT DETECTOR
   - PHOTOELECTRIC DETECTOR

12. CONDUITS/SAFETY RELATED
   - CC-001-1P DIVISION I
   - CC-001-2P DIVISION II

13. CONDUITS & CABLE TRAYS FIRE RATED SEPARATION (TECH. SPEC.) BARRIER

14. CABLE TRAY FIREBREAKS

PIS NUMBERS

NOTE

DETROIT EDISON COMPANY DRAWING NO. 6A721-2400, REV. P

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-1

FIRE PROTECTION EVALUATION PLOT PLAN

Redacted in accordance with 10 CFR 2.390

DETROIT EDISON COMPANY DRAWING NO. 6A721-2401, REV. L

Fermi 2

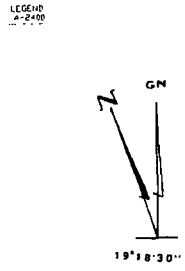
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-2

FIRE PROTECTION EVALUATION
REACTOR BUILDING SUBBASEMENT PLAN
(ELEVATION 540.0 FT)

REV 12 11/03

Redacted in accordance with 10 CFR 2.390



DETROIT EDISON COMPANY DRAWING NO. 6A721-2402, REV. P

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-3

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
BASEMENT PLAN (ELEVATION 562.0 FT)

REV 12 11/03

Redacted in accordance with 10 CFR 2.390

DETROIT EDISON COMPANY DRAWING NO. 6A721-2403, REV. S

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-4

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
FIRST FLOOR PLAN
ELEVATION 583.5 FT

REV 15 05/08

Redacted in accordance with 10 CFR 2.390

DETROIT EDISON COMPANY DRAWING NO. 6A721-2404, REV. N

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-5

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
CABLE TRAY AREA PLAN (ELEVATION 603.5 FT)

Redacted in accordance with 10 CFR 2.390

DETROIT EDISON COMPANY DRAWING NO. 6A721-2405, REV Y

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-6

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
SECONG FLOOR PLAN (ELEVATION 613.5 FT)

Redacted in accordance with 10 CFR 2.390

Fermi 2

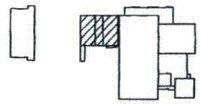
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-7

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
CABLE SPREADING AREA PLAN
(ELEVATION 630.5 FT)

DETROIT EDISON COMPANY DRAWING NO. 6A721-2406, REV. N

Redacted in accordance with 10 CFR 2.390



KEY PLAN

EQUIPMENT LIST

ITEM NO.		DESCRIPTION
1	DIVISION I	MAIN BATTERY CHARGER
2	DIVISION I	MAIN DISTRIBUTION CABINET
3	DIVISION I	EMERGENCY BATTERY CHARGER
4	DIVISION I	24 VOLT BATTERY CHARGER
5	DIVISION I	24 VOLT DISTRIBUTION CABINET
6	DIVISION II	MAIN BATTERY CHARGER
7	DIVISION II	MAIN DISTRIBUTION CABINET
8	DIVISION II	EMERGENCY BATTERY CHARGER
9	DIVISION II	24 VOLT BATTERY CHARGER
10	DIVISION II	24 VOLT DISTRIBUTION CABINET
11	DIVISION I AND DIVISION II	EMERGENCY 24 VOLT BATTERY CHARGER
12	DIVISION I	RESIDUAL HEAT REMOVAL, CORE SPRAY EMERGENCY EQUIPMENT COOLING WATER CONTROL, AIR COMPRESSOR, MAIN STEAM ISOLATION VALVE
13	DIVISION I	480V AND 4160V SYSTEM SERVICE/ DIESEL GENERATOR COMBINATION OPERATING PANEL
14	DIVISION I	HVAC, DRYWELL ATMOSPHERE RADIATION MONITOR
15	DIVISION II	RESIDUAL HEAT REMOVAL, CORE SPRAY HIGH PRESSURE CORE INJECTION, EMERGENCY EQUIPMENT COOLING WATER REACTOR WATER CLEANUP, MAIN STEAM RELIEF VALVE
16	DIVISION II	480V AND 4160V SYSTEM SERVICE/ DIESEL GENERATOR COMBINATION OPERATING PANEL
17	DIVISION II	DRYWELL COOLING, STANDBY GAS TREATMENT, HVAC COMBINATION OPERATING PANEL

NOTES:
1. FOR FIRE PROTECTION LEGEND DESIGNATION SEE DWG. A-2400.
2. REFER TO DRAWING A-2400 FOR FIRE DETECTION ZONE VERSUS UFSAR FIRE ZONE CROSS REFERENCE

DETROIT EDISON COMPANY DRAWING NO. 6A721-2407, REV. S

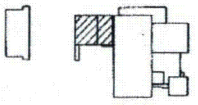
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-8

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
THIRD FLOOR PLAN
ELEVATION 641.5 FT AND 643.5 FT

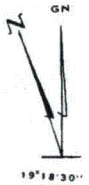
REV 14 11/06



KEY PLAN

Redacted in accordance with 10 CFR 2.390

TURBINE BUILDING



NOTE

1. FOR FIRE PROTECTION LEGEND DESIGNATION SEE DWG. [illegible]
2. REFER TO DRAWING [illegible] FOR FIRE DETECTION ZONE VERSUS SPRAY FIRE ZONE CROSS REFERENCE

DETROIT EDISON COMPANY DRAWING NO. 6A721-2408, REV. U

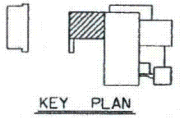
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-9

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
FOURTH FLOOR (ELEVATION 659.5 FT)

REV 15 05/08



KEY PLAN

Redacted in accordance with 10 CFR 2.390

NOTES:

1. FOR FIRE PROTECTION LEGEND DESIGNATION SEE DWG. A-2400
2. REFER TO DRAWING A-2406 FOR FIRE DETECTION ZONE VERSUS UFSAR FIRE ZONE CROSS REFERENCE

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

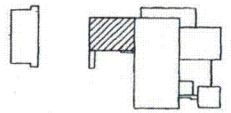
FIGURE 9A-10

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
FIFTH FLOOR PLAN
(ELEVATIONS 677.5 FT AND 684.5 FT)

REV 19 10/14

DETROIT EDISON COMPANY DRAWING NO. 6A721-2409, REV. U

Redacted in accordance with 10 CFR 2.390



KEY PLAN

DETROIT EDISON COMPANY DRAWING NO. 6A721-2410, REV. G

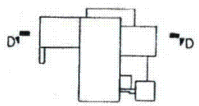
Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-11

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
ROOF PLAN (ELEVATION 697.5 FT AND 735.5 FT)

REV 12 11/03



KEY PLAN

Redacted in accordance with 10 CFR 2.390

DETROIT EDISON COMPANY DRAWING NO. 6A721-2411, REV. I

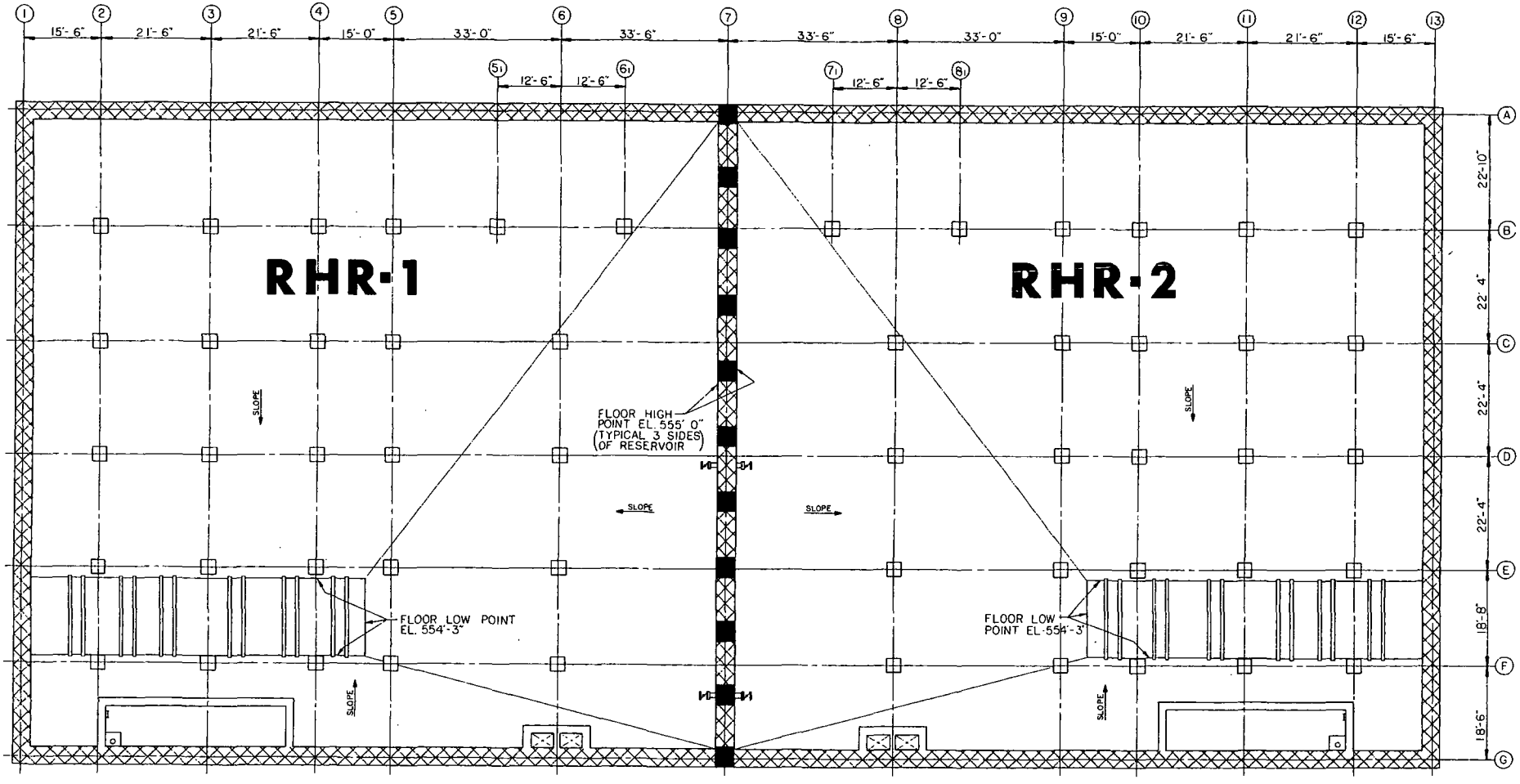
Fermi 2

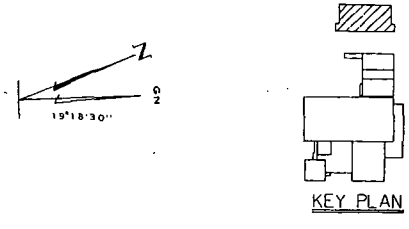
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-12

FIRE PROTECTION EVALUATION
REACTOR AND AUXILIARY BUILDINGS
SECTION D-D

REV 13 06/05





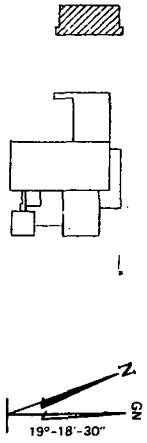
Fermi 2
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-13

FIRE PROTECTION EVALUATION
RESIDUAL HEAT REMOVAL COMPLEX
BASEMENT FLOOR PLAN (ELEVATION 554.25 FT)

DETROIT EDISON COMPANY DRAWING NO. 6A721N-2040, REV. A

Redacted in accordance with 10 CFR 2.390



DETROIT EDISON COMPANY DRAWING NO. 6A721N-2041, REV 1

Fermi 2

UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-14

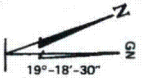
FIRE PROTECTION EVALUATION
RESIDUAL HEAT REMOVAL COMPLEX
GRADE FLOOR PLAN (ELEVATION 590.0 FT)

DIVISION I EQUIPMENT LIST

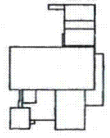
ITEM NO.	DESCRIPTION
1	AIR INTAKE FILTER (010)
2	DIESEL GENERATOR ROOM VENTILATION FAN (003)
3	DIESEL GENERATOR ROOM VENTILATION FAN (004)
4	OUTSIDE AIR INTAKE FILTER UNIT
5	SWITCHGEAR ROOM VENTILATION FAN (011)
6	SWITCHGEAR ROOM VENTILATION FAN (012)
7	DIESEL FUEL OIL STORAGE ROOM VENTILATION FAN (022)
8	X4103F115
9	X4103F116
10	X4103F117
11	X4103F11B
12	X4163F119
13	X4103F120
14	X4103F121
15	X4103F151
16	X4103F152
17	X4103F179
18	X4103F179
19	X4103F181
20	X4103F182
21	480 VOLT SWITCHGEAR (037)
22	4160 VOLT SWITCHGEAR (002B)
23	DIESEL GENERATOR CONTROL PANEL (002)
24	MOTOR CONTROL CENTER (017A)
25	AIR INTAKE FILTER (009)
26	DIESEL GENERATOR ROOM VENTILATION FAN (001)
27	DIESEL GENERATOR ROOM VENTILATION FAN (002)
28	OUTSIDE AIR INTAKE FILTER UNIT
29	SWITCHGEAR ROOM VENTILATION FAN (009)
30	SWITCHGEAR ROOM VENTILATION FAN (010)
31	DIESEL FUEL OIL STOPAGE ROOM VENTILATION FAN (021)
32	X4103F183
33	X4103F184
34	X4103F185
35	X4103F186
36	X4103F187
37	X4103F188
38	X4103F189
39	X4103F149
40	X4103F150
41	X4103F172
42	X4103F173
43	X4103F175
44	X4103F176
45	480 VOLT SWITCHGEAR (036)
46	4160 VOLT SWITCHGEAR (002A)
47	DIESEL GENERATOR CONTROL PANEL (005)
48	MOTOR CONTROL CENTER (016A)
49	MOTOR CONTROL CENTER (016B)
50	DC DISTRIBUTION CABINET (063)

DIVISION II EQUIPMENT LIST

ITEM NO.	DESCRIPTION
51	AIR INTAKE FILTER (012)
52	DIESEL GENERATOR ROOM VENTILATION FAN (007)
53	DIESEL GENERATOR ROOM VENTILATION FAN (008)
54	OUTSIDE AIR INTAKE FILTER UNIT
55	SWITCHGEAR ROOM VENTILATION FAN (015)
56	SWITCHGEAR ROOM VENTILATION FAN (016)
57	DIESEL FUEL OIL STORAGE ROOM VENTILATION FAN (024)
58	X4103F139
59	X4103F140
60	X4103F141
61	X4103F142
62	X4103F143
63	X4103F144
64	X4103F145
65	X4103F139
66	X4103F140
67	X4103F190
68	X4103F191
69	X4103F193
70	X4103F194
71	480 VOLT SWITCHGEAR (038)
72	4160 VOLT SWITCHGEAR (002D)
73	DIESEL GENERATOR CONTROL PANEL (004)
74	MOTOR CONTROL CENTER (019A)
75	AIR INTAKE FILTER (011)
76	DIESEL GENERATOR ROOM VENTILATION FAN (005)
77	DIESEL GENERATOR ROOM VENTILATION FAN (006)
78	OUTSIDE AIR INTAKE FILTER UNIT
79	SWITCHGEAR ROOM VENTILATION FAN (013)
80	SWITCHGEAR ROOM VENTILATION FAN (014)
81	DIESEL FUEL OIL STORAGE ROOM VENTILATION FAN (023)
82	X4103F127
83	X4103F128
84	X410JF129
85	X4103F130
86	X4103F131
87	X4103F132
88	X4103F133
89	X4103F153
90	X4103F154
91	X4103F194
92	X4103F185
93	X4103F187
94	X4103F188
95	480 VOLT SWITCHGEAR (038)
96	4160 VOLT SWITCHGEAR (020)
97	DIESEL GENERATOR CONTROL PANEL (007)
98	MOTOR CONTROL CENTER (019A)
99	MOTOR CONTROL CENTER (019B)
100	DC DISTRIBUTION CABINET (068)



Redacted in accordance with 10 CFR 2.390



KEY PLAN

SWITCHGEAR ROOMS — RHR-1 | SWITCHGEAR ROOMS — RHR-2

NOTE:
FOR FIRE PROTECTION LEGEND DESIGNATION
SEE DWG. 6A721-2400 (FIGURE 9A-11)

DETROIT EDISON COMPANY DRAWING NO. 6A721-N-2042, REV. E

Fermi 2

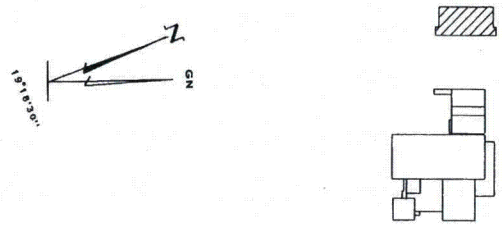
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-15

FIRE PROTECTION EVALUATION
RESIDUAL HEAT REMOVAL COMPLEX
UPPER FLOOR PLAN (ELEVATION 617.0 FT)

REV 12 11/03

Redacted in accordance with 10 CFR 2.390



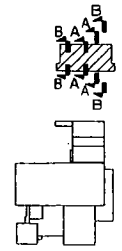
FUTURE UNIT 3

DETROIT EDISON COMPANY DRAWING NO. 6A721N-2043, REV. A

Fermi 2
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-16

FIRE PROTECTION EVALUATION
RESIDUAL HEAT REMOVAL COMPLEX
ROOF PLAN (ELEVATIONS 617.0 FT AND 637.0 FT)



KEY PLAN

Redacted in accordance with 10 CFR 2.390

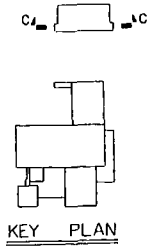
Fermi 2
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-17

FIRE PROTECTION EVALUATION
RESIDUAL HEAT REMOVAL COMPLEX
SECTION A-A AND SECTION B-B

REV 3 3/90

DETROIT EDISON COMPANY DRAWING NO. 6A721N-2044, REV. B



Redacted in accordance with 10 CFR 2.390

DETROIT EDISON COMPANY DRAWING NO. 6A721N-2045, REV. C

Fermi 2
UPDATED FINAL SAFETY ANALYSIS REPORT

FIGURE 9A-18

FIRE PROTECTION EVALUATION
RESIDUAL HEAT REMOVAL COMPLEX
SECTION C-C

REV 3 3/90