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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 62 Related to ESBWR Design Certification Application – Tier 1 – Fire Protection – RAI Numbers 14.3-5 through 14.3-10, 14.3-12, 14.3-13 and 14.3-16 through 14.3-21**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

If you have any questions about the information provided here, please let me know.

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

D068

Reference:

1. MFN 06-380, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 62 Related to ESBWR Design Certification Application,* September 29, 2006

Enclosure:

1. MFN 06-494 – Response to Portion of NRC Request for Additional Information Letter No. 62 Related to ESBWR Design Certification Application – Tier 1 – Fire Protection – RAI Numbers 14.3-5 through 14.3-10, 14.3-12, 14.3-13 and 14.3-16 through 14.3-21

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eDRF 0000-0060-8972

ENCLOSURE 1

MFN 06-494

Response to Portion of NRC Request for
Additional Information Letter No. 62
Related to ESBWR Design Certification Application
Tier 1 – Fire Protection
RAI Numbers 14.3-5 through 14.3-10, 14.3-12, 14.3-13
and 14.3-16 through 14.3-21

NRC RAI 14.3-5

Tier 1 should include the information on the SRP Section 14 fluid system checklist, as applicable. (DCD Tier 1, Subsection 2.16.3)

Section 14.3 of the standard review plan (SRP), Draft 0, April 1996, includes a checklist for information to be provided in Tier 1 for fluid systems. The list includes system function, location, operation, logic, etc. Much of this information for the fire protection fluid systems is not included in DCD Tier 1, Subsection 2.16.3. Provide all of the applicable information in Tier 1.

GE Response

DCD Tier 1, Subsection 2.16.3 will be revised to include the applicable information from SRP, Section 14.3, Appendix C Fluid Systems. The fire protection system is not safety-related, and thus no safety-related items from Appendix C will be included.

NRC RAI 14.3-6

Explain how the fire pumps meet National Fire Protection Association (NFPA) design criteria. (DCD Tier 1, Subsection 2.16.3)

The Design Description (DD) states that each fire pump is capable of delivering the flow and pressure required to the location that is farthest from the fire water supply. This may not be the most hydraulically demanding requirement. The pump flow rate should be in accordance with NFPA 804, 2001 Edition, Section 7.2.1. The pump should be capable of supplying fire water at the pressure required for each fixed suppression system while also providing 500 gpm for manual hose streams. The pump head should also be capable of providing hose station pressure in accordance with NFPA 14, Section 7.8 of NFPA 14, 2003 Edition (both of these NFPA standards are referenced in DCD Tier 2, Table 1.9-20).

GE Response

The fire pump flow rate determination is described in the response to RAI 9.5-15, and the fire pump flow rate complies with Section 7.2.1 of NFPA 804, 2001 edition.

Consistent with Section 7.8 of NFPA 14, 2003, 100 psig will be available, for the highest hose station (i.e., hydraulic head) in the TB and RB. This is addressed in ITAAC Item 4.a, and the third paragraph in the Design Description has been clarified.

NRC RAI 14.3-7

Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) should include inspections to verify fire barrier integrity and conformance to design. (DCD Tier 1, Table 2.16.3-1)

Section 14.3, Appendix C of the SRP, Draft 0, April 1996, provides guidance for building structure review that includes fire barriers. The ITAAC for fire barriers should include inspections to verify that all fire barriers and barrier penetration seals and other closure devices are constructed in accordance with the applicable approved designs, including verification that the design basis integrity of each barrier is provided (e.g., that all required penetration seals are in place and that the required closure of all barrier openings is complete). Update the ITAAC to include this information.

GE Response

Tier 1, Subsection 2.16.3 addresses the design and functional capabilities of the Fire Protection System (FPS), the scope of which does not include the fire barriers. The basis for fire barriers are addressed within Tier 2 Chapter 9 and its appendices, however, most of the specific design details of plant-specific fire barriers are outside the scope of the design certification Tier 1 ITAAC. However, new Subsection 2.16.3.1 is added to provide the fire barrier design commitments within the scope of the ESBWR design certification.

NRC RAI 14.3-8

DCD Tier 1, Table 2.16.3-1 should be consistent with the Design Description in Tier 1.

DCD Tier 1, Table 2.16.3-1 includes Design Commitments that are not included in the Design Description in Tier 1. According to the guidance in Section 14.3, Appendix C of the SRP, Draft 0, April 1996, the Certified Design Commitments should be included in the Design Description (e.g., fire water tank size and fire pump rating are listed as Design Commitments and referred to a Certified Design Commitments in the Acceptance Criteria in ITAAC but are not included in the DD). Clarify the inconsistency between DCD Tier 1, Table 2.16.3-1 and the DD in Tier 1.

GE Response

As part of the response to RAI 14.3-5, Tier 2, Table 9.5-2 was copied and inserted as a new table in Tier 1, Subsection 2.16.3. Plus, the ITAAC table was updated to include the fire water tank sizes and fire pump flows.

No additional Tier 1 change will be made in response to this RAI.

NRC RAI 14.3-9

Explain the difference between the value provided in the DCD and the requirements of NFPA 14 (DCD Tier 1, Table 2.16.3-1)

DCD Tier 1, Table 2.16.3-1, ITAAC Item 4 states that the fire pumps will provide a minimum of 2,000 gpm at the most hydraulically remote hose station. NFPA 14 provides the flow requirements for hose stations (250 gpm). As noted above, the pump requirements should be described in accordance with the referenced applicable NFPA standards. The pump design should envelop the separate flow and pressure requirements of the NFPA standards.

GE Response

Table 2.16.3-1, Item 1c is updated to verify the 2000 gpm requirement. Table 2.16.3-3, ITAAC Design Commitment No. 4 will be separated into two commitments covering fire pump capacity and standpipes & hose station capacity separately. Applicable inspections, tests, analyses, and acceptance criteria will be listed for each commitment accordingly.

As described in the response to RAI 9.5-15, the fire pump flow rate goes as follows:

The single largest non-SC I design basis fire would result from catastrophic failure of the Turbine Generator with cascading oil down to lower levels. This could actuate the following non-SC I suppression systems:

1) Turbine Bearing preaction spray (624 gpm)

2) Under Turbine wet-pipe sprinkler (2400 gpm)

3) Steam Tunnel water curtain deluge (432 gpm)

4) Seal Oil Skid (300 gpm)

The maximum resulting combined flow rate plus manual hose streams (500 gpm) would be:

624 gpm + 2400 gpm + 432 gpm + 300 gpm + 500 gpm = 4256 gpm

The largest non-SC I fire water demand (4256 gpm for Turbine Building) is more than double the fire water demand for the largest SC I fire water demand (1250 gpm for manual fire fighting in the Reactor Building). With the large disparity in flow rates, the most economical arrangement is to use multiple fire pumps in parallel, allowing any one pump to be out of service and fire water supplied by two operating fire pumps.

Each of the fire pumps shall be able to deliver the following:

4256 gpm / 2 = 2128 gpm

Allowing fire pumps to operate at up to 140% of their rated capacity as allowed by NFPA 20 results in the following minimum capacity:

2128 gpm / 1.4 = 1520 gpm

Therefore 2000 gpm rated capacity main fire pumps are acceptable. The fire pump design envelopes flow and pressure requirements of NFPA standards.

NRC RAI 14.3-10

The ESBWR ITAAC should include NFPA tests and inspections. (DCD Tier 1, Table 2.16.3-1)

NFPA standards include specific requirements for testing and inspection of fire protection systems and equipment. Update the ESBWR ITAAC to include those tests and inspections.

GE Response

The responses to other fire protection RAIs (e.g., 14.3-5, 14.3-7, 14.3-13) and their associated Tier 1 changes cover the scope of this RAI, including equipment sizes/capacities and their verifying ITAAC.

No Tier 1 change will me made in response to this RAI.

NRC RAI 14.3-12

ITAAC Item No. 6 should include inspection of the location of safe shutdown equipment. (DCD Tier 1, Table 2.16.3-1)

DCD Tier 1, Table 2.16.3-1, ITAAC Item No. 6 verifies the Design Commitment that no safe shutdown equipment is more than 100 ft from two hose stations on separate standpipes. The Inspection only mentions verification of the location of the hose rack locations. To verify the Design Commitment, both the hose station and the safe shutdown equipment locations must be verified. Update the ITAAC to include this information.

GE Response

Tier 1, Table 2.16.3-3, ITAAC Design Commitment Item No. 6 will be revised to include verification of the safe shutdown equipment locations. ITAAC Inspections, Tests, Analyses and Acceptance Criteria will also be revised accordingly.

NRC RAI 14.3-13

Clarify Design Commitment No. 7 which states that automatic fire suppression is provided for all electrical areas. (DCD Tier 1, Table2.16.3-1)

The Tier 2 description of areas protected by automatic suppression systems does not include automatic suppression systems in all electrical areas, e.g., the electrical building corridor (with installed cables) and the battery rooms are not protected by automatic suppression systems. The Design Commitment in DCD Tier 1, Table 2.16.3-1 should be more specific. In addition, the reference to the applicable NFPA codes should state, as the Design Commitment, that the automatic suppression systems meet or exceed the requirements of NFPA 13 or NFPA 15, as applicable.

GE Response

DCD Tier 1, Table 2.16.3-3, ITAAC will be revised to state more specifically where automatic fire suppression is provided. Design Commitment Item No. 7 and No. 8 will be revised as follows.

7. Automatic fire suppression complying with NFPA 13 & 15 is provided for all electrical areas exceeding the combustible load limit of 1400 MJ/m^2.

8. Automatic fire suppression complying with NFPA 13 & 15 is provided for all non-electrical areas exceeding the combustible load limit of 700 MJ/m^2.

NRC RAI 14.3-16

ITAAC Item 10 should include the same method of verification of tank volume as Item 3. (DCD Tier 1, Table2.16.3-1)

ITAAC Item 10 only includes an inspection to verify the volume of the fuel oil tanks. The ITAAC should be similar to the ITAAC for the firewater storage tank (Item 3) - verify volumetric calculations using as-built dimensions. The fuel oil tank ITAAC should also verify the fuel consumption calculation that dictated the volume using the as-built diesel engine fuel consumption rate. Update the ITAAC to include this information.

GE Response

DCD Tier 1, Table 2.16.3-3, ITAAC Inspections, Tests, Analysis, and Acceptance Criteria Item No. 10 will be revised to verify volumetric calculations using as-built dimensions and testing will verify the fuel consumption rate to ensure that there will be adequate fuel volume.

NRC RAI 14.3-17

ITAAC Item 11 should include a test of control room displays and controls for the fire protection system. (DCD Tier1, Table 2.16.3-1)

ITAAC Item 11 only includes an inspection to verify the Design Commitment. This ITAAC should also include appropriate tests that verify the displays and controls function properly. Update the ITAAC to include this information.

GE Response

DCD Tier 1, Table 2.16.3-1, ITAAC Inspections, Tests, Analyses Item No. 11 will be revised to include appropriate tests to verify that the displays and controls function properly.

NRC RAI 14.3-18

The fire protection system (FPS) interfaces for emergency makeup should identify the system to which emergency makeup is being provided. (DCD Tier 1, Figure 2.16.3-1)

DCD Tier 1, Figure 2.16.3-1 indicates two FPS interfaces as "Emergency Makeup". The figure should indicate the specific system to which each interface is providing emergency makeup. Update Figure 2.16.3-1.

GE Response

DCD Tier 1, Figure 2.16.3-1 does indicate the specific system code that interfaces with the Fire Protection System (U43). The specific systems are Reactor Component Cooling Water (P21) and Fuel and Auxiliary Pools Cooling System (G21). These system identifications will be clarified on Figure 2.16.3-1.

NRC RAI 14.3-19

Clarify emergency backup function for Isolation Condenser / Passive Containment Cooling System (IC/PCCS). (DCD Tier 1, Subsection 2.16.3)

The DCD Tier 1, DD states that the FPS provides an emergency backup source of makeup water 72 hours after a loss of coolant accident (LOCA) for IC/PCCS pools. This IC/PCCS makeup function is not mentioned in DCD Tier 2, Section 9.5.1.1 that describes the other emergency backup functions of the FPS. Revise Section DCD Tier 1, Subsection 2.16.3 and/or DCD Tier 2, Section 9.5.1 to consistently describe the backup functions in accordance with the ESBWR proposed design. Also verify that this FPS function and the other FPS emergency backup functions are not required safety-related functions.

GE Response

Emergency backup source of makeup water 72 hours after a loss of coolant accident (LOCA) for IC/PCCS pools is provided through a piping connection to the Fuel and Auxiliary Pools Cooling System, as correctly stated in Tier 2, Subsection 9.5.1.1, second to last bullet. The FPS emergency backup water source function is a nonsafety-related defense-in-depth function. The Subsection 2.16.3 description shall be so clarified.

NRC RAI 14.3-20

State the ESBWR commitment to the enhanced fire protection criteria for advanced light-water reactor designs. (DCD Tier 1, Table 2.16.3-1)

Commission Papers SECY 90-016, SECY 93-087 and SECY 94-084 describe enhanced fire protection criteria for new reactor designs. The ESBWR commitment to these criteria should be included in DCD Tier 1, Subsection 2.16.3.

GE Response

ESBWR design criteria includes the enhanced fire protection criteria for advanced reactor designs as described in Commission Reports SECY 90-116, SECY 93-087, and SECY 94-084. This is partially reflected in DCD Tier 2, Sections 9A.4.1 through 9A.4.9 and in DCD Tier 2, Tables 9A.5-1 through 9A.5-7.

This commitment to comply with enhanced fire protection criteria for advanced reactor designs as described in Commission Papers SECY 90-116, SECY 93-087, and SECY 94-084 will be incorporated into DCD Tier 1, Subsection 2.16.3 design description.

NRC RAI 14.3-21

Identify FPS controls and displays in the main control room.

Section 14.3, Appendix C of the SRP, Draft 0, April 1996, provides guidance for DCD Tier 1, DDs. The information to be included in the DD includes controls and displays. Describe the FPS controls and displays that will be provided in the main control room.

GE Response

Tier 1 Subsection 2.16.3 instrumentation and controls information will be updated, based DCD Tier 2, Subsection 9.5.1.14.

2.16.3 Fire Protection System

Design Description

The Fire Protection System (FPS) is nonsafety-related, and thus, does not require a Class 1E power source. However, because of nonsafety-related to safety-related interfaces, some equipment (see Table 2.16.3-1) has elevated seismic and quality classifications. It includes the fire protection water supply system, yard piping, water sprinkler, standpipe and hose systems, a foam system, smoke detection and alarm system, and fire barriers.

A simplified diagram of the FPS is provided in Figure 2.16.3-1. Table 2.16.3-2 provides the important component design characteristics.

Each of the three 50% capacity firewater pumps provides 100% of the firewater demand to the worst-case fire within the nuclear island (Reactor Building, Fuel Building, and Control Building) or 50% of the firewater demand to the worst-case fire within the balance of plant. The pumps are capable of delivering the flow and pressure required to the location that has the largest hydraulic head with respect to the firewater supply source. Two of the three pumps are located near the nuclear island power block in a fire pump enclosure. The third pump is located remote from the other two pumps to prevent a common-location failure.

For the two Nuclear Island fire pumps, the lead pump is motor-driven and the backup pump is diesel-driven. The backup pump provides firewater in the event of failure of the motor-driven pump or loss of preferred power (LOPP). The main diesel-driven fire pump, including its suction and discharge piping, meets the requirements of ASME B31.1 and remains functional after an SSE and is located in a separate fire-rated compartment from the motor-driven fire pump.

The combustible loading limit for electrical areas is conservatively determined as 1400 MJ/m^2, and the combustible loading limit for all other indoor areas is conservatively determined as 700 MJ/m^2. Rooms that exceed these limits require automatic fire suppression.

The second diesel-driven fire pump provides a back up to the other two pumps. This back-up diesel-driven fire pump may be new or existing and is connected to the main yard piping loop.

The fuel oil tanks for the diesel-driven fire pumps have sufficient capacity to allow diesel engine operation for approximately 8 hours before refilling based upon the fuel consumption and margin criteria provided in NFPA 24.

The fire water supply piping consists of a non-seismic, buried yard main and a suspended ASME B31.1 piping loop. The ASME B31.1 piping loop supplies firewater to the nuclear island buildings and remains functional following an SSE. The main firewater pumps discharge to the ASME B31.1 piping loop. A connection from the ASME B31.1 piping loop supplies firewater to the yard main. The second diesel-driven fire pump supplies firewater directly to the yard main, but is also capable of supplying water to the ASME B31.1 piping loop. Motor-operated isolation valves are provided between the buried, non-seismic, yard piping loop and the suspended, Seismic Category I, ASME B31.1 piping loop.

The FPS can perform a nonsafety-related defense-in-depth function of being backup source of makeup water (through a piping connection to the Fuel and Auxiliary Pools Cooling System) 72

hours after a LOCA for IC/PCCS pools and the spent fuel pool and reactor water inventory control.

The FPS is nonsafety-related. However, one source of fire water supply, one of the fire pumps and the fire water main leading to and including the standpipes and subsystems for areas containing safe shutdown equipment are analyzed to withstand the effect of a Safe Shutdown Earthquake (SSE). They shall remain functional during and after an SSE.

Commission papers SECY 90-116, SECY 93-087 and SECY 94-084 provide enhanced fire protection criteria for advanced reactor designs. These criteria are directed toward plants with active safety-related systems, however, within the constraints of the active-to-passive design differences, the ESBWR design those criteria.

Instrumentation and Controls

Controls and instrumentation are provided for a fully functioning system. There are three main types of FPS instrumentation: instrumentation supporting fire detection, instrumentation supporting automatic suppression systems, and instrumentation supporting fire water delivery.

Critical and essential information and controls are provided in the main control room. In addition to automatic operation any of the fire pumps can be manually started either from MCR or local panels.

Instrumentation for the Fire Detection System:

Instrumentation for the fire detection system provides signals for early detection and warning of fires. Local fire alarm panels per National Fire Protection Association (NFPA) 72 supervise fire and smoke detectors. The local fire alarm panels are in turn connected to the main fire alarm panel (MFAP) via a dedicated data link. Signals transmitted include detector status (normal, alarm, supervisory, trouble) as well as local fire alarm panel status.

Upon receipt of a signal from any of the area fire detectors, audible and visual annunciation is activated at the MFAP in the MCR and at the local fire alarm panel.

Instrumentation for fire detection is either Factory Mutual (FM) approved or Underwriter Labs (UL) listed, where available.

Instrumentation Supporting Fire Suppression Systems:

Each fire suppression system automatically actuated by a fire detection system has the control logic and capability for manual actuation available at the local fire alarm panel for the protected area. Remote manual actuation of these suppression systems is also available from the MCR. Automatic sprinkler systems that do not require separate detection systems for actuation are not equipped with manual actuation means.

Instrumentation for fixed fire suppression systems provides local and remote monitoring capability for the suppression system status. All instruments for automatic suppression systems are wired to the local fire alarm panels for control. Dedicated data links transmit command and status information to and from the local fire alarm panels and the MFAP in the MCR.

All instrumentation for automatically actuated fire suppression systems is either FM approved or UL listed, where available.

Instrumentation Supporting Fire Water Delivery:

Instrumentation supporting firewater delivery provides status indication of fire water tank level, fire water main pressure, jockey pump status, and main fire pump status conditions.

When a portion of the firewater system activates, the motor-driven fire pump automatically starts on low-pressure. If the motor-driven pump fails to start or cannot maintain pressure, the main diesel-driven pump starts from a different pressure switch. The second diesel-driven pump is designed to start last if the two main pumps fail to start or cannot maintain the required system pressure. All pumps are stopped manually. Any pump can be started manually from the MFAP in the MCR or locally.

A pressure switch is used to automatically start and stop the motor-driven jockey pump.

Interface Requirements

Interface requirements for the service water basins are described in Section 4.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.3-3 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria, which will be undertaken for the Fire Protection System.

Table 2.16.3-1

Fire Protection System Equipment Classifications

Principal Components	Safety Class.	Location(s)	Quality Group	Seismic Category
Non-seismic yard piping loop and valves including supports	N	OO, OL	D	NS
Seismic category I piping loop and valves including supports	N	OO, RB, CB, FB	C	I
Fire water storage tank	N	OO	C	I
Fire pump enclosure	N	OO	—	II
Seismic category I pump including diesel-engine drive	N	OO	C	I
Other pumps and motors	N	OO	D	NS
Electrical modules and cables for RB pre-action sprinklers	N	RB	—	NS
All other electrical modules and cables	N	ALL	—	NS
CO_2 actuation modules	N	TB	—	NS
Sprinklers	N	RB, TB, RW, SB, EB, OL	D	NS
Foam, pre-action or deluge	N	EB, TB, OO	—	NS

Location codes: ALL = all

CV	=	Containment Vessel	RW	=	Radwaste Building
CB	=	Control Building	CP	=	Circulating Water Pump House
RB	=	Reactor Building	SF	=	Service Water Building
OO	=	Outdoors Onsite	TB	=	Turbine Building
OL	=	Any Other Location	EB	=	Electrical Building
FB	=	Fuel Building	SB	=	Services Building

Table 2.16.3-2

FPS Component Design Characteristics

Fire Water Pumps	
Motor-driven fire pump	454.2 m^3/hr (2,000 gpm)***
Primary diesel-driven fire pump	454.2 m^3/hr (2,000 gpm)***
Secondary diesel-driven fire pump*	454.2 m^3/hr (2,000 gpm)***
Motor-driven jockey pump	4.54 m^3/hr (20 gpm) minimum as required to maintain the fire water main pressure 68.8 kPa (10 psi) above the start pressure of the fire pumps
Required minimum total makeup flow rate to IC/PCC and spent fuel pools at 72 hours into an event	46 m^3/hr (200 gpm)
Fire Water Storage	
Primary storage tank(s) minimum fire water storage	3900 m^3 (1,030,000 gallons)
Secondary storage minimum fire water storage**	2081.8 m^3 (550,000 gallons)

* Secondary diesel-driven fire pump may be new or existing depending upon available site-specific provisions.

** Secondary fire water storage may be a tank, cooling tower basin, or a large body of water depending upon available site-specific provisions. Storage volume listed is the minimum storage volume to be dedicated for fire protection use.

*** Based on the largest fire water demand of 967 m^3/hr (4256 gpm) for Turbine Building, including hose stream.

Table 2.16.3-3

ITAAC For The Fire Protection System

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1.	1.	1.
a. The basic configuration of the Fire Protection System is as described in Subsection 2.16.3 and Figure 2.16.3-1.	a. Inspections of the as-built system will be conducted.	a. The as-built Fire Protection System conforms to the basic configuration contained in the Design Description of Subsection 2.16.3 and Figure 2.16.3-1.
b. Fire protection equipment will meet the quality and seismic requirements, as shown in Table 2.16.3-1.	b. Inspections of the as-built equipment design documentation will be conducted.	b. Fire protection equipment meet the quality and seismic requirements, as shown in Table 2.16.3-1.
c. Fire protection pumps will have the flow capabilities shown in Table 2.16.3-2.	c. Test of the as-built pumps will confirm pump flow capabilities.	c. Fire protection pumps will have the flow capabilities shown in Table 2.16.3-2.
2. The motor driven pump described in the Design Description for the Fire Protection System is powered from the non-Class 1E bus.	2. A test of the power availability to the motor driven pump described in the Design Description in Subsection 2.16.3 will be conducted with power supplied from the permanently installed electric power busses.	2. The motor driven pump described in the Design Description for the Fire Protection System receives power from non-Class 1E busses only.
3. Two water supplies one with a minimum volume of about 3900 m^3 (1,030,000 gal) and another with a minimum volume of about 2000 m^3 (550,000 gal) each are provided.	3. Inspection of the as-built water supply sources and volumetric calculations using as-built dimensions will be performed.	3. As-built water supply sources meet the volumetric requirements specified in the Certified Design Commitment.

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4.a. The fire water pumps independently will provide their required flow at a pressure of 689 kPa gauge (100 psig) at the most hydraulically remote 65 mm (~2.5 in) hose connections station in the Reactor Building and Control Building.	4.a. A test of the flow rate and pressure from each pump will be conducted.	4.a. The fire water pumps independently provide their required flow at a pressure of 689 kPa gauge (100 psig) at the most hydraulically remote 65 mm (~2.5 in) hose connections station in the Reactor Building and Control Building.
4.b. Fire water pumps independently will provide their required flow at 448 kPa gauge (65 psig) at the most hydraulically remote 40 mm (1.57 in) hose station in the Reactor Building and Control Building.	4.b. A test of the flow rate and pressure from each pump will be conducted.	4.b. The fire water pumps independently provide their required flow at 448 kPa gauge (65 psig) at the most hydraulically remote 40 mm (1.57 in) hose station in the Reactor Building and Control Building.
5. No location within a fire area is more than [30.5 m (100 ft)] from a hose station.	5. Inspection of the as-built hose rack locations will be performed.	5. Standpipe and hose rack stations are located such that no location within a fire area is more than [30.5 m (100 ft)] from a hose station.
6. No safe shutdown equipment is more than [30.5 m (100 ft)] from two hose stations on separate standpipes.	6. Inspection of the as-built hose rack and safe shutdown equipment locations will be performed.	6. Standpipe, hose rack stations and safe shutdown equipment are located as such that no safe shutdown equipment is more than [30.5 m (100 ft)] from two hose stations on separate standpipes.
7. Automatic fire suppression complying with NFPA 13 & 15 is provided for all electrical areas exceeding the combustible load limit of 1400 MJ/m^2.	7. Inspections to assure that of all electrical areas, exceeding the combustible load limit of 1400 MJ/m^2, have automatic fire suppression, per NFPA 13 & 15.	7. Confirm that of all electrical areas, exceeding the combustible load limit of 1400 MJ/m^2, have fire suppression, per NFPA 13 & 15.

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
8. Automatic fire suppression complying with NFPA 13 & 15 is provided for all non-electrical areas exceeding the combustible load limit of 700 MJ/m^2.	8. Inspections to assure that all non-electrical areas, exceeding the combustible load limit of 700 MJ/m^2, have fire suppression, per NFPA 13 & 15.	8. Confirm that of all non-electrical areas, exceeding the combustible load limit of 700 MJ/m^2, have fire suppression, per NFPA 13 & 15.
9. Automatic foam-water extinguishing systems are provided for the diesel generator and day tank rooms, per codes NFPA 11& 16.	9. Inspection of as-built systems and testing of automatic logic under simulated fire conditions will be conducted.	9. The automatic foam-water suppression systems exist and initiation logic is actuated under simulated fire conditions.
10. The fuel oil tanks for the diesel-driven fire pumps have sufficient capacity to allow diesel engine operation for approximately 8 hours as described in this Subsection 2.16.3.	10. a. Testing will confirm fuel consumption rates of the as-built diesel engines. b. Analysis will confirm the as-built fuel oil tank volume(s). c. Analysis will confirm that there is sufficient fuel oil tank volume for the diesel engines to operation for 8 hours.	10. The fuel oil tanks for the diesel-driven fire pumps have sufficient capacity to allow diesel engine operation for approximately 8 hours before refilling based upon the as built fuel tanks and fuel consumption rates and margin criteria provided in NFPA 24.
11. Control room indications and controls for the Fire Protection System are as defined in Subsection 2.16.3.	11. Inspections will be performed on the control room indications/displays and controls for the Fire Protection System. Tests of the displays and controls will be performed to assure that the displays and controls function properly.	11. Indications/displays and controls exist or can be retrieved in the MCR as defined in Subsection 2.16.3, and that the displays and controls function properly.
12. The fire water supply system shall be capable of supplying a total makeup flow rate of ≥ 46 m^3/hr (200 gpm) to the IC/PCC and spent fuel pools.	12. A test of the flow rate from each pump will be conducted.	12. The fire water supply system pumps independently provide the flow and pressure specified in the Certified Design Commitment.

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
13.Fire Detection	13.	13.
a. Local fire alarm panels supervise fire and smoke detectors.	a. Tests will confirm that local fire alarm panels supervise each fire and smoke detector.	a. Each fire and smoke detector is supervised by a local fire alarm panel.
b. The local fire alarm panels are connected to the alarm MFAP via a dedicated data link.	b. Inspections will confirm that local fire alarm panels are connected to the alarm MFAP via a dedicated data link.	b. A dedicated data link connects the local fire alarm panels to the MFAP.
c. Transmitted signals include detector status (normal, alarm, supervisory, trouble) and local fire alarm panel status.	c. Inspections will confirm that transmitted signals include detector status (normal, alarm, supervisory, trouble) and local fire alarm panel status.	c. Transmitted signals include detector status (normal, alarm, supervisory, trouble) and local fire alarm panel status.
d. Instrumentation for fixed and automatic fire suppression systems provides local and remote monitoring capabilities for the suppression system status.	d. Tests of the fixed and automatic fire suppression system instrumentation confirm local and remote monitoring capabilities.	d. Fixed and automatic fire suppression system instrumentation have local and remote monitoring capabilities.
e. All instrumentation for automatically actuated fire suppression systems is either FM approved or UL listed, where available.	e. Inspections will confirm that all instrumentation for automatically actuated fire suppression systems is either FM approved or UL listed.	e. All instrumentation for automatically actuated fire suppression systems is either FM approved or UL listed.

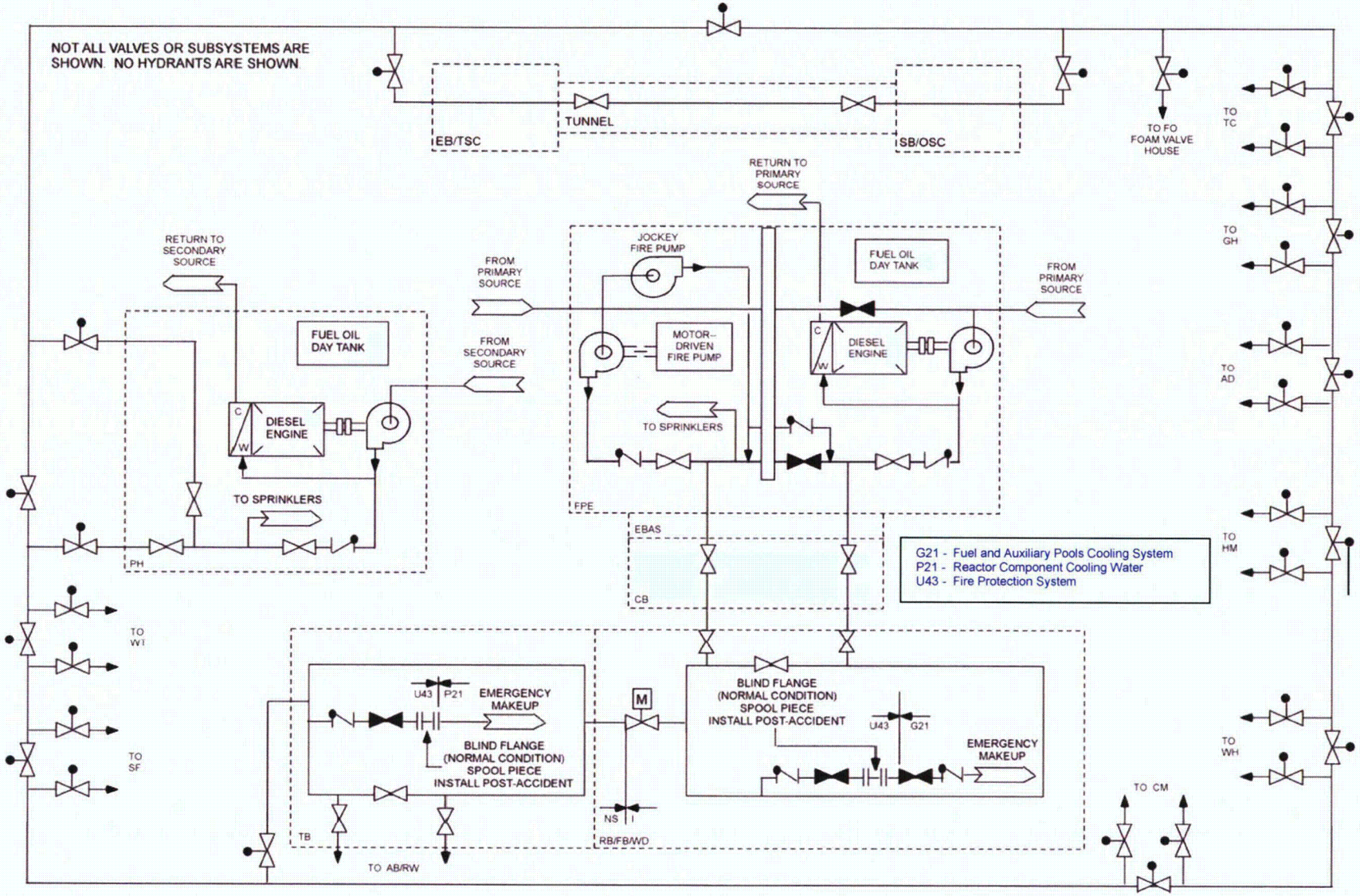

Figure 2.16.3-1. Fire Protection System

2.16.3.1 Fire Barriers

Design Description

Fire barriers of 3-hour fire resistance rating are provided separating:

- Safety-related systems from any potential fires in nonsafety-related areas that could affect the ability of safety-related systems to perform their safety function.
- Redundant divisions or trains of safety-related systems from each other to prevent damage from a single fire.
- Components within a single safety-related electrical division that present a fire hazard to components in another safety-related division.

Penetrations through fire barriers are sealed or closed to provide fire resistance ratings at least equal to that of the barriers. Only noncombustible materials qualified per ASTM E-119 are used for construction of fire barriers. Fire dampers protect ventilation duct openings in fire barriers as required by NFPA 90A

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.16.3.1-1 provides a definition of the inspections, test and/or analyses, together with associated acceptance criteria, which will be undertaken for the Fire Barriers.

Table 2.16.3.1-1

ITAAC For Fire Barriers

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. 3-hour fire barriers shall be installed in all locations listed in Subsection 2.16.3.1.	1. Inspections will assure 3-hour fire barriers are installed.	1. All locations listed in Subsection 2.16.3.1 are protected by 3-hour fire barriers.
2. Penetrations through fire barriers are sealed or closed to provide fire resistance ratings at least equal to that of the barriers.	2. Inspections will confirm that penetrations through fire barriers are sealed or closed to provide fire resistance ratings at least equal to that of the barriers.	2. Penetrations through fire barriers provide fire resistance ratings at least equal to that of the barriers.
3. Only noncombustible materials qualified per ASTM E-119 are used for construction of fire barriers.	3. Inspections of material records will confirm that Only noncombustible materials qualified per ASTM E-119 are used for construction of fire barriers.	3. Only noncombustible materials qualified per ASTM E-119 are used for construction of fire barriers
4. Fire dampers protect ventilation duct openings in fire barriers as required by NFPA 90A.	4. Inspections confirm that fire dampers in ventilation duct openings meet NFPA 90A.	4. Fire dampers in ventilation duct openings meet NFPA 90A.