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Subject: **Response to Portion of NRC Request for Additional Information Letter Nos. 129 and 140 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Numbers 9.5-65, 9.5-67, 9.5-68 (NRC Letter No. 129), and 9.5-70 (NRC Letter No. 140)**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter 129 dated December 19, 2007, Reference 1 and NRC letter 140, dated January 11, 2008, Reference 2. GEH response to RAI Numbers 9.5-65, 9.5-67, 9.5-68, and 9.5-70 are addressed in Enclosure 1.

If you have any questions or require additional information, please contact me.

Sincerely,

James C. Kinsey  
Vice President, ESBWR Licensing

*DOLO*  
*NRC*

References:

1. MFN 07-701, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 129 Related To ESBWR Design Certification Application*, dated December 19, 2007
2. MFN 08-031, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 140 Related To ESBWR Design Certification Application*, dated January 11, 2008

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter Nos. 129 and 140 Related to ESBWR Design Certification Application - Auxiliary Systems - RAI Numbers 9.5-65, 9.5-67, 9.5-68 (NRC Letter 129), and 9.5-70 (NRC Letter 140)

cc: AE Cabbage      USNRC (with enclosure)  
GB Stramback      GEH/San Jose (with enclosure)  
RE Brown          GEH/Wilmington (with enclosure)  
DH Hinds          GEH/Wilmington (with enclosure)  
eDRF                0000-0081-6538, Revision 2

**Enclosure 1**

**MFN 08-251**

**Response to Portion of NRC Request for  
Additional Information Letter Nos. 129 and 140  
Related to ESBWR Design Certification Application**

**Auxiliary Systems**

**RAI Numbers 9.5-65, 9.5-67, 9.5-68 (NRC Letter No.  
129) and 9.5-70 (NRC Letter No. 140)**

**NRC RAI 9.5-65**

*The new description in DCD Tier 2, Revision 4, Section 9.5.1.15.4.2 for the qualifications for membership in the fire brigade is not in accordance with regulatory guidance provided in Regulatory Guide (RG) 1.189, Regulatory Position (RP) 1.6.4.1. The qualifications described in the DCD make no distinction among the members of the brigade. The guidance in RP 1.6.4.1 has unique qualifications for the fire brigade leader; for two members with knowledge of the effects of fire suppressants on safe shutdown capability; and, for a fire team advisor for plants with dedicated professional fire departments. In addition, the annual physical should include a determination that the fire brigade members are able to perform strenuous firefighting activities.*

**GEH Response**

The qualifications of the fire brigade personnel as described in Regulatory Guide (RG) 1.189, Regulatory Position (RP) 1.6.4.1 will be incorporated into DCD Tier 2, Subsection 9.5.1.15.4.2.

**DCD Impact**

DCD Tier 2, Subsection 9.5.1.15.4.2 is revised in Revision 5 to incorporate qualification requirements as noted in the attached markup pages.

**NRC RAI 9.5-67**

*DCD Tier 2, Revision 4, Figure 9A.2-33 identifies the fire pump enclosure as fire area F7170, whereas Table 9A.5-7 identifies the fire pump enclosure as fire area F8250 for electric fire pump A and fire area F8260 for diesel fire pump B. The DCD should be revised to provide consistent numbering for the fire pump fire areas. Figure 9A.2-33 also indicates a Note 5 near the transformers, but there are only three (3) notes in the figure legend, and they are numbered sequentially from 1 to 3.*

**GEH Response**

DCD Tier 2 Appendix 9A, Figure 9A.2-33, is revised in Revision 5 to delete fire area designator F7170 since there are multiple fire areas for equipment in the Fire Pump Enclosure (FPE) and it is not practical to designate several fire areas for this building on this Figure. Note 5 near the transformer area was undefined and therefore is removed in Revision 5 of DCD Tier 2 Appendix 9A, Figure 9A.2-33. There was no note 4 on DCD Revision 4.

**DCD Impact**

Fire area designator F7170 and Note 5 are deleted from Figure 9A.2-33 of DCD Tier 2 Appendix 9A in Revision 5 as noted in attached mark-up.

**NRC RAI 9.5-68**

*Question 1. DCD Tier 2, Revision 4, Section 9.5.1.11 states that smoke control in accordance with NFPA 92A guidelines is provided for unsprinklered areas where the FHA identifies a potential for heavy smoke or heat conditions. The 2006 Edition of NFPA 92A (the edition identified in DCD Tier 2, Table 1.9-22) applies to a specific method of smoke control that relies on maintaining a differential pressure across fire area boundaries to prevent the spread of smoke from the area on fire to adjacent areas, or in the case of stairwells, prevent smoke from entering the stairwell. Regarding Tables 9A.5-1 through 9A.5-7 of the FHA in Appendix 9A of DCD Tier 2, Revision 4, the staff is not able to find any unsprinklered areas where a potential for heavy smoke or heat conditions is identified by GEH and none of the fire area descriptions indicate that smoke control is provided in accordance with NFPA 92A. These tables would be the appropriate place to identify any provisions for smoke control for specific fire areas. The DCD should be revised to indicate in Tables 9A.5-1 through 9A.5-7 any areas that are provided with smoke control in accordance with NFPA 92A or should include a statement that no areas meeting the criteria for this type of smoke control have been identified and provide the criteria for "heavy smoke or heat conditions".*

*Question 2. DCD Tier 2, Revision 4, Section 9.5.1.12 quotes the regulatory guidance that it should be demonstrated that smoke, hot gases, or the fire suppressant does not migrate into other fire areas to the extent that safe shutdown capabilities, including operator actions, could be adversely affected and states that the ESBWR fire protection design satisfies this guidance with a combination of fire dampers and other barriers, smoke evacuation capabilities, and minimal required operator manual actions. Fire dampers that are not smoke dampers do not provide an effective means of preventing smoke from passing through a ventilation duct that penetrates a fire barrier. The smoke evacuation capabilities described in the DCD are generally for smoke clearing after the fire has been extinguished. If smoke control measures are required during a fire to prevent the migration of smoke from one fire area to another in order to achieve and maintain safe shutdown, the details of these smoke control capabilities should be described in the DCD.*

*Question 3. Also note that the ABWR certified design includes smoke control capabilities that use the methods described in NFPA 92A (differential pressure across the fire barrier) and the ABWR certified design includes ITAAC for the verification of that capability. Should the ESBWR credit similar NFPA 92A smoke control capabilities for post-fire safe shutdown, similar ITAAC would be required for the ESBWR.*

*Question 4. DCD Tier 2, Revision 4, Section 9.5.1.11 also states that safe egress and safe smoke refuge areas during a fire incident are provided in*

*accordance with NFPA 92A guidelines for building occupants and the fire brigade. Section 9.4.4.2 states that the turbine building main stairwells are pressurized to prevent infiltration of smoke from other turbine building areas in the event of a fire. Section 9.4 does not identify any other stairwells in the plant that are pressurized. Are the turbine building stairwells the only stairwells in the plant that are pressurized to prevent smoke infiltration? As above, provision should be identified in Tables 9A.5-1 through 9A.5-7 since it is relevant to the FHA.*

### **GEH Response**

#### **RAI question 1 regarding smoke control**

DCD Tier 2, Revision 4, Subsection 9.5.1.11 does state that smoke control in accordance with NFPA 92A guidelines is provided for unsprinklered areas where the FHA identifies a potential for heavy smoke or heat conditions. However, areas identified in the FHA with a potential for heavy smoke or heat condition are provided with sprinkler systems for smoke control. The Fire Hazard Analysis (FHA) provides the criteria for automatic suppression as quantity and type of combustible materials present. Therefore, smoke control per NFPA 92A, Standard for Smoke-Control system Utilizing Barriers and Pressure Differences, is not required for maintaining smoke to the zone of fire origin. DCD 9.5.1.11 is revised to state areas identified in the FHA with a potential for heavy smoke or heat condition are provided with sprinkler systems for smoke control.

### **DCD Impact**

DCD Tier 2, Subsection 9.5.1.11 is revised to state areas identified in the FHA with a potential for heavy smoke or heat condition are provided with sprinkler systems for smoke control as shown on attached DCD Revision 5 markup.

#### **RAI question 2 regarding smoke migration affecting safe shutdown**

The ESBWR fire protection design satisfies this guidance with a combination of fire dampers and other barriers with minimal required operator actions. The operator actions would be in the MCR to initiate shutdown prior to evacuation. Details are provided in the fire hazards analysis in Appendix 9A.

The following is the risk evaluation of potential smoke propagation.

- **N-DCIS room A (fire area F3301), Div I and IV Q-DCIS rooms (fire areas F3110 and F3140):** The risk increase due to the additional failures for the postulated smoke damage is not significant since the ESBWR plant has N-2 redundancy in the safety system design. With the additional

failure probability of the smoke removal mode and the failure of fire dampers to isolate, the risk contribution due to smoke propagation is not significant.

- **N-DCIS room B (fire area F3302), Div II and Div III Q-DCIS rooms (fire areas F3120 and F3130):** Same as above. The risk increase due to smoke propagation is not significant.
- **Electric and electronic rooms in the electric building for each train of the electrical distribution system:** The risk increase due to the additional failures for the postulated smoke damage is not significant since only one train of the electric system is impacted. With the additional failure probability of the smoke removal mode and the failure of fire dampers to isolate, the risk contribution due to smoke propagation is not significant.
- **Different areas in the reactor building:** The ESBWR plant is designed with N-2 redundancy (four divisions) in safety related systems to enable safe shutdown of the facility with only one of the four divisions operational. Each division is separated by smoke barriers with smoke/fire damper combinations in the ductwork passing between fire areas. The risk increase due to smoke propagation from one fire area to adjacent areas is therefore not significant.

In summary, the risk associated with postulated smoke propagation is not significant.

#### **DCD Impact**

None

#### **RAI question 3 regarding credit for smoke control for post fire shutdown**

The ESBWR does not credit NFPA 92A smoke control capabilities for post-fire shutdown; therefore, no ITAAC is required.

#### **DCD Impact**

None

#### **RAI question 4 regarding pressurization of stairwells**

The Turbine, Electrical, Reactor, Fuel, Radwaste and Control Buildings are provided with pressurized stairwells, in accordance with International Building Code (IBC) 2003 edition, section 1019.1.8 which requires pressurized stairwells where stairwells serve floors 75 ft. or more above the lowest level of fire

department vehicle access (grade level) or more than 30 ft. below the level of exit discharge. The design of the pressurized stairwells complies with NFPA 92A. Per the requirements of IBC 2003 section 1019.1.8, pressurized stairwells are not required for the Service Building.

**DCD Impact**

DCD Tier 2, Subsection 9.5.1.11 is revised to address the buildings requiring pressurized stairwells, in accordance with International Building Code (IBC) 2003 Edition, Section 1019.1.8 as shown on attached DCD Revision 5 markup.

**NRC RAI 9.5-70**

*DCD Sections 9.5.1.15.2; 9.5.1.15.3; and 9.5.1.15.4.1 refer to Section 13.1 for a description/discussion of the fire protection program staffing and the fire brigade organization. Section 13.1 of the ESBWR DCD, Revision 4 does not include any description or discussion of the fire protection staffing or fire brigade organization and states that Section 13.1 is the responsibility of the COL applicant. Revise Section 9.5.15 of the DCD to explain that the description of the fire protection program staffing and fire brigade organization is the responsibility of the COL applicant and provide pointers applicable COL items (13.1-1(A), 13.4-1(A) and 9.5.1-10(H) where the COL applicant will address these issues.*

**GEH Response**

DCD Tier 2 Chapter 13 Revision 4, Sections 13.1, Organizational Structure of Applicant, and 13.4, Operational Program Implementation, contain COL Applicant and Holder Information requiring the COL Applicant to demonstrate the organizational structure and fully describe Operational Programs such as the Fire Protection Program. Individual organizations and programs are not described in Sections 13.1 and 13.4.

**DCD Impact**

DCD Tier 2 Subsection 9.5.1 is revised in Revision 5 to add a pointer to COL item (13.1-1-A) for providing a description of the fire protection program staffing requirements including the organization of the Fire Brigade as reflected in the attached markup. DCD Tier 2 Subsection 9.5.1 is also revised in Revision 5 to add a pointer to COL item (13.1-4-A) for providing a description of the Fire Protection Program.

- Developing and implementing preventive maintenance, corrective maintenance, and surveillance test fire protection procedures;
- Ensuring plant modifications, new procedures and revisions to procedures associated with fire protection equipment and systems that have significant impact on the Fire Protection Program are reviewed by an individual who possesses the qualifications of a fire protection engineer. The COL applicant shall provide the proposed fire protection license condition for making changes to the fire protection system without prior review and approval of the NRC (9.5.1-9-A).
- Ensuring a continuing evaluation of fire hazards during construction or modification of other units on the site. Additional fire barriers, fire protection capability and administrative controls are provided as necessary to protect the operating unit(s) from construction or modification activities.

#### 9.5.1.15.3 Fire Protection Program Staffing Requirements

Fire Protection Staffing requirements are described in Section 13.1. The COL applicant shall provide a description of the fire protection program staffing requirements and the organization of the Fire Brigade (COL 13.1-1-A).

#### 9.5.1.15.4 Onsite Fire Operations Training

The COL Holder shall provide provisions for manual fire-fighting capability for all plant areas (9.5.1-10-H).

##### 9.5.1.15.4.1 General

The Fire Brigade organization is discussed in Subsection 13.1.2.1.5. Fire protection training consists of training in three specific areas:

- Employees designated to be members of the station fire brigade;
- Employees assigned to the fire protection staff; and
- Offsite fire departments.

Specific training requirements for each of the above categories of personnel are described in the following sections

##### 9.5.1.15.4.2 Fire Brigade Training

The qualifications of the fire brigade personnel are described in Regulatory Guide 1.189, Regulatory Position 1.6.4.1. The brigade leader and at least two members should have sufficient training in or knowledge of plant systems to understand the effects of fire and fire suppressants on safe-shutdown capability. Such competence by the brigade leader may be evidenced by possession of an operator's license or equivalent knowledge of plant systems. Nuclear power plants staffed with a dedicated professional fire department may utilize a fire team advisor to assess the potential safety consequences of a fire and advise the control room and incident commander. The fire team advisor should possess an operator's license or equivalent knowledge of plant systems and be dedicated to supporting the fire incident commander during fire emergency events. The fire team advisor does not need to meet the qualifications of a brigade

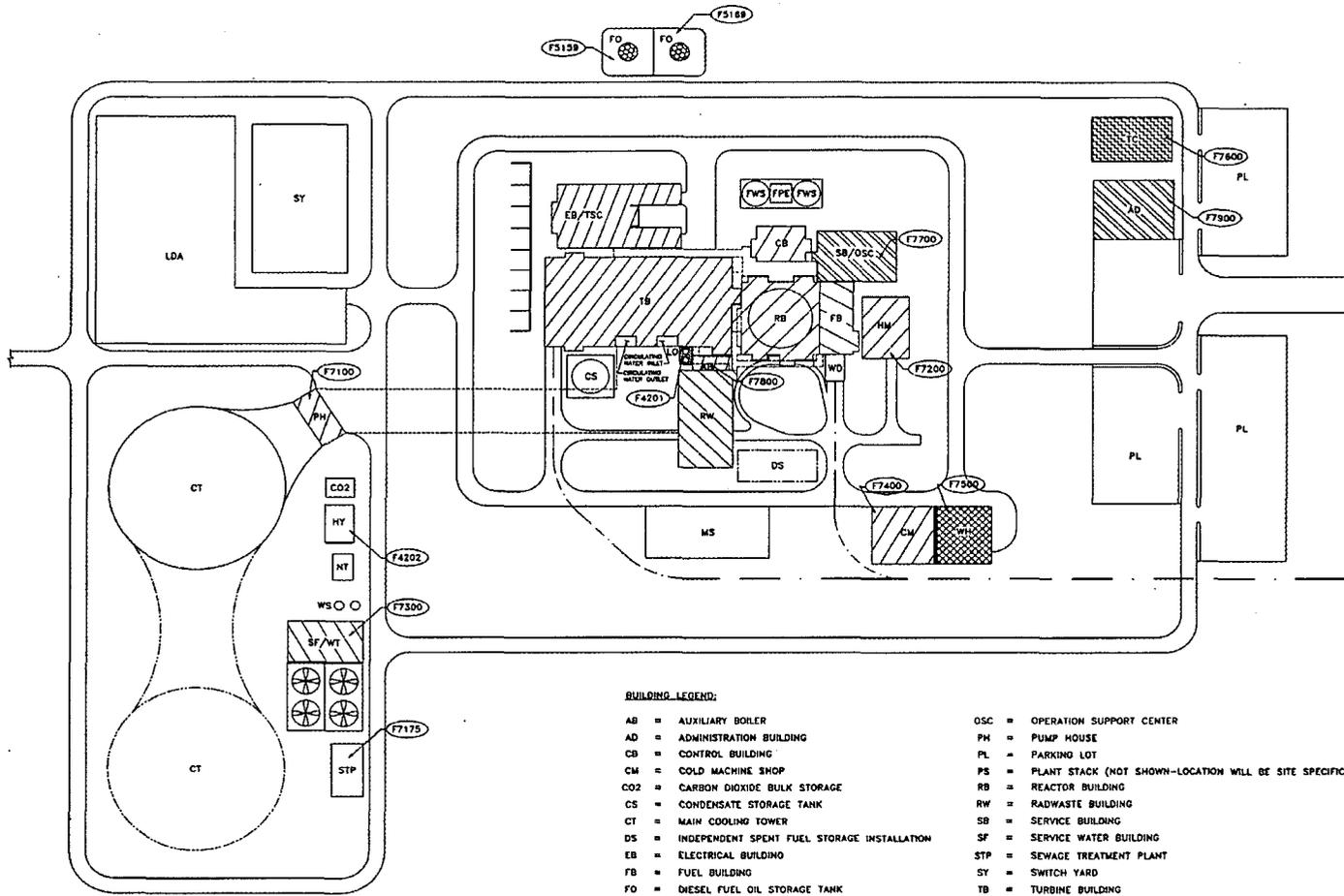
member, but if the team advisor does not meet the qualifications of a fire brigade member, there should be five available qualified fire brigade members in addition to the fire team advisor. Personnel assigned as fire brigade members receive formal training prior to assuming brigade duties. The course subject matter is selected to satisfy the requirements of Regulatory Guide 1.189. In addition, course material selection also includes guidance from NFPA Codes 600 and 1500 as appropriate. Additional training may also include material selection from NFPA 1404 and 1451.

Course material includes the following classroom instruction:

- Chemistry of fire;
- Classification of fires and principles of extinguishment;
- Fire prevention and inspection techniques;
- Fire protection systems;
- Radiological safety aspects of fires at nuclear facilities;
- Indoctrination of plant firefighting plans with specific identification of individual responsibilities;
- Identification of the type and location of fire hazards and associated types of fires that could occur in the plant;
- The toxic and corrosive characteristics of expected products of combustion;
- Identification of the location of firefighting equipment for each fire area and familiarization with the layout of the plant, including access and egress routes;
- The proper use of available firefighting equipment and the correct method of fighting each type of fire including: fires in energized electrical equipment, fires in cables and cable trays, hydrogen fires, fires involving flammable and combustible liquids or hazardous process chemicals, fires resulting from construction or modifications (welding), and record file fires;
- The proper use of communication, lighting, ventilation, and emergency breathing equipment;
- The proper method for fighting fires inside buildings and confined spaces;
- The direction and coordination of firefighting activities (fire brigade leaders only); and
- Detailed review of firefighting strategies and procedures.

Field exercises are conducted to reinforce the classroom training and provide an opportunity to practice the skills learned. These exercises include:

- Fighting small fires with portable fire extinguishers;
- Fighting interior fires using breathing apparatus;
- Controlling incidents involving flammable gases or pressurized liquid fuels;
- Fighting large flammable liquid fires using hose lines and/or foam; and



- NOTES:  
 1. THE FOLLOWING SYMBOLS ARE USED ON THIS DRAWING.
- 2-HR RATED FIRE BARRIER (WALL)
  - FIRE AREA DESIGNATION
  - RETRIMING COVERAGE
  - INSULATION COVERAGE
  - SFT-PIPE SPRINKLER COVERAGE
  - SFT-PIPE SPRINKLER COVERAGE
  - FOAM WATER DELUGE COVERAGE
2. FOR CURRENT GENERAL ARRANGEMENT INFORMATION SEE DESIGN TOGETHERS.  
 3. BACKGROUND GENERAL ARRANGEMENT INFORMATION IS FOR REFERENCE ONLY.

**BUILDING LEGEND:**

- |  |   |
|--|---|
| AB = AUXILIARY BOILER                            | OSC = OPERATION SUPPORT CENTER                              |
| AD = ADMINISTRATION BUILDING                     | PH = PUMP HOUSE   |
| CB = CONTROL BUILDING                            | PL = PARKING LOT  |
| CM = COLD MACHINE SHOP                           | PS = PLANT STACK (NOT SHOWN-LOCATION WILL BE SITE SPECIFIC) |
| CO2 = CARBON DIOXIDE BULK STORAGE                | RB = REACTOR BUILDING                                       |
| CS = CONDENSATE STORAGE TANK                     | RW = RADWASTE BUILDING                                      |
| CT = MAIN COOLING TOWER                          | SB = SERVICE BUILDING                                       |
| DS = INDEPENDENT SPENT FUEL STORAGE INSTALLATION | SF = SERVICE WATER BUILDING                                 |
| EB = ELECTRICAL BUILDING                         | STP = SEWAGE TREATMENT PLANT                                |
| FB = FUEL BUILDING                               | SY = SWITCH YARD  |
| FO = DIESEL FUEL OIL STORAGE TANK                | TB = TURBINE BUILDING                                       |
| FPE = FIRE PUMP ENCLOSURE                        | TC = TRAINING CENTER  |
| FWS = FIRE WATER STORAGE TANK                    | TSC = TECHNICAL SUPPORT CENTER                              |
| HM = HOT MACHINE SHOP & STORAGE                  | WD = WASH DOWN BAYS (EQUIPMENT ENTRY)                       |
| HT = HYDROGEN BULK STORAGE                       | WH = WAREHOUSE  |
| LDA = LAY DOWN AREA                              | WS = WATER STORAGE  |
| LO = DIRTY/CLEAN LUBE OIL STORAGE TANK           | WT = WATER TREATMENT  |
| MS = MISCELLANEOUS SERVICE AREA                  |   |
| NT = NITROGEN STORAGE TANK                       |   |

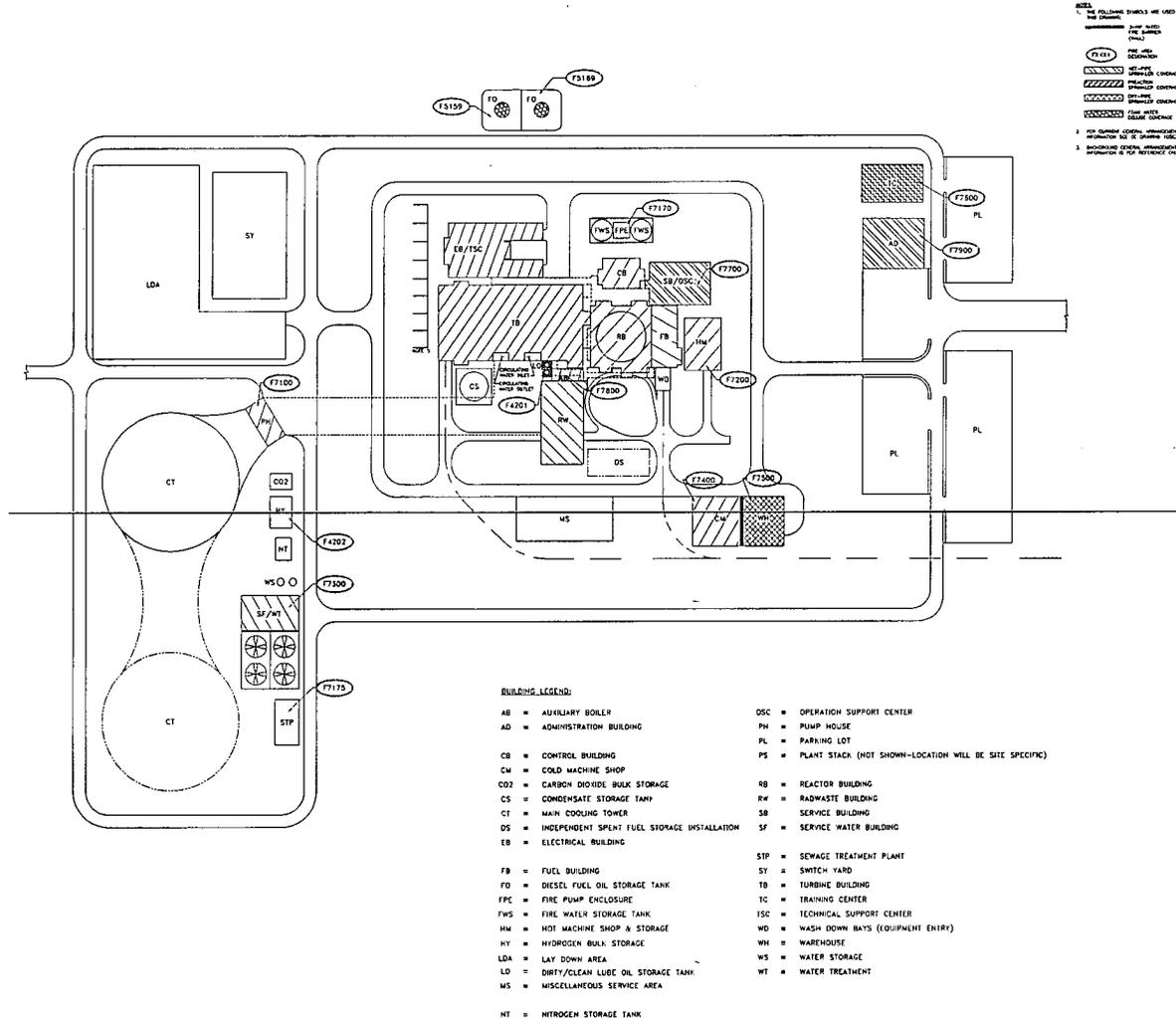


Figure 9A.2-33. Site Fire Protection Zone ESBWR DCD Plot Plan

The COL applicant shall provide specific design and certification testing details for fire barriers and electrical raceway fire barrier systems in accordance with applicable sections of NFPA 251, ASTM E-119 and guidance in Regulatory Guide 1.189 (9.5.1-5-A).

#### **9.5.1.11 Building Ventilation**

Fire protection/smoke control provisions for ventilation for the various building areas are designed as follows:

~~Smoke control in accordance with NFPA 92A guidelines is provided for unsprinklered areas where the FHA identifies a potential for heavy smoke or heat conditions.~~ Areas identified in the FHA with a potential for heavy smoke or heat condition are provided with sprinkler systems for smoke control. Additionally, safe egress and safe smoke refuge areas during a fire incident are provided in accordance with NFPA 92A guidelines for building occupants and the fire brigade. NFPA 101 guidelines are utilized for the design and labeling of safe egress routes.

Smoke removal meets NFPA 804 with exception to NFPA 804 Sections 8.4.3 (3) and 8.4.3.2. Automatic sprinkler protection is provided for the high density cable tunnels, fuel oil tank rooms, diesel-generator rooms and a significant portion of the Turbine Building to limit heat and smoke generation. The COL Holder will establish provisions for manual smoke control by manual actions of the fire brigade for all plant areas in accordance with NFPA 804 guidelines (9.5.1-6-H).

#### **Pressurization of Stairwells**

The Turbine, Electrical, Reactor, Fuel, Radwaste and Control Buildings are provided with pressurized stairwells, in accordance with International Building Code (IBC) 2003 edition, section 1019.1.8 which requires pressurized stairwells where stairwells serve floors 75 ft. or more above the lowest level of fire department vehicle access (grade level) or more than 30 ft. below the level of exit discharge. The design of the pressurized stairwells complies with NFPA 92A. Per these IBC requirements, pressurized stairwells are not required for the Service Building.

#### **Control Building (CB) Smoke Removal**

The CB HVAC System (CBVS) provides smoke removal through two CBVS subsystems: Control Room Habitability Subsystem (CRHAVS) and Control Building General Area HVAC Subsystem (CBGAVS). Fire-rated penetration seals and smoke dampers are provided to prevent smoke and hot gases from migrating into other fire areas.

#### **Control Room Habitability HVAC Area Subsystem (CRHAVS)**

The MCR is separated from the rest of the Control Building by a 1-hour fire barrier and separated from other major plant areas by 3-hour fire barriers.

Manual fire fighting capability in the MCR consists of portable dry Class ABC chemical fire extinguishers. Additionally, hose stations with UL-approved fixed fog nozzles are installed outside both entrances to the MCR. No hose stations are located within the MCR.

The MCR is provided with smoke detectors that actuate audible and visible alarms on the MFAP in the MCR.

The primary motor-driven fire pump is designed to start, if the primary jockey pump cannot maintain pressure in the NI loop. If pressure is not maintained in the NI loop with the motor-driven fire pump, then the primary Seismic Category I diesel-driven fire pump initiates. The secondary motor-driven fire pump initiates if the secondary jockey pump cannot maintain pressure in the yard loop. If pressure is not maintained in the yard loop with the secondary motor-driven fire pump, then the secondary NS diesel-driven fire pump initiates. All fire pumps are stopped manually. Any fire pump can be started manually from the MFAP in the MCR or locally.

Pressure instrumentation automatically starts and stops the primary and secondary motor-driven jockey pumps.

#### **9.5.1.15 Fire Protection Program**

The ESBWR Fire Protection Program is established to ensure that a fire will not prevent safe shutdown of the plant and will not endanger the health and safety of the public. Fire protection at the plant uses a defense-in-depth concept that includes fire prevention, detection, control and extinguishing systems and equipment, administrative controls, procedures, trained personnel and the shutdown capability. The COL applicant shall provide a milestone for implementation of the applicant's Fire Protection Program (9.5.1-8-A).

##### **9.5.1.15.1 Fire Protection Program Criteria**

The ESBWR Plant Fire Protection Program is based on the criteria of several industry and regulatory documents that are referenced in Table 9.5-1.

##### **9.5.1.15.2 Organization and Responsibilities**

~~The organizational staffing structure of the Fire Protection Program is discussed in Chapter 13.1.~~ The COL applicant shall provide a description of the Fire Protection program (COL 13.4-1-A).

The on-duty Shift Supervisor has responsibility for taking certain actions based on an assessment of the magnitude of the fire emergency. These actions include safely shutting down the plant, making recommendations for implementing the Emergency Plan, notification of emergency personnel and requesting assistance from off-duty personnel, if necessary. Emergency Plan consideration of fire emergencies includes the guidance of Regulatory Guide 1.101.

The site engineer in charge of the Fire Protection Program is responsible for the following:

- Ensuring that programs and periodic inspections are implemented to;
  - Minimize the amount of combustibles in safety-related areas; and
  - Determine the effectiveness of housekeeping practices.
- Assure the availability and acceptability of the following;
  - Fire Protection System and components;
  - Manual fire fighting equipment;
  - Emergency breathing apparatus;