SEABROOK STATION

Evaluation and Comparison to BTP APCSB 9.5-1, Appendix A

Revision 19

On September 30, 1976, the NRC requested the Public Service Company of New Hampshire to conduct a re-evaluation of the fire protection program proposed for Seabrook Units 1 & 2, and to compare in detail the fire protection provisions proposed for Seabrook with the guidelines in Appendix A to Branch Technical Position APCSB 9.5-1. The request also stated that the re-evaluation would require the preparation of a fire hazards analysis, with assistance and technical direction from a qualified fire protection engineer.

The above request resulted in a report which included an evaluation and fire hazards analysis originally performed by United Engineers and Constructors under the direction of UE&C's Mr. Alfred S. Bocchino, P. E. Mr. Bocchino's resume is included in Appendix C of this report. The operational aspects of the re-evaluation were conducted by a Yankee Atomic Electric Company task force under the direction of Mr. E. A. Sawyer, whose resume is also included in Appendix C.

The above evaluation of the fire protection provisions was based on the guidelines contained in Appendix A to BTP APCSB 9.5-1 (plants for which applications for construction permits were docketed prior to July 1, 1976, but have not received a construction permit) and fully addressed the issues, criteria and concerns presented by the NRC.

The major changes incorporated in the above evaluation included:

1. Various changes resulting from the review and evaluation of 10 CFR 50, Appendix R.

2. Incorporation of Safety Evaluation Report (SER) commitments.

In the course of the above evaluation, the concept of "defense-in-depth" was applied and fire protection was treated from this viewpoint. Simply stated, this concept is:

1. Preventing fires from starting;

2. Detecting fires quickly, suppressing those fires that occur, putting them out quickly, and limiting their damage; and

3. Designing plant safety systems so that a fire that starts in spite of the fire prevention program and burns for a considerable time in spite of fire protection activities will not prevent essential plant safety functions from being performed.

When this report is updated, the philosophy of the methodology remains unchanged. The following discussion describes the philosophy of the above report and any subsequent updates.

Plant design was reviewed and design provisions were included to provide protection of essential plant safety systems by physical barriers or spatial separation. Combustibles were identified and minimized as much as is practicable. Additionally, provisions were included for early detection of possible fires, with primary systems and back-up fire fighting systems available in the safety-related plant areas. The plant was designed to be constructed of non-combustible materials, where practical.

The fire protection systems described in this report are those required for protection of structures, systems and components required for safe reactor shutdown and safety-related systems. Other fire protection systems not described in this report are available for protection of non-safety-related structures, systems and components.

For prompt extinguishing of the fires associated with major electrical cables, efficient use of water is made from fixed systems spraying directly on the fires, as well as manual application with fire hoses.

A description of the fire protection system is provided in Section B. Included are pertinent general arrangement and P&ID system drawings, and a plot plan, as well as a tabulation of suppression and detection means by area and zone.

A brief discussion on safe shutdown systems and procedures is presented in the Fire Protection of Safe Shutdown Capability (10 CFR, Appendix R) Report.

The criteria used in the evaluation program are presented in Section D of the report, and include the applicable general design criteria as well as criteria for single failure, defense-in-depth, fire suppression systems capacity and capability, and occurrence of fire coincident with other accidents, events or phenomena.

The method of review and analysis is described in Section E of the report.

The basis for the fire hazards analysis is defined and the scope of the evaluation, including assumptions and design basis fire conditions, is provided. Designation of fire areas and zones is also discussed here.

The summary of the results of the evaluation program is set forth in Section F of the report. Subsection F.l presents a brief tabular summary indicating compliance, partial compliance or non-compliance with the BTP positions and page number of the partial compliance and non-compliance items. The bulk of the report is contained in Subsection F.2 which comprises the detailed analyses of the consequences of a fire in each of the designated fire areas/zones, as well as selected general arrangement drawings of the plant areas housing the safety-related equipment and equipment required for safe shutdown of the plant, with the designated fire areas/zones and ingress/egress routes from these areas 5 superimposed. Section F.3 presents the detailed responses to each of the positions of Branch Technical Position APCSB 9.5-1, Appendix A. This review indicates criteria that are satisfied, partially satisfied and those not satisfied, with an explanation in each instance.

This report is applicable only to Unit 1. The construction to Unit 2 has been halted and the fire protection program evaluation for Unit 2 has been deleted from this report.

1. General

The plant fire protection system is a non-safety-related system designed to detect, control and extinguish potential fires, and to minimize their effect.

The relative location of the various plant buildings is shown on the station layout drawing, UFSAR Figure 1.2-1, sh. 1. The fire protection yard piping system is depicted on UFSAR Figure 9.5-4 and the fire pump house fire protection piping system is depicted on UFSAR Figure 9.5-5.

Fire detection is provided at locations determined by the fire hazard analysis as having significant fire hazards resulting from the presence of combustible liquids, solids or other flammable materials. Detection is also provided in other areas on a case basis.

Fire protection system piping and components in the area of safety-related systems required for safe shutdown of the plant are designed so that neither piping failure, seismic event, nor inadvertent operation of the system components, could result in the loss of safety related systems.

2. Design Features

a. Water Supply and Pumping Arrangements

The water supply for the plant fire protection system is obtained from two (2) 500,000-gallon water storage tanks. 300,000 gallons of water from each tank is dedicated for fire protection; the remainder is available for other plant use. During the winter months, the fire protection water is heated to prevent freezing. Two (2) diesel-driven and one (1) electric motor-driven fire pumps are provided to guarantee an uninterrupted supply of water.

Two (2) diesel-driven or one (1) diesel-driven and one (1) electric motor-driven fire pumps have the capacity to serve the maximum predicted demand for a safety related area suppression purposes, plus 500 gpm for hose streams through the yard hydrants or standpipe hose reels. (Reference Deviation No. 9, SBN 932, dated January 24, 1986). Deviation No. 9 of SBN-932 indicated that the largest demand safety related area was the Diesel Generator Room. Per EC274103, it has since been determined that the largest demand safety related area is the PAB.

Electric motor-driven jockey pumps normally will maintain system pressure.

A diesel fuel storage tank is provided for each diesel engine to supply fuel for a minimum of eight (8) hours.

A flow meter is included with the pump installation for the purpose of testing pump performance.

Piping is so arranged that any or all fire pumps can take suction from either water storage tank. The buildings within the protected area are encircled by a 12" underground cement-lined, welded steel pipe fire loop to supply yard fire hydrants and the various fire protection systems in the plant.

Post indicator isolation valves are provided at strategic locations in the underground loop header to allow for sectionalization during maintenance and repair, and to provide flow from the pumping facilities in either of two different directions in the event of a line break. Post indicator valves are also positioned in the loop header to isolate the loop between the take-offs for primary suppression and secondary systems.

Fire hydrants, spaced approximately 250 feet apart and having individual isolation valves, are provided on branches off the underground loop. Hose houses and associated equipment are located at alternate hydrants.

b. Stand-Pipe System

Wet and dry standpipe systems are installed in the various buildings of the plant, including stair towers and other points of normally accessible areas. Dry standpipes are installed in the containment. Wet standpipes are installed in the control building, primary auxiliary building, fuel storage building, equipment vault, emergency feedwater pump building, diesel generator building and waste processing building. Wet standpipes are also installed in the administration building and turbine building. Hose stations are strategically located throughout the buildings. Hose stations are located in each building or section of building, such that all portions of each elevation of the building are adequately covered.

c. Sprinkler and Spray Systems

Wet pipe automatic sprinkler systems are installed in the administration and service building, turbine building, guardhouse, chlorination building, fire pump house, Alternate RP Checkpoint and Mechanical Maintenance Storage Facility.

Pre-action sprinkler systems are installed in the electrical tunnels from control building to containment, including penetrations, from the control building to primary auxiliary building (PAB), El. 25'-0" and the electrical chase of the PAB, the diesel generator fuel oil storage tanks, fuel oil piping in floor trenches in the diesel generator building, diesel generator engine rooms, the PAB (component cooling area), Turbine Generator bearings and oil piping (bearings to guard pipe).

The following equipment are provided with deluge systems:

Oil - filled Transformers

Lube Oil Storage Tanks

Lube Oil Conditioning Equipment

Hydraulic Oil Pumping Unit

Hydrogen Seal Oil Unit

Oil Day Tanks in the Diesel Generator Building

Cable Spreading Room

Turbine Feedpump Lube Oil Conditioning Equipment

Waste Process Bldg. Equipment (Asphalt Metering Pump; Extr./Evap.; Turn Table Area; Full Drum Conveyor)

An Automatic fixed Halon 1301 fire suppression systems is provided for the main computer room adjacent to the main control room. Fire barrier walls are provided between the main unit, start-up and station service transformers to limit the spread of fire from one transformer to another. The turbine building wall adjacent to the transformers is also a fire barrier wall.

d. Fire Detection and Alarm

Thermal, ultraviolet, smoke (i.e. photoelectric and ionization) and beam type fire detectors are located throughout the plant, as required by the fire hazard analysis. All fire detectors provide alarm at its local control panel and a visual and an audible alarm in the main control room. Carbon monoxide detectors have been installed at certain charcoal filters. See Table 1 for fire detection and suppression methods employed in the various safety-related fire areas and zones.

e. Miscellaneous Fire Protection

Portable hand-held extinguishers, primarily dry chemical, $C0_2$, Halon 1211 and water are provided at strategic locations throughout the various buildings to provide protection against small local fire hazards.

Note: The term Halon or Halon 1211 is used to identify any of a family of Halon fire extinguishing gases: Halon 1211 or any of the Halon 1211 replacement gases such as hydrofluorocarbons (HFC's), hydrochlorofluorocarbons (HCFC) or blended agents such as Halotron.

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
1. CONTAINMENT				
C-F-l-Z	Containment Floor	Port. Exting.	Hose Station	Smoke
C-F-2-Z	Containment Floor	Port. Exting.	Hose Station	Smoke
C-F-3-Z	Containment Floor	Port. Exting.	Hose Station	None
	CAH-F-8	Port. Exting.	Hose Station	Temp Elements & Carbon Monoxide Detection in Filter
2. EMERGENCY FEEDWATER PUMP BUILDING				
EFP-F-l-A	Feedwater Pump Room	Port. Exting.	Hose Station	Smoke
3. MAIN STEAM AND FEEDWATER PIPE CHASE				
MS-F-lA-Z	Lower Level	Port. Exting.	Yard Hydrant	Smoke
MS-F-lB-Z	Lower Level	Port. Exting.	Hose Station	Smoke
MS-F-2A-Z	Upper Level	Port. Exting.	Hose Station	Beam
MS-F-2B-Z	Upper Level	Port. Exting.	Hose Station	Beam
MS-F-3A-Z	Electrical Room	Port. Exting.	Yard Hydrant	Smoke
MS-F-3B-Z	Personnel Hatch Area	Port. Exting.	Yard Hydrant	Smoke
MS-F-4A-Z	H_2 Analyzer Room	Port. Exting.	Yard Hydrant	Smoke
MS-F-5A-Z	Cable Tunnel	Port. Exting.	Hose Station	Smoke

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
4. RHR. S.I. EQUIPMENT VAULT				
RHR-F-1A-Z	Containment Spray 9B	Port. Exting.	Hose Station	Smoke
RHR-F-1B-Z	Containment Spray 9A	Port. Exting.	Hose Station	Smoke
RHR-F-1C-Z	RHR Pump 8B	Port. Exting.	Hose Station	Smoke
RHR-F-1D-Z	RHR Pump 8A	Port. Exting.	Hose Station	Smoke
RHR-F-2A-Z	Safety Injection Pump 6B	Port. Exting.	Hose Station	Smoke
RHR-F-2B-Z	Safety Injection Pump 6A	Port. Exting.	Hose Station	Smoke
RHR-F-3A-Z	RHR Ht. Exch. 9B	Port. Exting.	Hose Station	Smoke
RHR-F-3B-Z	RHR Ht. Exch. 9A	Port. Exting.	Hose Station	Smoke
RHR-F-4A-Z	Stairway & Manlift Area - South	Port. Exting.	Hose Station	Smoke
RHR-F-4B-Z	Stairway & Hatch Area - North	Port. Exting.	Hose Station	Smoke

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
5. CONTROL BUILDING				
CB-F-1A-A	Switchgear Room “A” (Includes MG Set Rod Drive Rooms)	Port. Exting.	Hose Station	Smoke
CB-F-lB-A	Switchgear Room “B"	Port. Exting.	Hose Station	Smoke
CB-F-1D-A	Battery Room A	Port. Exting.	Hose Station	Smoke
CB-F-1E-A	Battery Room C	Port. Exting.	Hose Station	Smoke
CB-F-1F-A	Battery Room B	Port. Exting.	Hose Station	Smoke
CB-F-1G-A	Battery Room D	Port. Exting.	Hose Station	Smoke
CB-F-2A-A	Cable Spreading Room	Auto. Deluge	Port. Exting	Smoke
CB-F-2B-A	Mechanical Rm. North	Port. Exting.	Hose Station	Smoke
CB-F-2C-A	Mechanical Rm. South	Port. Exting.	Hose Station	Smoke
CB-F-3A-A	Control Room	Port. Exting.	Hose Station	Smoke & Thermal
CB-F-3A-A	Computer Engineer's Work Space	Port. Exting.	Hose Station	Smoke
CB-F-3B-A	HVAC Eqpt. & Duct Rm.	Port. Exting.	Hose Station	Smoke
CB-F-3B-A	Emerg. Clean-Up Air Unit - CBA-F-38, -8038	Port. Exting.	Hose Station	Carbon Monoxide Detect Monitored Temp. Indication
CB-F-3C-A	Computer Room	Fixed Halon1301 System	Port. Exting.	Smoke
CB-F-S1-0	Stairwell	Port. Exting.	Hose Station	None
CB-F-S2-0	Stairwell	Port. Exting.	Hose Station	None

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
6. ELECTRICAL TUNNELS				
ET-F-1A-A	Upper Electrical Tunnel Train "A"	Pre-Action	Port. Exting.	Smoke
ET-F-1B-A	Electrical Tunnel Train "A"	Pre-Action	Port. Exting.	Smoke
ET-F-1C-A	Lower Electrical Tunnel Train "B"	Pre-Action	Port. Exting.	Smoke
ET-F-1D-A	Electrical Tunnel, Train "B"	Pre-Action	Port. Exting.	Smoke
ET-F-S1-0	Stairwell	Port. Exting.	Hose Station	None

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
7. DIESEL GENERATOR BUILDING				
DG-F-1A-A	Fuel Oil Storage Tank Area - North	Auto. Preaction	Port. Exting.	Smoke & Thermal
DG-F-1B-A	Fuel Oil Storage Tank Area - South	Auto. Preaction	Port. Exting.	Smoke & Thermal
DG-F-2A-A	Engine Room North	Auto Preaction (on Oil Piping) Manual Preaction (area wide for room)	Port. Exting.	Thermal Smoke Ultraviolet
DG-F-2B-A	Engine Room South	Auto Preaction(on Oil Piping) Manual Preaction(area wide for room)	Port. Exting.	Thermal Smoke Ultraviolet
DG-F-3A-Z	HVAC Equipment Area	Port. Exting.	Hose Station	Smoke
DG-F-3B-Z	HVAC Equipment Area	Port. Exting.	Hose Station	Smoke
DG-F-3C-A	Fuel Oil Day Tank Area	Auto. Deluge	Port. Exting.	Smoke & Thermal
DG-F-3D-A	Fuel Oil Day Tank Area	Auto. Deluge	Port. Exting.	Smoke & Thermal
DG-F-3E-A	Train A, DG Air Intake Area	Port. Exting.	Hose Station	None
DG-F-3F-A	Train A, DG Air Intake Area	Port. Exting.	Hose Station	None
DG-F-S1-0	Stairwell	Port. Exting.	Hose Station	None
DG-F-S2-0	Stairwell	Port. Exting.	Hose Station	None

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
8. PRIMARY AUXILIARY BUILDING				
PAB-F-1A-Z	Chiller Pump Area	Port. Exting.	Hose Station	Smoke
PAB-F-1B-Z	Demin. Filter & Vlv. Maintenance Area	Port. Exting.	Hose Station	None
PAB-F-1C-A	Charging Pmp-2A Area	Port. Exting.	Hose Station	Smoke
PAB-F-1D-A	Charging Pmp-2B Area	Port. Exting.	Hose Station	Smoke
PAB-F-1E-A	Reciprocating Charging Pump Area	Port. Exting.	Hose Station	Smoke
PAB-F-1F-Z	Letdown Degasifier	Port. Exting.	Hose Station	Smoke
PAB-F-1G-A	Electrical Chase	Pre-Action Dry Pipe	Hose Station	Smoke
PAB-F-1J-Z	Aux. Steam Cond. Tank Area	Port. Exting.	Hose Station	Smoke
PAB-F-1K-Z	RCA Walkway and Non-Rad. Pipe Tunnel	Port. Exting.	Hose Station	None
PAB-F-2A-Z	Resin Fill Tank Area	Port. Exting.	Hose Station	Smoke
PAB-F-2B-Z	Boric Acid Tank Area	Port. Exting.	Hose Station	Smoke
PAB-F-2C-Z	Primary Component Cooling Pump Area	Pre-Action Dry Pipe	Port. Exting.	Smoke
PAB-F-3A-Z	Water Cooler Heat Exch. Area CAP-F-40	Port. Exting. Port. Exting.	Hose Station Hose Station	Smoke Temp Elements & Carbon Monoxide Detection in Filter
PAB-F-3B-Z	PAB Supply & Exhaust Fan Area	Port. Exting.	Hose Station	Smoke

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
PAB-F-4-Z	Filter Area PAH-F-16	Port. Exting. Port. Exting.	Hose Station Hose Station	Smoke Temp Elements & Carbon Monoxide Detection in Filter
PAB-F-S1-0	Stairwell	Port. Exting.	Hose Station	None
PAB-F-S2-0	Stairwell	Port. Exting.	Hose Station	None
9. FUEL STORAGE BUILDING				
FSB-F-lA-A	Elev. 7'-0", l0'-0", 21'-6", 25'-0",64'-0", 84'-0", FAH-F-41,74	Port. Exting. Port. Exting.	Hose Station Hose Station	Smoke Temp Elements & Carbon Monoxide Detect. in Filters
10. WASTE PROCESSING BUILDING				
W-F-1A-Z	Truck Bay & Drum Storage Area	Port. Exting.	Hose Station	Smoke
W-F-1B-Z	Decontamination Area	Port. Exting.	Hose Station	Smoke
W-F-2A-Z	Extruder/Evap. Area	Deluge System	Hose Station	Smoke & Thermal
W-F-2B-Z	Crystallizer Pump Rm.	Port. Exting.	Hose Station	None
W-F-2C-Z	Asphalt Meter Pump Room	Deluge System	Hose Station	Smoke & Thermal
W-F-2D-Z	Turntable & Drum Conv. Areas	Deluge System	Hose Station	Smoke & Thermal
W-F-2E-Z	Waste Solidification Control Room	Port. Exting.	Hose Station	Smoke
TF-F-1-0	Tank Farm (RWST)	Port. Exting.	Standpipe/ Hose Reel	None

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
11. SERVICE WATER PUMP HOUSE				
SW-F-1A-Z	Circulating Pump Area	Port. Exting.	Yard Hydrant	None
SW-F-1B-A	Electrical Control Room "A"	Port. Exting.	Yard Hydrant	Smoke
SW-F-1C-A	Electrical Control Room "B"	Port. Exting.	Yard Hydrant	Smoke
SW-F-1D-A	Fan Room	Port. Exting.	Yard Hydrant	Smoke
SW-F-1E-Z	Service Water Pump Area	Port. Exting.	Yard Hydrant	Smoke
SW-F-2-0	Service Water Intake & Discharge Structure	Port. Exting.	Yard Hydrant	None
12. SERVICE WATER COOLING TOWER				
CT-F-1C-A	Switchgear Room #3 Unit #1 Train “B”	Port. Exting.	Yard Hydrant	Smoke
CT-F-1D-A	Switchgear Room Unit #1 Train "A"	Port. Exting.	Yard Hydrant	Smoke
CT-F-2B-A	Ventilation & Mech. Room for Unit #1	Port. Exting.	Yard Hydrant	Smoke
CT-F-3-0	Top of Cooling Twr.	Port. Exting.	Yard Hydrant	None
13. CONTAINMENT ENCLOSURE VENTILATION AREA AND CONTAINMENT ANNULUS				
CE-F-l-Z	Cont. Encl. Ventil. EAH-F-9, -69	Port. Exting. Port. Exting.	Hose Station Hose Station	Smoke Temp Elements & Carbon Monoxide Detect. in Filter

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
14. FIRE PUMP HOUSE				
FPH-F-1A-A	Diesel Pump Rm.-West	Auto Sprinkler	Port. Exting.	Thermal
FPH-F-1B-A	Electric Pump Room	Auto Sprinkler	Port. Exting.	Smoke
FPH-F-1C-A	Diesel Pump Rm.-East	Auto Sprinkler	Port. Exting.	Thermal
15. TURBINE BUILDING				
TB-F-1A-Z	Ground Floor	Auto Sprinkler	Hose Station	None
TB-F-1B-A	Battery Room	Port. Exting	Hose Station	Smoke
TB-F-1C-Z	Relay Room	Port. Exting	Hose Station	Smoke
TB-F-2-Z	Mezzanine	Auto Sprinkler	Port. Exting.	None
TB-F-3-Z	Start-Up & Turbine Erector's Office Electronic Work Area SAS Computer Room	Port. Exting Port Exiting	Hose Station Hose Station	Smoke Smoke
16. MECHANICAL PENETRATION AREA				
PP-F-1A-Z	Rad. Piping Area	Port. Exting	Hose Station	Smoke
PP-F-2A-Z	Rad. Piping Area	Port. Exting	Hose Station	Smoke
PP-F-1B-Z	Rad. Piping Area	Port. Exting	Hose Station	Smoke
PP-F-2B-Z	Rad. Piping Area	Port. Exting	Hose Station	Smoke
PP-F-3A-Z	Rad. Piping Area	Port. Exting	Hose Station	Smoke
PP-F-3B-Z	Rad. Piping Area	Port. Exting	Hose Station	Smoke
PP-F-4B-Z	Non-Rad. Piping Area	Port. Exting	Hose Station	Smoke
PP-F-5B-Z	Rad. Piping Area	Port. Exting	Hose Station	Smoke

TABLE 1

FIRE DETECTION AND SUPPRESSION METHODS BY FIRE AREA AND ZONE

FIRE AREA	AREA NAME	FIRE SUPPRESSION SYSTEM		DETECTION
		Primary	Secondary	
17. NON-ESSENTIAL SWITCHGEAR ROOM				
NES-F-1A-Z	Non-Essential Swgr.	Port. Exting	Yard Hydrant	Smoke
18. CONDENSATE STORAGE TANK				
CST-F-1-0	Cond. Stor. Tank	Port. Exting	Yard Hydrant	None
19. MAKE-UP AIR				
MUA-F-1-0	Make-Up Air East	Port. Exting	Yard Hydrant	None
20. DUCTBANKS				
DCT-F-1A-0	Ductbanks	N/A	N/A	N/A
DCT-F-1B-0	Ductbanks	N/A	N/A	N/A
DCT-F-2A-0	Ductbanks	N/A	N/A	N/A
DCT-F-2B-0	Ductbanks	N/A	N/A	N/A
DCT-F-3B-0	Ductbanks	N/A	N/A	N/A
DCT-F-4A-0	Ductbanks	N/A	N/A	N/A
DCT-F-4B-0	Ductbanks	N/A	N/A	N/A
DCT-F-5A-0	Ductbanks	N/A	N/A	N/A
DCT-F-5B-0	Ductbanks	N/A	N/A	N/A

NOTE: This listing does not include the Administration Building, part of Turbine Building, Chlorination Building, RCA Storage Facility, Mechanical Maintenance Storage Facility, Supplemental Emergency Power System and Guard House which do not contain safety-related equipment.

See PID-1-FP-B20274

See PID-1-FP-B20266

SEABROOK STATION UPDATED FINAL SAFETY ANALYSIS REPORT	Fire Protection Fire Pumphouse Detail	
		Figure 9.5-5

For details relating to safe shutdown systems and safe shutdown capability, refer to the Seabrook Station report, "Fire Protection of Safe Shutdown Capability (10 CFR 50, Appendix R)", latest revision.

Section F.2, Tabs 1 through 17, contain tables labeled "Equipment and Systems in Fire Area/Zone" (Item 12.0.) These tables denote the safety related equipment and systems in each plant Fire Area/Zone.

The criteria listed below served as the basis for the overall evaluation and comparison of the fire protection system against the guidelines of BTP APCSB 9.5-1, Appendix A:

1. Safe shutdown analyses for the areas listed in this report have been superseded by analyses included in the "Fire Protection of Safe Shutdown Capability, 10 CFR 50, Appendix R" report.

   Operation of the Fire Protection system for safe shutdown scenarios, as described in paragraph 3.2.2.3 of the Appendix R report, supersedes the BTP APCSB 9.5-1, Appendix A exclusivity usage requirement.

2. For the purposes of this fire hazard analysis evaluation, a conservative approach was utilized in determining what could be found in any specific fire area or zone. This especially holds true in the electrical design area where the following conservative criteria were applied:

   a. Use of cable with low auto-ignition temperature of 750°F.

   b. Use of cable trays 40% filled for control, instrumentation and low voltage medium power, or a spaced single layer for high voltage power and low voltage power cables.

   c. Use of average size cables for cable tray loading and fire loading.

   d. Interlocked armored cable will be used for all 15 kV cables and all 5 kV cables, except the condensate and start-up feed pumps, which are routed in duct and conduit runs and the Supplemental Emergency Power System feeders which are routed in dedicated metal raceways.

3. The fire hazard analysis and evaluation was generally limited to those systems required to place the plant in a cold shutdown condition or to mitigate the consequences of an accident. According to BTP APCSB 9.5-1, safety-related systems and components are systems and components required to shutdown the reactor, mitigate the consequences of postulated accidents or maintain the reactor in a safe shutdown condition.

4. A single failure of an active component in a fire detection or fire support system will not impair both primary and backup plant fire protection capability.

5. Fire barriers between redundant cable separation groups and/or automatic sprinkler systems for cable raceway systems were used as a primary protection means from common mode failure by fire. The cabling raceway design meets the spatial separation requirements of Attachment "C," Physical Independence of Electric Systems, to the AEC letter dated Dec. 14, 1973, a forerunner of Regulatory Guide 1.75 (hereinafter referred to as Attachment "C").

   Fire stop locations in vertical cable tray runs were selected on the bases of limiting materially 1) the spread of fire via a vertical cable tray run and 2) the resultant damage due to a fire in a vertical cable tray run.

   The following guidelines were employed:

   a) Horizontal offsets >1 foot were considered to end vertical cable tray runs.

   b) Fire stops were not installed where cable tray fire suppression was present regardless of vertical run.

c) In vertical cable tray runs >25 feet, fire stops were placed to limit the spread of fire to not more than 35 feet. In fact more than two thirds of the vertical runs between fire stops are approximately 25 feet or less. The remaining vertical runs between fire stops vary from about 28 feet to about 35 feet. Where practical in vertical cable tray runs greater than 25 feet, fire stop locations were adjusted to floor elevations.

6. The majority of the cable used meet the fire test requirements of IEEE-383-1974 with the exception noted in Section F-3.

7. For each area containing significant fire hazard material, fire protection in the form of appropriate fire detection has been provided.

8. In areas where the fire hazard analysis indicates that a credible fire, should it occur, would adversely affect a safety-related or safe shutdown function, automatic fire suppression capability is provided.

9. Although the fire hazard analysis has indicated that no fire hazard exists, detectors and automatic suppression have been provided in electrical tunnels, chases and the cable spreading room. Also, in other selected electrical areas as shown by Table 1 (Section B), appropriate fire detection has been provided.

10. Fire is not considered to occur simultaneously with other accidents, events or phenomena such as a design-basis accident. Capability is provided to safely shut down the plant in the event of any single fire.

11. The fires postulated in this fire hazard analysis and evaluation are presented in Subsection F.2, Results of Fire Hazard Analysis. The heat of combustion values used are as follows:

Combustible	Heat of Combustion	Auto - ignition Temperature
Oil (any type)	150,000 BTU/gal	300°F
Grease	18,000 BTU/lb.	800°F
Class A (paper, wood)	8,000 BTU/lb.	800°F
Electrical cables	10,500 BTU/lb.	750°F

1. Methodology

The organization of the Branch Technical Position APCSB 9.5-1, Appendix A, is broken down into overall fire protection requirements, general guidelines for both building design and specific systems, specific requirements for fire protection and suppression and general guidelines for specific plant areas. For the purpose of review, this fire hazards analysis and evaluation is sub-divided into two major areas in accordance with the above requirements, as follows:

- o General fire protection review (fire hazard analysis and evaluation)
- o Specific subject review

These two areas of review are detailed in the following paragraphs:

a. General Fire Protection Review

The purpose of this review is to evaluate the fire hazards associated with the plant, the capability to achieve safe reactor plant shutdown and to prevent a single fire from adversely affecting a safety function.

Figure depicts the flow path used for completing this analysis. As can be seen, this was basically accomplished on an area by area and system by system approach.

b. Specific Subject Review

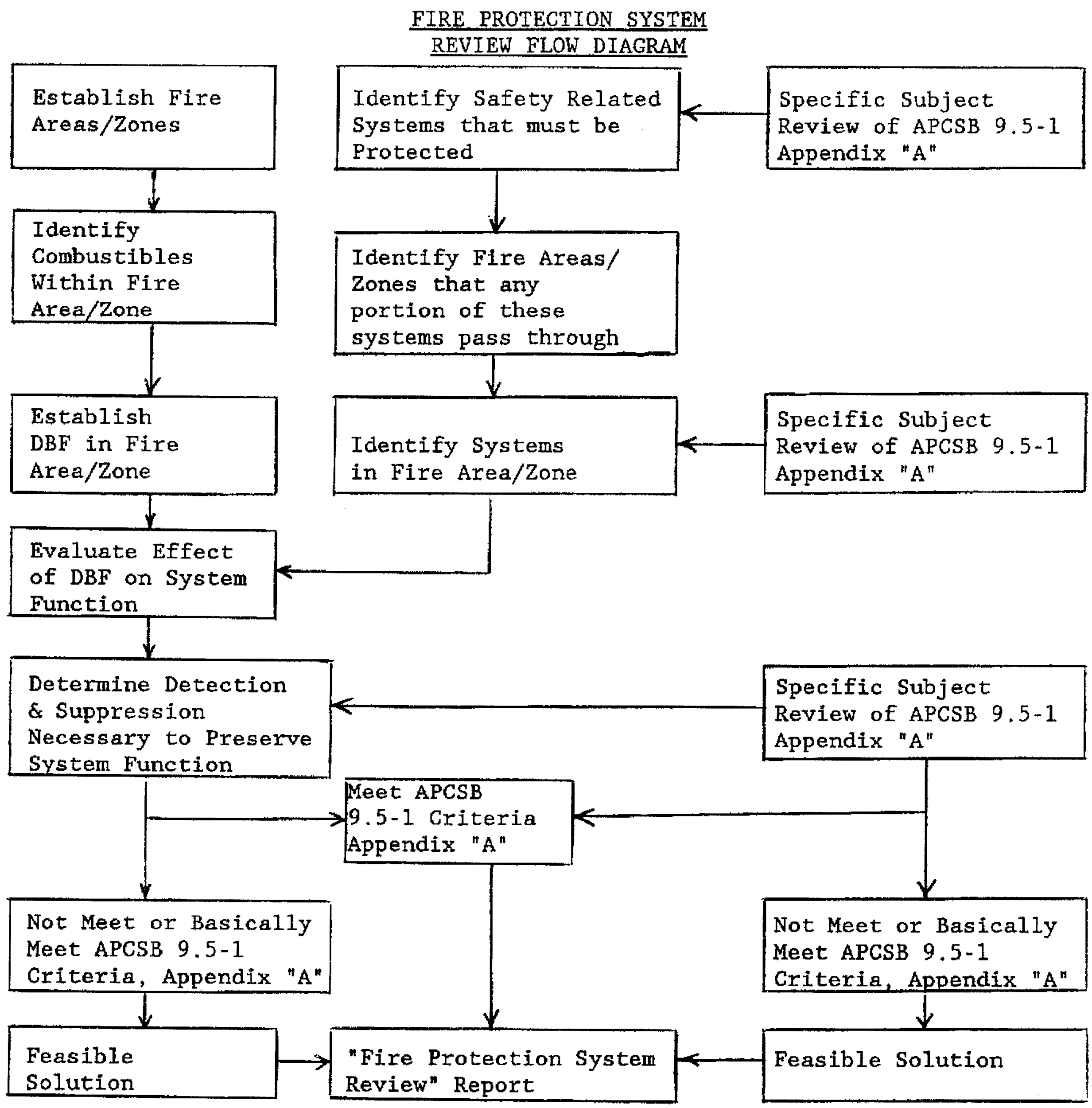
Once the general review was completed, it was further necessary to review the specific requirements for those systems described in the Branch Technical Position, as well as review the guidelines for specific plant areas. Figure also shows the flow path of this review.

Note that this review is repeated for each individual plant area requirement. In addition, there is an inter-relationship between these flow paths, such that upon completion of the overall plant review, specific and feasible solutions are derived that may or may not completely comply with the guidelines of APCSB 9.5-1, Appendix A. The results of these reviews are contained in this report. A summary of these results are found in Subsection F.1, Evaluation and Comparison Matrix.

The specific subjects under review are enumerated as follows:

- Plant Area Requirements
- Fire Detection
- Fire Suppression (including water supply system)
- Electrical
- Ventilation
- Lighting and Communications
- Construction (fire walls, etc.)

Figure I



FIRE PROTECTION SYSTEM
REVIEW FLOW DIAGRAM
Establish Fire Areas/Zones
Identify Safety Related Systems that must be Protected
Specific Subject Review of APCSB 9.5-1 Appendix "A"
Identify Combustibles Within Fire Area/Zone
Identify Fire Areas/ Zones that any portion of these systems pass through
Establish DBF in Fire Area/Zone
Identify Systems in Fire Area/Zone
Specific Subject Review of APCSB 9.5-1 Appendix "A"
Evaluate Effect of DBF on System Function
Determine Detection & Suppression Necessary to Preserve System Function
Specific Subject Review of APCSB 9.5-1 Appendix "A"
Meet APCSB 9.5-1 Criteria Appendix "A"
Not Meet or Basically Meet APCSB 9.5-1 Criteria, Appendix "A"
Not Meet or Basically Meet APCSB 9.5-1 Criteria, Appendix "A"
Feasible Solution
"Fire Protection System Review" Report
Feasible Solution

2. Review Assumptions

The assumptions listed below were utilized during this review.

a. Fire areas were established based on plant design and floor levels, and designated as that portion of a building separated from other areas by barriers (walls, floors and ceilings) having designated fire ratings of one, one and one-half, or three-hour, as required by the fire hazard analyses. Fire areas, in some cases, were further sub-divided into fire zones for purposes of fire protection evaluation.

b. Credit was taken for spatial separation of combustibles within a given area such that the "maximum credible fire" was established as the postulated fire in each zone. This postulated fire may consist of multiple fires within a given area only if such fires could credibly spread with no suppression.

c. While fire barrier walls may have fire resistance capability in excess of that required for fire protection (because of shielding or structural requirements), the penetrations are designed for the fire resistance rating designated for the fire barrier.

d. For purposes of this report, outside walls and ceilings of the top floors were not considered as requiring a fire rating.

e. It is assumed that a postulated fire cannot exist if only electrical cables are involved. The material selection and construction of the electrical cable insulation meet IEEE 383-1974 (except as noted in Section F-3). In addition, electrical faults will be mitigated by selective tripping of breakers or blowing of fuses.

f. The cable construction and insulation material of the safety related and non-safety related cables meet the requirements of IEEE 383-1974. This will certify the cable's non-propagational and fire resistance capabilities.

However, it is noted that the cable will burn when subjected to external flame or high temperature (greater than 750°F). Therefore, if a design basis fire is determined to be hot enough and burn long enough, cabling in the immediate vicinity is assumed to burn, incapacitating the system the cabling serves and forming another heat source that is analyzed for additional fire possibilities.

(1) The additional heat source is considered as part of the original postulated fire.

(2) To become an additional heat source, the cable is considered to auto-ignite at an ambient temperature of approximately 750°F when heat of the original postulated fire is applied for five (5) minutes or longer.

(3) Once auto-ignition has taken place, the entire stack of cable trays is considered to be involved in the fire.

(4) It is assumed that any cabling system enclosed in conduit, which also passes through a postulated fire area, would not provide additional combustibility to the postulated fire. The cabling is assumed to fail as the heat of the fire destroys the insulation, however, the fire and damage is contained within the conduit. The heat contributed is considered insignificant.

g. Electric motors are not considered as combustibles due to their metal enclosures, and do not add to the intensity of the original postulated fire. They could, however, be damaged by a postulated fire if situated in the cone of fire influence.

h. It was assumed that electrical equipment such as switchgear, unit substations, motor control centers, etc., do not contribute to a fire due to their metal enclosure. Electrical equipment, however, could be damaged by a fire. Electrical equipment specifications required that organic insulating materials used in the equipment construction be qualified as being self-extinguishing and non-propagating when exposed to fire and flame. It was also assumed that miscellaneous combustible materials mounted on the electrical equipment, such as operating coils, relays, control switches, etc., are of such small quantities that the heat released is insignificant.

i. In many cases small quantities of grease are contained in valves, motors, fans and pumps. Since these small quantities are contained within a packing gland or a bearing, it is not considered as contributing to a fire.

j. Air cleaning units, which contain roughing filters, HEPA filters and charcoal filters, are contained in heavy metal casings and are not considered in the fire hazard analysis for total Fire Loading in the Fire Area and the total combustibles. However, an individual Fire Hazard Analysis was conducted on CAH-F-8, CAP-F-40, EAH-F-9, 69, FAH-F-4l, 74 and PAH-F-l6, to be used for the Appendix "R" to 10CFR50 Safe Shutdown Study. See Appendix "D" for analysis. All filter units have early Fire Warning Detection Systems, i.e., Carbon Monoxide detectors and temperature elements within the filter units.

k. Pipe and its insulation are not combustible and are not considered in the fire hazard analysis, however, if the pipe is in the cone of fire influence and the temperature of the fire is greater than 2000°F. for a duration greater than ten (10) minutes, the pipe is considered to rupture, incapacitating the system that it is a part of.

l. Bare structural steel is not combustible but tends to degrade structurally when an ambient temperature of greater than 1100°F. is maintained for longer than ten (10) minutes. Fireproof-coated steel maintains its integrity for at least three (3) hours.

m. The fire hazard analysis of each fire area/zone is conducted as follows:

1. The original postulated fire is a fire that starts through the ignition of combustibles and covers a certain floor area. The effects of this fire forms a vertical shaft of fire influence over the fire which extends to the ceiling. For Class "A" fires, the temperature of the vertical shaft is assumed constant throughout its entire height, and is determined with the use of the NFPA heat potential and time/temperature curves or with the use of other published literature on the subject.

2. Effects of the postulated fire on cabling within 3'-O" of the shaft are re-evaluated if the temperature or duration of the fire exceeds the auto-ignition assumptions of the cabling. A time/temperature value is determined by forming a cone of influence over the fire covering an area 20 degrees from the vertical edge of the fire, with the fire acting as a flattened vortex of the cone. The new time/temperature value is determined by dividing the BTU value of the original fire by the area of the cone at the intersection of the combustible and the cone.

   If the temperature and duration of the re-evaluated fire exceeds the auto-ignition assumptions of cabling, then the BTU contents of the cabling are added to the original BTU value, and a secondary fire is postulated.

   The secondary fire has a time duration equal to that of the postulated fire, and its fire loading is determined by dividing the total BTU value by the area of the entire zone.

   If the temperature and duration of this secondary fire exceeds the auto-ignition assumption of cabling, then the remainder of the cabling in the fire area-zone auto-ignites and also burns.

n. Bulk storage of combustible materials, including spare parts, adjacent to or in safety-related buildings during operation, maintenance or refueling periods is controlled by administrative procedures.

3. <u>Designation of Fire Area and Zones</u>

As part of the fire hazard analysis effort, applicable plant general arrangement drawings were modified by superimposing on them the perimeters of fire areas and zones. Heavy solid lines were used to denote 3-hour minimum fire-rated walls, thin slanted lines were used to show 1- ½ hour fire-rated walls, heavy dashed lines were used to identify fire zone boundaries, heavy slanted lines were employed to define outside walls of buildings, and arrows were used to indicate the route to a fire exit.

Designations assigned to the various fire areas and zones denote the name of the building or structure, the floor level and whether the location is an area or zone. As an example, C-F-1-Z = Containment, Fire Analysis, Floor level 1 and Fire Zone. Another example, CB-F-1A-A = Control Building, Fire Analysis, Fire Subdivision A of Floor Level 1 and Fire Area. The Containment was treated as a single fire area comprised of a number of fire zones. Some other designation such as PAB-F-S1-0, Primary Auxiliary Building, Fire Analysis; stairwell has been assigned for convenience. This Suffix “0” designated area may or may not have fire rated boundaries.

A listing of the various fire areas and zones which were subjected to the fire hazards analysis, together with their applicable drawings, is presented in **TABLE 2**.

Abbreviations for the various buildings, structures and locations used in the fire area and zone designations are tabulated below:

TABLE 1 - Tab Index

Tab.	Abbreviation	Name of Building/Structure
1	C	Containment
2	EFP	Emergency Feedwater Pump Building
3	MS	Main Steam & Feedwater Pipe Enclosure
4	RHR	RHR, S.I., Equipment Vault
5	CB	Control Building
6	ET	Electrical Tunnels
7	DG	Diesel Generator Building
8	PAB	Primary Auxiliary Building
9	FSB	Fuel Storage Building
10	W	Waste Processing Building
10	TF	Tank Farm
11	SW	Service Water Pump House
12	CT	Service Water Cooling Tower
13	CE	Containment Enclosure Ventilation Area
14	FPH	Fire Pump House
15	TB	Turbine Building
16	PP	Mechanical Penetration Area
17	NES	Non-Essential Switchgear Room
18	CST	Condensate Storage Tank
19	MUA	Make up Air Intakes - East & West
20	DCT	Ductbanks

TABLE 2
Identification of Fire Area and Zones on Drawings

TAB	Structure and Applicable Drawings		Fire Area or Zone Designation
1	Containment		
	Dwg. No. 9763-F-	Title	
	805051-FP	Containment Structure Plan El. (-) 26'-0" – Gen. Arrg't.	C-F-1-Z
	805052-FP	Containment Structure Plan El. 0'-0" - Gen. Arrg't.	C-F-2-Z
	805053-FP	Containment Structure Plan El. 25'-0" - Gen. Arrg't.	C-F-3-Z
2	Emergency Feedwater Pump Building		
	Dwg. No. 9763-F-	Title	
	202065-FP	Emergency Feedwater Pump Building Plan & Sections, Gen. Arrg't.	EFP-F-l-A
3	Main Steam and Feedwater Pump Building		
	Dwg. No. 9763-F-	Title	
	202063-FP	Main Steam & Feedwater Pipe Chase - Plan General Arrg't	MS-F-1A-Z, MS-F-1B-Z, MS-F-2A-Z, MS-F-2B-Z, MS-F-3A-Z, MS-F-3B-Z, MS-F-4A-Z, MS-F-5A-Z, EFF- 1A-A
	202064-FP	Main Steam & Feedwater Pipe Enclosure – Sections General Arrg't	MS-F-1A-Z, MS-F-1B-Z, MS-F-2A-Z, MS-F-2B-Z, MS-F-3A-Z, MS-F-4A-Z

TABLE 2
Identification of Fire Area and Zones on Drawings

TAB	Structure and Applicable Drawings		Fire Area or Zone Designation
4	RHR Containment Spray Vault. SI Equipment Vault		
	Dwg. No. 9763-F-	Title	
	805060-FP	RHR, Containment Spray, S.I. Equip. Vault – General	RHR-F-lA-Z, RHR-F-1B-Z, RHR-F-1C-Z, RHR-F-1D-Z, RHR-F-2A-Z, RHR-F-2B-Z, RHR-F-3A-Z, RHR-F-3B-Z, RHR-F-4A-Z, RHR-F-4B-Z
	805078-FP	RHR, Containment Spray, S.I. Equip. Vault – General Arrg't – Sections	RHR-F-1A-Z, RHR-F-1B-Z, RHR-F-1C-Z, RHR-F-1D-Z, RHR-F-2A-Z, RHR-F-2B-Z, RHR-F-3A-Z, RHR-F-3B-Z, RHR-F-4A-Z
5	Control Building		
	Dwg. No. 9763-F-	Title	
	310431-FP	Control Building El. 21'-6" Electrical General Arrg't	CB-F-lA-A, CB-F-1B-A, CB-F-S1-0, CB-F-S2-0, CB-F-1D-A, CB-F-1E-A, CB-F-1F-A,CB-F-1G-A
	310452-FP	Control Building El. 50'-0" Cable Tray Layout - Plan	CB-F-2A-A, CB-F-2B-A, CB-F-2C-A,
	3l0455-FP	Control Building El. 21'-6" Cable Tray Layout - Sections Sheet 1	CB-F-lA-A,
	310461-FP	Control Building El . 50'-0" Cable Tray Layout - Sections Sheet 1	CB-F-2A-A, CB-F-2B-A
	500090-FP	Control Building Control Room Arrg't Plan at El.75'-0"	CB-F-3A-A, CB-F-3B-A, CB-F-3C-A

TABLE 2
Identification of Fire Area and Zones on Drawings

TAB	Structure and Applicable Drawings		Fire Area or Zone Designation
6	Electrical Tunnels		
	Dwg. No. 9763-F-	Title	
	310453-FP	Electrical Tunnel - A Train Cable Tray Layout - Plan	ET-F-1A-A, ET-F-1B-A, ET-F-S1-0
	310454- FP	Electrical Tunnel - B Train Cable Tray Layout - Plan	ET-F-1C-A, ET-F-1D-A
	310465-FP	Electrical Tunnel - A Train Cable Tray Layout - Sections Sheet 1	ET-F-1A-A, ET-F-1B-A
	310466-FP	Electrical Tunnel - A Train Cable Tray Layout - Sections Sheet 2	ET-F-1A-A, ET-F-1B-A
	310468-FP	Electrical Tunnel - B Train Cable Tray Layout - Sections Sheet 1	ET-F-1C-A, ET-F-1D-A
	310469-FP	Electrical Tunnel - B Train Cable Tray Layout - Sections Sheet 2	ET-F-1D-A
7	Diesel Generator Building		
	Dwg. No. 9763-F-	Title	
	202068 -FP	Diesel Generator Building -Plan & Sections – Below Grade General Arrangement	DC-F-1A-A, DG-F-1B-A, DG-F-S1-0, DG-F-S2-0
	202069-FP	Diesel Generator Building -Plan Above Grade – General Arrangement	DC-F-2A-A, DG-F-2B-A, DC-F-3A-Z, DC-F-3B-Z, DC-F-3C-A, DC-F-3D-A, DC-P-3E-A, DG-F-3F-A

TABLE 2
Identification of Fire Area and Zones on Drawings

TAB	Structure and Applicable Drawings		Fire Area or Zone Designation
8	Primary Auxiliary Building		
	Dwg. No. 9763-F-	Title	
	805061-FP	Primary Auxiliary Building - Plans at El. 7’-0” and Below - General Arrangement	PAB-P-1A-Z, PAB-F-1B-Z, PAB-F-1C-A, PAB-F-1D-A, PAB-F-1E-A, PAB-F-1F-Z, PAB-P-1G-A, PAB-F-1J-A, PAB-F-1K-Z
	805062-FP	Primary Auxiliary Building Plans at El. 25-0” -General Arrangement	PAB-F-2A-Z, PAB-F-2B-Z, PAB-F-2C-Z, PAB-F-1G-A, PAB-F-1K-Z
	805063-FP	Primary Auxiliary Building - Plans at El. 53’-0” & 8l’-0” General Arrangement	PAB-F-3A-Z, PAB-F-3B-Z, PAB-F-4A-Z, PAB-F-1K-Z, PAB-F-S1-0, PAB-F-S2-0
	805060-FP	RHR, Containment Spray, S.I. Equip. Vault – General	PAB-F-1G-A
9	Fuel Storage Building		
	Dwg. No. 9763-F-	Title	
	805058-FP	Fuel Storage Building - Plan at El. 7’- 0” 10’-0” -General Arrangement	FSB-F-1-A
	805059-FP	Fuel Storage Building - Plan at El. 21’-6” & 25’-0” -General Arrangement	FSB-F-1-A
	805084-FP	Fuel Storage Building - Plan at. El. 64’-0” & 84’-0” -General Arrangement	FSB-F-1-A

TABLE 2
Identification of Fire Area and Zones on Drawings

TAB	Structure and Applicable Drawings		Fire Area or Zone Designation
10	Waste Processing Building		
	Dwg. No. 9763-F-	Title	
	805661-FP	Waste Processing Building-Plan at El. 25'-0" -General Arrangement	W-F-1A-Z, W-F-1lB-Z, TF-F-1-0
	805882-FP	Waste Processing Building - Plan & Sections El. 42'-5" & 65'-0" - General Arrangement	W-F-2A-Z, W-F-2B-Z, W-F-2C-Z, W-F-2D-Z, W-F-2E-Z
11	Service Water Pump House		
	Dwg. No. 9763-F-	Title	
	202476-FP	Service & Circ. Water Pump House - Plan & Section - General Arrangement	SW-F-1A-Z, SW-F-1B-A, SW-P-1C-A, SW-F-1D-A, SW-F-1E-Z
	202478-FP	Service & Circ. Water Pump House - Sections - General Arrangement	SW-F-1A-Z, SW-F-1B-A, SW-F-1D-A
	300245-FP	Underground Duct Plan - Circ. & Service Water Area	SW-F-2-0
12	Service Water Cooling Tower		
	Dwg. No. 9763-F-	Title	
	805068- FP	Service Water Cooling Tower - General Arrangement	CT-F-1C-A, CT-F-1D-A, CT-F-2B-A, CT-F-3-0

TABLE 2
Identification of Fire Area and Zones on Drawings

TAB	Structure and Applicable Drawings		Fire Area or Zone Designation
13	Containment Enclosure Ventilation Area		
	Dwg. No. 9763-F-	Title	
	805059-FP	Fuel Storage Building - Plan at El. 21'-6" & 25'-0" General Arrangement	CE-F-l-Z
	805053-FP	Containment Structure Plan at Elev. 25'-0" General Arrangement	CE-F-l-Z
	805052-FP	Containment Structure Plan at Elev. 0'-0" General Arrangement	CE-F-l-Z
	805051-FP	Containment Structure Plan at Elev. (-)26'-0" General Arrangement	CE-F-l-Z
	805056-FP	Containment Structure Elev. "D-D", "E-E", "F-F" General Arrangement	CE-F-l-Z
	805055-FP	Containment Structure Plan at Elev. (-)44'-9"	CE-F-l-Z
14	Fire Pump House		
	Dwg. No. 9763-F-	Title	
	300831-FP	Fire Pump House Tray Plan and Grounding	FPH-F-1A-A, FPH-F-1B-A, FPH-F-1C-A

TABLE 2
Identification of Fire Area and Zones on Drawings

TAB	Structure and Applicable Drawings		Fire Area or Zone Designation
15	Turbine Building		
	Dwg. No. 9763-F-	Title	
	202052-FP	Turbine Building Plan Ground Floor, Elevation 2l'-0", General Arrangement	TB-F-1A-Z, TB-F-1B-A, TB-F-1C-Z
	202053-FP	Turbine Bldg Plan, Mezzanine Floor, Elevation 46'-0" and 50' -0", General Arrangement	TB-F-2-Z
	202054-FP	Turbine Building Plan - Operating Floor, Elevation 75' - 0", General Arrangement	TB-F-3-Z
16	Mechanical Penetration Area		
	Dwg. No. 9763-F-	Title	
	3l1429-FP	Main Steam Tunnel-West Lighting Plan-Lower Levels	PP-F-lA-Z, PP-F-2A-Z, PP-F-1B-Z, PP-F-2B-Z, PP-P-3A-Z, PP-F-3B-Z, PP-F-4B-Z, PP-F-5B-Z
17	Non Essential Switchgear Room		
	Dwg. No. 9763-F-	Title	
	310289- FP	Non Essential Swgr. Room Electrical General Arrangement and Grounding	NES-F-1A-Z
18	Condensate Storage Tank		
	Dwg. No. 9763-F-	Title	
	310828-FP	Condensate & Demineralized Water Stor. Tks. Conduit, Ltg. & Ground. Plan	CST-F-1-0
19	Make-Up Air, East and West		
	Dwg. No. 9763-F-	Title	
	310248-FP	Underground Duct Plan - Center	MUA-F-1-0

TABLE 2
Identification of Fire Area and Zones on Drawings

TAB	Structure and Applicable Drawings		Fire Area or Zone Designation
20	Duct Banks		
	Dwg. No. 9763-F-	Title	
	320251-FP	Underground Duct Plan - Center	DCT-F-5A-0 DCT-F-5B-0
	310254-FP	Underground Duct & Grounding, Misc. Area Plans, Details & Elevations	DCT-F-7-0
	310248-FP	Underground Duct Plan - Center	DCT-F-4A-0, DCT-F-lB-0, DCT-F-5A-0, DCT-F-4B-0, DCT-F-7-0, DCT-F-1A-0, DCT-F-3B-0
	310249-FP	Underground Duct Plan - South	DCT-F-1A-0, DCT-F-2B-0, DCT-F-lB-0, DCT-F-2A-0
	300245- FP	Underground Duct Plan - Circ. & Service Water Area	DCT-F-6-0
	320252-PP	Underground Duct Plan - South	DCT-F-2A-0 DCT-F-2B-0
	310828 -FP	Condensate & Demineralized Water Storage Tanks Conduit, Lighting & Grounding Plan	DCT-F-7-0

NOTE: Refer to controlled equipment drawings for most up to date equipment locations

This section summarizes the results of the fire analysis performed on Seabrook Station. The information is presented under the following major headings:

F.1 Evaluation and Comparison Matrix

F.2 Results of Fire Hazard Analysis

F.3 Responses to BTP APCSB 9.5-1, Appendix A:

- o Overall requirements of Nuclear plant fire protection program
- o Administrative procedures, controls and fire brigade
- o Quality assurance program
- o General guidelines for plant protection
- o Fire detection and suppression
- o Guidelines for specific plant areas
- o Special protection guidelines

F.1 EVALUATION AND COMPARISON MATRIX

The Evaluation and Comparison Matrix, Table 3, correlates the requirements of each position of the BTP with each fire area/zone, and summarizes the areas of compliance, basic compliance and non-compliance with APCSB 9.5-1, Appendix A.

Table 3
Fire Protection System Evaluation And Comparison Matrix

	Appendix A Branch Technical Position APCSB 9.5-1	Comply With	Partially Comply With	Do Not Comply With	See Following Pages For Discussion
A. Overall Requirements of Nuclear Plant Fire Protection Program					
1.	Personnel	X			F.3-15
2.	Design Bases	X			F.3-17
3.	Back-up	X			F.3-17
4.	Single Failure Criterion	X			F.3-18
5.	Fire Suppression Systems	X			F.3-20
6.	Fuel Storage Areas	X			F.3-21
7.	Fuel Loading	X			F.3-21
8.	Multiple-Reactor Sites	X			F.3-22
9.	Simultaneous Fires	X			F.3-22
B. Administrative Procedures Controls and Fire Brigade					
1.	Fire Protection System and Personnel Administrative Procedures	X			F.3-23
2.	Bulk Storage of Combustible Materials	X			F.3-24
3.	Normal/Abnormal Conditions Or Other Anticipated Operations	X			F.3-24
4.	Public Fire Department Support	X			F.3-26
5.	Plant Fire Brigade Guidance	X			F.3-26
6.	Coordination With Local Fire Department	X			F.3-28
7.	NFPA Standards	X			F.3-29

Table 3
Fire Protection System Evaluation And Comparison Matrix

	Appendix A Branch Technical Position APCSB 9.5-1	Comply With	Partially Comply With	Do Not Comply With	See Following Pages For Discussion
C. Quality Assurance Program					
1.	Design Control and Procurement Document Control	X			F.3-30
2.	Instructions, Procedures and Drawings	X			F.3-31
3.	Control of Purchased Material, Equipment and Services	X			F.3-31
4.	Inspection	X			F.3-32
5.	Test and Test Control	X			F.3-32
6.	Inspection, Test and Operating Status	X			F.3-33
7.	Non-Conforming Items	X			F.3-33
8.	Corrective Action	X			F.3-34
9.	Records	X			F.3-34
10.	Audits	X			F.3-35
D. General Guidelines for Plant Protection					
1.	Building Design				
	(a) Plant Layouts	X			F.3-36
	(b) Detailed Fire Hazard Analysis	X			F.3-37
	(c) Cable Spreading Rooms		X		F.3-37
	(d) Non-Combustibility Requirements for Interior Construction	X			F.3-38
	(e) Metal Deck Roof Construction	X			F.3-39
	(f) Suspended Ceilings	X			F.3-39
	(g) High Voltage, High Ampere Transformers	X			F.3-40
	(h) Oil-Filled Transformers	X			F.3-40
	(i) Floor Drains		X		F.3-41
	(j) Floors, Walls and Ceilings		X		F.3-43

Table 3
Fire Protection System Evaluation And Comparison Matrix

	Appendix A Branch Technical Position APCSB 9.5-1	Comply With	Partially Comply With	Do Not Comply With	See Following Pages For Discussion
D. General Guidelines for Plant Protection (Continued)					
2.	Control of Combustibles				
	(a) Protection of Safety-Related Systems	X			F.3-44
	(1) Diesel generator fuel oil day tank	X			F.3-44
	(2) Turbine - generator oil and hydraulic control systems	X			F.3-44
	(3) Reactor coolant pump lube oil System		X		F.3-45
	(b) Bulk Gas Storage	X			F.3-45
	(c) Use of Plastic Materials	X			F.3-48
	(d) Storage of Flammable Liquids	X			F.3-49
3.	Electric Cable Construction, Cable Trays and Cable Penetrations				
	(a) Cable Tray Construction	X			F.3-50
	(b) Cable Spreading Rooms		X		F.3-50
	(c) Cable Trays Outside Cable Spreading Rooms		X		F.3-51
	(d) Cable and Cable Tray Penetrations of Fire Barriers	X			F.3-52
	(e) Fire Breaks	X			F.3-52
	(f) Flame Test of Electric Cables	X			F.3-53
	(g) Corrosive Gases from Cables	X			F.3-54
	(h) Content of Cable Trays, Raceways, Conduit, Trenches and Culverts	X			F.3-54
	(i) Smoke Venting of Cable Tunnels, Culverts and Spreading Rooms	X			F.3-55
	(j) Control Room Cables		X		F.3-55

Table 3
Fire Protection System Evaluation And Comparison Matrix

	Appendix A Branch Technical Position APCSB 9.5-1	Comply With	Partially Comply With	Do Not Comply With	See Following Pages For Discussion
D. General Guidelines for Plant Protection (Continued)					
4.	Ventilation				
	(a) Discharge of Products of Combustion		X		F.3-56
	(b) Evaluation of Inadvertent Operation or Single Failures	X			F.3-57
	(c) Power Supply and Controls		X		F.3-58
	(d) Protection of Charcoal Filters		X		F.3-59
	(e) Fresh Air Supply Intakes	X			F.3-60
	(f) Stairwells		X		F.3-60
	(g) Smoke and Heat Vents		X		F.3-61
	(h) Self-Contained Breathing Apparatus	X			F.3-62
	(i) Total Flooding Gas Extinguishing Systems	X			F.3-63
5.	Lighting and Communications				
	(a) Fixed Emergency Lighting		X		F.3-63
	(b) Portable Lights	X			F.3-63
	(c) Fixed Emergency Communication	X			F.3-63
	(d) Portable Radio Communication	X			F.3-63

Table 3
Fire Protection System Evaluation And Comparison Matrix

	Appendix A Branch Technical Position APCSB 9.5-1	Comply With	Partially Comply With	Do Not Comply With	See Following Pages For Discussion
E. Fire Detection & Suppression					
1.	Fire Detection				
	(a) Conformance to NFPA 72D	X			F.3-66
	(b) Alarm and Annunciation		X		F.3-66
	(c) Distinctive and Unique Fire Alarms	X			F.3-66
	(d) Connection to Emergency Power Supply	X			F.3-66
2.	Fire Protection Water Supply System				
	(a) Yard Fire Main Loop	X			F.3-67
	(b) Multiple Units Fire Protection Water Supply Systems	X			F.3-68
	(c) Fire Pump Installation	X			F.3-69
	(d) Fire Water Supplies	X			F.3-70
	(e) Fire Water Supply Design Bases	X			F.3-71
	(f) Lakes or Ponds as Sources	NA			F.3-72
	(g) Outside Hose Installations	X			F.3-73
3.	Water Sprinklers and Hose Standpipe Systems				
	(a) Sprinkler and Standpipe Layout	X			F.3-74
	(b) Supervision of Valves		X		F.3-75
	(c) Automatic Sprinkler Systems	X			F.3-75
	(d) Fire Protection Water Supply System		X		F.3-76
	(e) Hose Nozzles	X			F.3-78
	(f) Foam Suppression	NA			F.3-78
4.	Halon Suppression Systems	X			F.3-79
5.	Carbon Dioxide Suppression Systems	NA			F.3-80
6.	Portable Extinguishers	X			F.3-81

Table 3
Fire Protection System Evaluation And Comparison Matrix

	Appendix A Branch Technical Position APCSB 9.5-1	Comply With	Partially Comply With	Do Not Comply With	See Following Pages For Discussion
F. Guidelines for Specific Plant Areas					
1.	Primary and Secondary Containment				
	(a) Normal Operation		X		F.3-82
	(b) Refueling and Maintenance	X			F.3-84
2.	Control Room		X		F.3-85
3.	Cable Spreading Room		X		F.3-87
4.	Plant Computer Room	X			F.3-89
5.	Switchgear Rooms		X		F.3-90
6.	Remote Safety-Related Panels		X		F.3-91
7.	Station Battery Rooms	X			F.3-92
8.	Turbine Lubrication and Control Oil Storage and Use Areas	X			F.3-93
9.	Diesel Generator Areas		X		F.3-94
10.	Diesel Fuel Oil Storage Areas		X		F.3-96
11.	Safety-Related Pumps		X		F.3-97
12.	New Fuel Area		X		F.3-98
13.	Spent Fuel Pool Area		X		F.3-99
14.	Radwaste Building		X		F.3-100
15.	Decontamination Areas		X		F.3-101
16.	Safety-Related Water Tanks	X			F.3-101
17.	Cooling Towers	X			F.3-102
18.	Miscellaneous Areas	X			F.3-102
G. Special Protection Guidelines					
1.	Welding and Cutting, Acetylene - Oxygen Fuel Gas Systems		X		F.3-103
2.	Storage Areas for Dry Ion Exchange Resins		X		F.3-104
3.	Hazardous Chemicals	X			F.3-104
4.	Materials Containing Radioactivity	X			F.3-105

Fire Hazard Analysis C-F-1-Z

1.0	Building			Containment Building	
2.0	Fire Area or Zone			C-F-1-Z	
	2.1 Area Name			Containment Floor	
	2.2 Location			El. (-) 26'-0"	
	Drawing No			9763-F-805051-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr.
			South	Concrete	3 Hr.
			East	Concrete	3 Hr.
			West	Concrete	3 Hr.
	3.2	Floor		Concrete	3 Hr.
	3.3	Ceiling		Concrete/Grating/Stl Plate	-
	3.4	Doors		None	-
	3.5	Others		-	-

4.0 Floor Area 15,400 Sq. Ft. Diameter 140' –0" Height 26'

5.0 Volume 400,000 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______

7.0 Exhaust Ventilation System Containment Recirculation System

7.1 Percentage of System's Capacity No Exhaust

		Yes	No
8.0	8 Hr. Emergency Lighting in Area	X	
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping	X	
9.2	Airborne	X	

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel (isolated in modes 1-4)
- 10.3 Detection: Ionization*
- 10.4 Other: -------------

11.0 Fire Loading in Area

11.1 This zone will be affected by a fire in the zone above (C-F-2-Z) due to the deck grating at the 0' –0" level, therefore see zone C-F-2-Z for effects of the design basis fire.

* Ref. Deviation No. 2, SBN-904, Dated Dec. 2, 1985.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Nuclear Instrumentation & Cabling	NI	X	X	X
Piping, Valves, Equipment & Cabling	RC	X	X	X
Piping, Valves & Cabling	SI	X	X	X
Piping, Valves & Cabling	CS	X	X	X
Cabling	CAP		X	X
Cabling	CAH		X	X
Piping, Instrumentation & Cabling	CBS	X	X	X
Piping, Valves, Motors & Cabling	CC	X	X	X
Piping, Valves & Cabling	COP		X	X
Penetrations, Equipment & Cabling	EDE	X	X	X
Piping, Valves & Cabling	NG		X	X
Piping, Valves & Cabling	VG		X	X
Piping Valves & Cabling	WLD		X	X
Pressurizer Heaters	RC	X	X	
Cabling	CGC		X	X
Instrumentation & Cabling	RM		X	X
Cabling	ED		X	
Cabling	IA		X	
Cabling	SA		X	

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Incore Instrumentation & Cabling	IC	X	X	X
Instrumentation & Cabling	FW	X	X	X
Instrument Racks	MM	X	X	X
Piping, Valves & Cabling	RH	X	X	X

Fire Hazard Analysis C-F-2-Z

1.0	Building			Containment Building	
2.0	Fire Area or Zone			C-F-2-Z	
	2.1	Area Name		Containment Floor	
	2.2	Location		El 0'-0"	
		Drawing No		9763-F-805052-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr.
			South	Concrete	3 Hr.
			East	Concrete	3 Hr.
			West	Concrete	3 Hr.
	3.2	Floor		Concrete/Grating/Stl Plate	-
	3.3	Ceiling		Concrete/Grating/Stl Plate	-
	3.4	Doors		None	-
	3.5	Others		-	-

4.0 Floor Area 15,400 Sq. Ft. Diameter 140' –0" Height 25'

5.0 Volume 385,000 Cu. Ft.

6.0 Floor Drains — Nuclear X Non-Nuclear ___

7.0 Exhaust Ventilation System — Containment Recirculation System

7.1 Percentage of System's Capacity — No Exhaust

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping	X	
9.2	Airborne	X	

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel (isolated in modes 1-4)
10.3	Detection	Ionization*
10.4	Other	-------------

11.0 Fire Loading in Area

11.1 Refer to page 3 (analysis continued Pg. 2 & 3)

* Ref. Deviation No. 2, SBN-904, Dated Dec. 2, 1985.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Rc Pumps	RC	X		
Steam Generators	RC			X
Piping, Valves, Fans & Cabling	CAH	X	X	X
Piping, Valves, Instruments & Cabling	FW	X	X	X
Piping, Valves, Instruments & Cabling	CC	X	X	X
Cabling	CBS	X	X	X
Piping, Valves & Cabling	CAP		X	X
Penetrations	EDE	X		X
Cabling	CS	X		X
Instrument Racks	MM	X	X	X
Instruments & Cabling	RC	X	X	X
Radiation Monitors & Cabling	RM	X	X	X
Piping Valves & Cabling	SI	X	X	X
Cabling	NI	X		
Distr Pnl & Cabling	ED	X		
Dryer, Contractor & Cabling	IA	X	X	
Compressor, Control Pnl & Cabling	SA	X	X	
Cabling	CGC	X		X
Contm. Coolers	CAH		X	
Contm. Coolers	CAH	X		
Piping, Valves & Cabling	SB	X		X
Incore Instruments & Cabling	IC	X	X	X

13.0 Design Basis Fire

13.1

Combustible in Area (In Situ)			Fire Loading in Area	
Oil:	1060 (4 Pumps)	Gallons	2580	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 2580 Btu/Sq. Ft.

Total Combustibles: 39,750,000 Btu

14.0 Design Basis Fire Description

See Appendix B of this report.

Fire Hazard Analysis – C-F-3-Z

1.0 Building: Containment Building

2.0 Fire Area or Zone: C-F-3-Z

- 2.1 Area Name: Containment Floor
- 2.2 Location: El. 25'-0"
- Drawing No: 9763-F-805053-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete/Grating/Stl Plate	-
3.3	Ceiling		Concrete	3 Hr
3.4	Doors		*	-
3.5	Others		-	-

4.0 Floor Area 15,400 Sq. Ft. Diameter 140' –0" Height 164' –0"25'

5.0 Volume 2,165,400 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______

7.0 Exhaust Ventilation System: Containment Recirculation System

- 7.1 Percentage of System's Capacity: None - Recirculated

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: None
- 10.4 Other: Carbon Monoxide Detection for CAH-F-8**

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

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* Personnel & Equipment Hatches

** Charcoal loading for CAH-F-8 is 1300 lb. Charcoal. Charcoal fire loading was not considered in total area. See appendix D.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Radiation Element. Monitors & Cabling	RM	X	X	X
Piping, Valves & Cabling	RC	X	X	X
Dampers, Motors & Cabling	CAH	X	X	X
Piping, Valves, Recombiners & Cabling	CGC	X	X	X
Penetrations	MM	X		X

Fire Hazard Analysis – EFP-F-1-A

1.0 Building: Emergency Feedwater Pump Building

2.0 Fire Area or Zone: EFP-F-1-A
- 2.1 Area Name: Pump Area
- 2.2 Location: El. 27'-0"
- Drawing No: 9763-F-202065-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	3 Hr.
		East	Concrete	3 Hr./Outside
		West	Concrete	3 Hr./Outside
3.2	Floor		Concrete	3 Hr
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	1 ½ Hr. (Stairwell)
3.5	Others		-	-

4.0 Floor Area 2,400 Sq. Ft. Length 79' Width Varies Height 18'

5.0 Volume 43,000 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: Wall Supply Fan
- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X
- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type
- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------------

11.0 Fire Loading in Area
- 11.1 Refer to page 2. (analysis continued page 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Emergency Feed Pump (M)	FW		X	X
Emergency Feed Pump (T)	FW	X	X	X
Flow Transmitters	FW	X	X	X
Cabling	FW	X	X	X
Fan FN-47 A & B	EPA	X	X	X
Damper DP-371, 373	EPA	X		X
Damper DP-372, 374	EPA		X	X
Temperature Switches	EPA	X	X	X
Instrument Racks IR-49, 50	MM	X	X	X
Piping And Valves	FW	X	X	X
Cabling	EPA	X	X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire		Fire Loading in Area	
Oil:	6	Gallons	375	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	32	Pounds	173	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 548 Btu/Sq. Ft.
Total Combustibles: 1,316,000 Btu

14.0 Design-Basis Fire Description

1. Turbine ruptures, oil spills spreading over 78 sq. Ft. Of floor. Oil film is 1/8" thick and burn rate is 5" per hour.

2. Oil ignites and is consumed.

3. One ventilation supply fan (14,000 cfm) is assumed to fail 30 seconds after fire starts.

4. A fire which considers oil to be sprayed over a large area will have the same total heat release but the heat will not be concentrated to a small area.

5. A fire which considers oil to spill over a small area will be more concentrated.

6. The DBF over the small area as postulated is considered to be the most serious as it will damage electrical cables in the immediate area.

14.1	DBF Fire Loading	11,500	Btu/Sq. Ft.
14.2	Duration of Fire	4 ½	Minutes
14.3	Peak Temperature	601	°F

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Turbine is lost.

15.2 Safe shutdown can be accomplished by use of startup feed pump. For further discussion, refer to the report on "Fire Protection Of Safe Shutdown Capability" (10 CFR 50, Appendix R).

16.0 Consequence of Design Basis Fire with Fire Protection

16.1 Loss of the turbine due to loss of oil.

17.0 Consequence of Inadvertent or Careless Operation or Rupture of the Fire Protection System

17.1 Not applicable (no water fire suppression in area).

18.0 Containing the Design Basis Fire in the Fire Area/Zone

18.1 A) Short fire duration.

B) Concrete structure.

19.0 How the Redundant Safe Shutdown Equipment in the Same Area is Protected

19.1 Spatial separation between pumps.

19.2 Curb around the turbine base to contain an oil spill.

Fire Hazard Analysis – MS-F-1A-Z

1.0	Building			Main Steam & Feedwater Enclosure (East)	
2.0	Fire Area or Zone			MS-F-1A-Z	
2.1	Area Name			Lower Level	
2.2	Location			East El. 3'-0"	
	Drawing No			9763-F-202063-FP, -202064-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
3.1	Walls	North		Concrete	Outside
		South		Concrete	3 Hr.
		East		Concrete	Outside
		West		Concrete	3 Hr./Outside/-
3.2	Floor			Concrete	3 Hr
3.3	Ceiling			Grating	-
3.4	Doors			Metal	3 Hr. /-
3.5	Others			-	-

4.0 Floor Area 1220 Sq. Ft. Length 74.75' Width 16.25' Height 25'

5.0 Volume 20.740 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System (Supply System Only)

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Yard Hydrant
10.3	Detection	Ionization
10.4	Other	------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Piping, Valves & Cabling	MS	X	X	X
Piping, Valves, Instrumentation & Cabling	FW	X	X	X
Cabling	EAH	X	X	X
Terminal Boxes	EDE	X		X
Piping, Valves & Cabling	MSD	X		X

Fire Hazard Analysis – MS-F-1B-Z

1.0	Building		Main Steam & Feedwater Pipe Chase (West)	
2.0	Fire Area or Zone		MS-F-1B-Z	
	2.1 Area Name		Lower Level	
	2.2 Location		El. 3'-0"	
	Drawing No		9763-F-202064-FP, -202063-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
	3.1 Walls	North	Concrete	Outside
		South	Concrete	3 Hr. /-
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
	3.2 Floor		Concrete	3 Hr
	3.3 Ceiling		Grating	-
	3.4 Doors		Metal	3 Hr
	3.5 Others		-	-

4.0 Floor Area 935 Sq. Ft. Length 74' Width 14' Height 25'

5.0 Volume 15,900 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System (Supply System Only)

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

		Type
10.0	Fire Protection	
	10.1 Primary	Fire Extinguisher(s)
	10.2 Secondary	Hose Station
	10.3 Detection	Ionization
	10.4 Other	------

11.0 Fire Loading in Area

11.1 Ref. Page 2 of 3

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Piping and Valves	SB	X	X	X
Instrument Rack – IR-52A, 52B	MM	X	X	X
Piping, Valves & Cabling	MS	X	X	X
Cabling	SB	X	X	X
Piping, Valves, Instrumentation & Cabling	FW	X	X	X
Terminal Boxes	EDE	X		X
Piping Valves & Cabling	MSD	X		X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note: Oil Fire

Combustible	Quantity	Unit	Fire Loading	Unit
Oil:	1	Gallons	160	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	11	Pounds	153	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 313 Btu/Sq. Ft.

Total Combustibles: 293,000 Btu

14.0 Design-Basis Fire Description

1. One of the four (4) steam recirculating pump ruptures, one quart oil spills on floor covering an area of 3 ft. x 4 ft. = 12 sq. Ft.
2. To add conservatism, the oil contents of all four (4) pumps is considered to be spilled on floor (total 1.0 gallon) and burn completely.
3. The ventilating supply fan failed.

14.1 DBF Fire Loading 125,000 Btu/Sq. Ft.

14.2 Peak Zone Temperature Fire 712 °F

14.3 Duration of Fire 4 ½ Min.

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of the steam recirculation and layup pumps due to loss of oil.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Not applicable (no water fire suppression in area).

17.0 Consequences of Inadvertent or Careless Operation or Rupture of the Fire Protection System

17.1 Not applicable (no water suppression in area).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Short fire duration, less than five minutes.

18.2 Concrete structure.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 The redundant safe shutdown equipment is located in a separate fire area.

Fire Hazard Analysis – MS-F-2A-Z

1.0	Building			Main Steam & Feedwater Enclosure (East)	
2.0	Fire Area or Zone			MS-F-2A-Z	
	2.1	Area Name		Upper Level	
	2.2	Location		East El. 27'-6"	
		Drawing No		9763-F-202063-FP, - 202064-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	3 Hr.
			East	Concrete	Outside
			West	Concrete	3 Hr./Outside
	3.2	Floor		Grating	-
	3.3	Ceiling		Concrete	Outside
	3.4	Doors		Metal	3 Hr/-
	3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 1,220 Sq. Ft. Length 74.75' Width 16.25' Height 40'

5.0 Volume 48,800 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Supply System Only

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0	Fire Protection		Type
	10.1	Primary	Fire Extinguisher(s)
	10.2	Secondary	Hose Station
	10.3	Detection	Beam
	10.4	Other	-------

11.0 Fire Loading in Area

11.1 Refer to page 2. (analysis continued pages 2 & 3).

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Piping and Valves	MS	X	X	X
Cabling	MS	X	X	X
Piping, Valves & Cabling	AS	X	X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Combustible	Quantity	Unit	Fire Loading	Unit
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	30	Pounds	320	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 320 Btu/Sq. Ft.
Total Combustibles: 390,000 Btu

14.0 Design-Basis Fire Description

1. For conservatism, the ladders are assumed to be in a vertical position. The bottom of both sets of rails are ignited and burn upward.

2. To add conservatism, it is assumed that the fire is self-sustaining, although the fire is not severe and has a low heat release rate.

3. The fire area will be limited to the length of the ladders and about 2 feet from the wall for an area covering 10 ft. x 2 ft. = 20 $ft.^2$.

14.1 DBF Fire Loading 19,500 Btu/Sq. Ft.

14.2 Peak Zone Temperature Fire 152 °F

14.3 Duration of Fire >>5 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Refer to Seabrook Station fire protection of safe shutdown capability

(10 CFR 50, App. R).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences . . . Fire will be extinguished with manual hose lines or portable extinguishers.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of The Fire Protection System

17.1 Not applicable.

18.0 Containing Design Basis Fire in The Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire would be extinguished using hose lines and/or portable extinguishers.

19.0 How The Redundant Safe Shutdown Equipment in The Same Area is Protected

19.1 Refer to safe shutdown requirements Table 3.2.7.58 of the report Seabrook Station Fire Protection Safe Shutdown Capability (10 CFR 50, Appendix R).

Fire Hazard Analysis – MS-F-2B-Z

1.0	Building			Main Steam & Feedwater Pipe Chase (West)	
2.0	Fire Area or Zone			MS-F-2B-Z	
	2.1	Area Name		Upper Level	
	2.2	Location		El. 27'-6"	
		Drawing No		9763-F-202064-FP, - 202063-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	3 Hr.
			East	Concrete	3 Hr./-
			West	Concrete	3 Hr.
	3.2	Floor		Grating	-
	3.3	Ceiling		Concrete	Outside
	3.4	Doors		Metal	-/3 Hr.
	3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 935 Sq. Ft. Length 66.75' Width 14' Height 40'

5.0 Volume 37.400 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System (Supply System Only)

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0	Fire Protection		Type
	10.1	Primary	Fire Extinguisher(s)
	10.2	Secondary	Hose Station
	10.3	Detection	Beam
	10.4	Other	------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Piping and Valves	MS	X	X	X	X
Cabling	MS	X	X	X	X
Cabling	SB	X	X	X	X

Fire Hazard Analysis – MS-F-3A-Z

1.0 Building: Main Steam & Feedwater Pipe Chase (East)

2.0 Fire Area or Zone: MS-F-3A-Z
- 2.1 Area Name: Electrical Room
- 2.2 Location: South End of East – MS&FEW – El. 3'-0"
- Drawing No: 9763-F-202063-FP, - 202064-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	Outside
		East	Concrete	Outside
		West	Concrete	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	-
3.4	Doors		Metal	1 ½ Hr.
3.5	Others		-	-

4.0 Floor Area 294 Sq. Ft. Length Varies Width 14'-0" Height 17'-6"

5.0 Volume 5145 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System: EAH
- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X
- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type
- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Yard Hydrant
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area
- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
MSIV-Logic Cab. CP-182	MS	X		X
MSIV-Logic Cab. CP-184	MS		X	X
Cabling	MS	X	X	X
Press. Transmitters & Cabling	FW	X	X	X
Instrument Racks IR-51A, 51B	MM	X	X	X
Control Panels Transf. & Cabling	HT	X	X	X

Fire Hazard Analysis – MS-F-3B-Z

1.0 Building: Main Steam & Feedwater Enclosure (West)

2.0 Fire Area or Zone: MS-F-3B-Z

- 2.1 Area Name: Personnel Hatch Area
- 2.2 Location: Northeast of West MS&FEW – N1 12’ –0” & 21’ –0”
- Drawing No: 9761-F-202063-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr./Outside
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	Outside/-
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr./ *
3.5	Others		-	-

4.0 Floor Area 1,656 Sq. Ft. Length Varies Width Varies Height Varies

5.0 Volume 40,392 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System ----

- 7.1 Percentage of System’s Capacity ----

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Yard Hydrant
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 Refer To Page 2. (Analysis continued pages 2 & 3).

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* Personnel Hatch

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Cabling	MS	X		X
Cabling	SB	X		X
Cabling	FW	X		X
Cabling	AS	X		X
Cabling	MSD	X		X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Combustible	Quantity	Unit	Fire Loading	Unit
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	161	Pounds	1264	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 1264 Btu/Sq. Ft.
Total Combustibles: 2,093,000 Btu

14.0 Design-Basis Fire Description

1. For conservatism, the ladders are assumed to be in a vertical position. The bottom of both sets of rails are ignited and burn upward.

2. To add conservatism, it is assumed that the fire is self-sustaining, although the fire is not severe and has a low heat release rate.

3. The fire area will be limited to the length of the ladders and about 2 feet from the wall for an area covering 40 ft. x 2 ft. = 80 ft.^{2}.

Note: Fiberglass ladders previously stored in MS-F-3B-Z were removed per EC 156668, but retained in this fire hazard analysis to support future ladder storage in this fire zone. The plastic components typically contained in the permanent storage area located in this fire zone for a Radiation Protection workstation are not considered to contribute to the design basis fire. Refer to Calc MS-MISC-41 for details and additional discussion.

14.1 DBF Fire Loading 18,038 Btu/Sq. Ft.

14.2 Peak Zone Temperature Fire 219 °F

14.3 Duration of Fire >5 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with manual hose lines or portable extinguishers.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable

18.0 Containing Design Basis Fire in The Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire would be extinguished using hose lines and/or portable extinguishers.

19.0 How The Redundant Safe Shutdown Equipment in The Area is Protected

19.1 Refer to Safe Shutdown Requirements Table 3.2.7.59 of the report Seabrook Station Fire Protection Safe Shutdown Capability (10 CFR 50, Appendix R).

Fire Hazard Analysis – MS-F-4A-Z

1.0	Building			Mainstream & Feedwater Pipe Chase (East)	
2.0	Fire Area or Zone			MS-F-4A-Z	
	2.1	Area Name		H_2 Analyzer Room	
	2.2	Location		South End of East MS & FEW – El. 22'-0"	
		Drawing No		9763-F-202063-FP & 202064-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr.
			South	Concrete	Outside
			East	Concrete	Outside
			West	Concrete	3 Hr.
	3.2	Floor		Concrete	-
	3.3	Ceiling		Concrete	Outside
	3.4	Doors		Metal	1 ½ Hr.
	3.5	Others		-	-

4.0 Floor Area 294 Sq. Ft. Length Varies Width 14'-0" Height 16'-0"

5.0 Volume 4,704 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System EAH

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

10.1	Primary		Fire Extinguisher(s)
10.2	Secondary		Yard Hydrant
10.3	Detection		Ionization
10.4	Other		------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Fan FN-174A & B	EAH	X	X	X
Cabling	EAH	X	X	X
H_2 Analyzer Pnl & Cabling	CGC	X	X	X
Temperature Sws	EAH	X	X	X
Control Panels, Transf. Heaters & Cabling	HT	X	X	X

Fire Hazard Analysis – MS-F-5A-Z

1.0	Building		Main Steam & Feedwater Pipe Chase (East)	
2.0	Fire Area or Zone		MS-F-5A-Z	
	2.1 Area Name		Cable Tunnel	
	2.2 Location		Northwest of East MS & FWE - El. 8'-2"	
	Drawing No		9763-F-202063-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
	3.1 Walls	North	Concrete	Outside
		South	Concrete	3 Hr.
		East	Concrete	-
		West	Concrete	3 Hr.
	3.2 Floor		Concrete	Outside
	3.3 Ceiling		Concrete	Outside/Partial 3 Hr.
	3.4 Doors		Metal	- /3 Hr.
	3.5 Others		-	-

4.0 Floor Area 485 Sq. Ft. Length Varies Width Varies Height 12'

5.0 Volume 5,800 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System -----

7.1 Percentage of System's Capacity -----

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points		X
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	None

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	MS	X		X	X
Cabling	SW	X		X	X
Cabling	SWA	X		X	X

Fire Hazard Analysis – RHR-F-1A-Z

1.0 Building: RHR, Containment Spray, SI Equip. Vault

2.0 Fire Area or Zone: RHR-F-1A-Z

- 2.1 Area Name: Containment Spray Pump – 9b
- 2.2 Location: Southwest El. (-) 61'-0" to 25' –6"
- Drawing No: 9763-F-805060-FP, 805078-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	Outside/3 Hr.
		East	Concrete/Open	-
		West	Concrete	Outside
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	-
3.4	Doors		Metal	-
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 250 Sq. Ft. Length 18' Width 14' Height 84'

5.0 Volume 21,200 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: PAB Exhaust System

- 7.1 Percentage of System's Capacity: 100% - Recirculated

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 Ref. Page 2.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Cont. Spray Pump P-9B	CBS		X	X
Instruments & Cabling	RH		X	X
Piping, Valves & Cabling	CBS		X	X
Piping, Valves and Cabling	CC		X	X

13.0 Design Basis Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note: Oil Fire

Combustible	Quantity	Unit	Fire Loading	Unit
Oil:	5.0	Gallons	3000	Btu/Sq. Ft.
	7.25	Gallons (other zones)		
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	5	Pounds	260	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 3,260 Btu/Sq. Ft.

Total Combustibles: 815,000 Btu

14.0 Design-Basis Fire Description

(a) Fire zones RHR-F-1AZ, RHR-F-1C-Z, RHR-F-2A-Z, and RHR-F-3A-Z constitute on large fire area as they contain open floor hatches and doors, therefore, heat of fire will be disbursed to all 4 zones.

(b) Containment spray pump ruptures and oil spills on floor covering an area of 5 ft. x 13 ft. = 65 sq. ft..

(c) The entire 5 gallons of oil in this zone will burn. In addition, because of high temperature, remote location and absence of automatic suppression system, entire oil content of RHR-F-1C-Z and RHR-F-2A-Z will burn (total of 12.5 gallons with 1,875,000 Btu as D. B. combustibles).

14.1 DBF Fire Loading 11,719 Btu/Sq. Ft.

14.2 Peak Area/ Zone Temp. During Fire 2,306 °F

14.3 Duration of Fire 4½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1. Loss of pump and loss of cabling in conduit servicing the motor.

15.2. Possible loss of any or all system "A" Train components located in RHR-F-1A-Z, RHR-F-1C-Z, RHR-F-2A-Z, and RHR-F-3A-Z.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1. Same as above as fire duration is less than five minutes, fire location is remote from control room, no automatic suppression system exists.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1. Not applicable (automatic suppression system does not exist).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1. 3-hr. fire barrier between Train "A" and Train "B" equipment and fire duration is less than five minutes, hence fire will be contained within the zones considered.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1. Safe shutdown can be accomplished with the redundant train equipment located in an area separated by 3-hr. fire barriers.

Fire Hazard Analysis – RHR-F-1B-Z

1.0	Building			RHR, Containment Spray, SI Equip. Vault			
2.0	Fire Area or Zone			RHR-F-1B-Z			
	2.1	Area Name		Containment Spray Pump – 9A			
	2.2	Location		Northwest El. (-) 61'-0" to 25' –6"			
		Drawing No		9763-F-805060-FP, 805078-FP			
3.0	Construction of Area						
				Material			Min. Fire Rating
	3.1	Walls	North	Concrete			Outside/3 Hr.
			South	Concrete			3 Hr.
			East	Concrete/Open			-
			West	Concrete			Outside
	3.2	Floor		Concrete			Outside
	3.3	Ceiling		Concrete			-
	3.4	Doors		Metal			-
	3.5	Others		Exposed Ceiling Beams			-

4.0 Floor Area 250 Sq. Ft. Length 18' Width 14' Height 84'

5.0 Volume 21,200 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: PAB Exhaust System

7.1 Percentage of System's Capacity: 100 % - Recirculated

			Yes	No
8.0	8 Hr. Emergency Lighting in Area			X
	8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity			
	9.1	Equipment/Piping		X
	9.2	Airborne		X

10.0 Fire ProtectionType

10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	------

11.0 Fire Loading in Area

11.1 Ref. Page 2 of 3.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Cont. Spray Pump P-9A	CBS	X		X
Cabling	RH	X		X
Piping, Valves & Cabling	CBS	X		X
Piping, Valves and Cabling	CC	X		X

13.0 Design Basis Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	5.0	Gallons	3,000	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	5	Pounds	260	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 3,260 Btu/Sq. Ft.

Total Combustibles: 815,000 Btu

14.0 Design-Basis Fire Description

(A) Fire zones RHR-F-1B-Z, RHR-F-1D-Z, RHR-F-2B-Z and RHR-F-3B-Z constitute one fire area as they contain open floor hatches and doors. Therefore, heat of the fire will be disbursed to all four zones.

(B) Containment spray pump ruptures and oil spills on floor covering an area of 5 ft. x 13 ft. = 65 sq. ft.

(C) The entire 5 gallons of oil will burn. In addition, because of high temperature, remote location and absence of automatic suppression system, entire oil content of RHR-F-1D-Z and RHR-F-2B-Z will burn (total of 12.5 gallons with 1,875,000 Btu as D.B. combustibles).

14.1 DBF Fire Loading 11,719 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire 2,306 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1. Loss of pump and loss of cabling in conduit servicing the motor.

15.2. Possible loss of any or all system "B" Train components located in RHR-F-1B-Z, RHR-F-1D-Z, RHR-F-2B-Z, and RHR-F-3B-Z.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1. Same as above as fire duration is less than five minutes, fire location is remote from control room, no automatic suppression system exists.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1. Not applicable (automatic suppression system does not exist).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1. 3-hr. fire barrier between Train "A" and Train "B" equipment and fire duration is less than five minutes, hence fire will be contained within the zones considered.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1. Safe shutdown can be accomplished with the redundant train equipment located in an area separated by 3-hr. fire barriers.

Fire Hazard Analysis – RHR-F-1C-Z

1.0 Building: RHR, Containment Spray, SI Equip. Vault

2.0 Fire Area or Zone: RHR-F-1C-Z

- 2.1 Area Name: RHR Pump – 8B
- 2.2 Location: South Side – El. (-) 61'-0"
- Drawing No: 9763-F-805060-FP, 805078-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	Outside
		East	Concrete	3 Hr.
		West	Concrete	-
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete/Grating	-
3.4	Doors		Metal	1 ½ Hr.
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 360 Sq. Ft. Length 20' Width 18' Height 8.5'

5.0 Volume 3,100 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: PAB Exhaust System

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe & Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------------

11.0 Fire Loading in Area

- 11.1 Refer to page 2 (analysis continued pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
RHR Pump P-8B	RH		X	X
Piping & Valves	RH		X	X
Piping & Valves	CC		X	X
Piping & Valves	CBS		X	X
Cabling	RH		X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	1.75	Gallons	729	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	5	Pounds	181	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 910 Btu/Sq. Ft.

Total Combustibles: 327,500 Btu

14.0 Design-Basis Fire Description

(A) Zones RHR-F-1C-Z, 2A-Z, 3A-Z and 1A-Z Constitute One Large Fire Area As They Contain Open Floor Hatches and Doors.

(B) RH pump ruptures, lube oil spills on floor, covering area of 24 sq. ft.

(C) 1.75 gallons oil ignites and is consumed. In addition, because of high temp. remote location and absence of automatic spray system, entire oil content of RHR-F-2A-Z AND RHR-F-1A-Z will burn (total of 12.5 gallons with 1,875,000 Btu as total D.B. combustibles).

14.1 DBF Fire Loading 11,719 Btu/Sq. Ft.

14.2 Peak Temperature 2,306 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of pump and cabling located in conduit servicing the motor.

15.2 Possible loss of any or all system “A” Train components located in RHR-F-1A-Z, RHR-F-1C-Z, RHR-F-2A-Z and RHR-F-3A-Z.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Same as above as fire duration is less than five minutes, fire location is remote from control room, no automatic suppression system exists.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of the Fire Protection System

17.1 Not applicable (automatic suppression system does not exist).

18.0 Containing the Design Basis Fire in the Fire Area/Zone

18.1 3-hr. fire barrier between Train “A” and Train “B” equipment and fire duration is less than five minutes, hence fire will be contained within the zones considered.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Safe shutdown can be accomplished with the redundant train equipment located in an area separated by 3-hr. fire barriers.

Fire Hazard Analysis – RHR-F-1D-Z

1.0	Building		RHR, Containment Spray, SI Equip. Vault	
2.0	Fire Area or Zone		RHR-F-1D-Z	
2.1	Area Name		RHR Pump – 8A	
2.2	Location		North Side – El. (-) 61'-0"	
	Drawing No		9763-F-805060-FP, 805078-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	-
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete/Grating	-
3.4	Doors		Metal	1½ Hr./-
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 360 Sq. Ft. Length 20' Width 18' Height 8.5'

5.0 Volume 3,100 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAB Exhaust System

7.1 Percentage of System's Capacity 100%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping	X	
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	------------

11.0 Fire Loading in Area

11.1 Refer to Page 2 (analysis continued pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
RHR Pump P-8A	RH	X		X
Piping & Valves	RH	X		X
Piping & Valves	CC	X		X
Piping & Valves	CBS	X		X
Cabling	RH	X		X

13.0 Design Basis Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Combustible in Area (In Situ)			Fire Loading in Area	
Note:	Oil Fire			
Oil:	1.75	Gallons	729	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	5	Pounds	181	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 910 Btu/Sq. Ft.

Total Combustibles: 327,500 Btu

14.0 Design-Basis Fire Description

(A) Zones RHR-F-1D-Z, 2B-Z, 3B-Z and 1B-Z constitute one large fire area as they contain open floor hatches and doors.

(B) RH pump ruptures, lube oil spills on floor, covering area of 24 sq. ft.

(C) 1.75 gallons oil ignites and is consumed. In addition, because of high temp. remote location and absence of automatic spray system, entire oil content of RHR-F-2B-Z AND RHR-F-1B-Z will burn (total of 12.5 gallons) with 1,875,000 Btu as D.B. combustibles.

14.1 DBF Fire Loading 11,719 Btu/Sq. Ft.

14.2 Peak Temperature 2,306 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of pump and cabling located in conduit servicing the motor.

15.2 Possible loss of any or all system "a" train components located in RHR-F-1B-Z, RHR-F-1D-Z, RHR-F-2B-Z and RHR-F-3B-Z.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Same as above as fire duration is less than five minutes, fire location is remote from control room, no automatic suppression system exists.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of the Fire Protection System

17.1 Not applicable (automatic suppression system does not exist).

18.0 Containing the Design Basis Fire in the Fire Area/Zone

18.1 3-hr. fire barrier between Train "A" and Train "B" equipment and fire duration is less than five minutes, hence fire will be contained within the zones considered.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Safe shutdown can be accomplished with the redundant train equipment located in an area separated by 3-hr. fire barriers.

Fire Hazard Analysis – RHR-F-2A-Z

1.0 Building: RHR, Containment Spray, SI Equip. Vault

2.0 Fire Area or Zone: RHR-F-2A-Z

- 2.1 Area Name: Safety Injection Pump – 6B
- 2.2 Location: South Side – El. (-) 50'-0" Train B Vault (Vault #2)
- Drawing No: 9763-P-805060-FP, 805078-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	Outside
		East	Concrete/Open	3 Hr.
		West	Concrete	-
3.2	Floor		Concrete/Grating	-
3.3	Ceiling		Concrete/Grating	-
3.4	Doors		Metal	1½ Hr./-
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 360 Sq. Ft. Length 201' Width 181' Height 15.66'

5.0 Volume 5,600 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ____ None ____

7.0 Exhaust Ventilation System: PAB Exhaust System

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ____ No X

- 8.1 Outside Area at Exit Points Yes X No ____

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ____
- 9.2 Airborne Yes ____ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 Refer to Page 2 (analysis continued Pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
SI Pump P-6B	SI		X	X	
Piping	RC		X	X	X
Piping & Valves	CBS		X	X	X
Piping & Valves	SI		X	X	
Piping & Valves	CS		X	X	
Piping & Valves	CC		X	X	X
Piping & Valves	RH		X	X	X
Cabling	CBS		X	X	
Cabling	RH		X	X	X
Cabling	SI	X	X	X	
Cabling	CC		X	X	

13.0 Design Base Fire (In Situ)

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	5.5	Gallons	2,292	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 2,292 Btu/Sq. Ft.

Total Combustibles: 825,000 Btu

14.0 Design-Basis Fire Description

(A) Zones RHR-F-1C-Z, 2A-Z, 3A-Z and 1A-Z constitute one large fire area as they contain open floor hatches and doors.

(B) Safety injection pump ruptures, lube oil spills on floor, covering area of 72 sq. ft.

(C) The entire 5.5 gallons of oil in this zone will burn. In addition, because of high temperature, remote location and absence of automatic spray system, entire oil content of RHR-F-1C-Z and RHR-F-1A-Z will burn (total of 12.5 gallons with 1,875 Btu as D.B. combustibles).

14.1 DBF Fire Loading 11,719 Btu/Sq. Ft.

14.2 Peak Temperature 2,306 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of pump and cabling located in conduit servicing the motor.

15.2 Possible loss of any or all system "A" Train components located in RHR-F-1A-Z, RHR-F-1C-Z, RHR-F-2A-Z, and RHR-F-3A-Z.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Same as above as fire duration is less than five minutes, fire location is remote from control room, no automatic suppression system exists.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of the Fire Protection System

17.1 Not applicable (automatic suppression system does not exist).

18.0 Containing the Design Basis Fire in the Fire Area/Zone

18.1 3-hr. fire barrier between Train "A" and Train "B" equipment and fire duration is less than five minutes, hence fire will be contained within the zones considered.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Safe shutdown can be accomplished with the redundant train equipment located in an area separated by 3-hr. fire barriers.

Fire Hazard Analysis – RHR-F-2B-Z

1.0 Building: RHR, Containment Spray, SI Equip. Vault

2.0 Fire Area or Zone: RHR-F-2B-Z

- 2.1 Area Name: Safety Injection Pump – 6A
- 2.2 Location: North Side – El. (-) 50’-0” Train A Vault (Vault #1)
- Drawing No: 9763-F-805060-FP, 805078-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	3 Hr.
		East	Concrete/Open	3 Hr.
		West	Concrete	-
3.2	Floor		Concrete/Grating	-
3.3	Ceiling		Concrete/Grating	-
3.4	Doors		Metal	1½ Hr./-
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 360 Sq. Ft. Length 20’ Width 18’ Height 15.66’

5.0 Volume 5.600 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: PAB Exhaust System

- 7.1 Percentage of System’s Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: -----------

11.0 Fire Loading in Area

- 11.1 Refer to page 2 (analysis continued pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
SI Pump P-6A	SI	X		X	
Piping	RC	X		X	X
Piping & Valves	CBS	X		X	X
Piping & Valves	SI	X		X	
Piping & Valves	CS	X		X	
Piping & Valves	CC	X		X	X
Piping & Valves	RH	X		X	X
Cabling	CBS	X		X	
Cabling	RH	X		X	X
Cabling	CS	X	X	X	
Cabling	CC	X		X	

13.0 Design Basis Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	5.5	Gallons	2.292	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 2,292 Btu/Sq. Ft.

Total Combustibles: 825,000 Btu

14.0 Design-Basis Fire Description

(A) Zones RHR-F-1D-Z, 2B-Z, 3B-Z and 1B-Z constitute one large fire area as they contain open floor hatches and doors.

(B) Safety injection pump ruptures, lube oil spills on floor, covering area of 72 sq. ft..

(C) The entire 5.5 gallons of oil in this zone will burn. In addition, because of high temperature, remote location and absence of automatic spray system, entire oil content of RHR-F-1C-Z and RHR-F-1A-Z will burn (total of 12.5 gallons oil with 1,875,000 Btu total D.B. combustibles).

14.1	DBF Fire Loading	11,719	Btu/Sq. Ft.
14.2	Peak Temperature	2,306	°F
14.3	Duration of Fire	4 ½	Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1. Loss of pump and cabling located in conduit servicing the motor.

15.2. Possible loss of any or all system "B" Train components located in RHR-F-1B-Z, RHR-F-1D-Z, RHR-F-2B-Z, and RHR-F-3A-Z.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1. Same as above as fire duration is less than five minutes, fire location is remote from control room, no automatic suppression system exists.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1. Not applicable (automatic suppression system does not exist).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1. 3-hr. fire barrier between Train "A" and Train "B" equipment and fire duration is less than five minutes, hence fire will be contained within the zones considered.

19.0 How is the Redundant Safe Shutdown Equipment in the Area Protected

19.1. Safe shutdown can be accomplished with the redundant train equipment located in an area separated by 3-hr. fire barriers.

Fire Hazard Analysis – RHR-F-3A-Z

1.0	Building		RHR, Containment Spray, SI Equip. Vault	
2.0	Fire Area or Zone		RHR-F-3A-Z	
2.1	Area Name		RHR Heat Exchanger – 9B	
2.2	Location		South Side El. (-) 31'-10" Train B Vault (Vault #2)	
	Drawing No		9763-F-805060, 805078	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete/Open	-
3.2	Floor		Concrete/Grating	-
3.3	Ceiling		Concrete/Grating	Outside
3.4	Doors		Metal	1½ Hr./-
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 360 Sq. Ft. Length 20' Width 18' Height 55'

5.0 Volume 19,800 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAB Exhaust System

7.1 Percentage of System's Capacity 100%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping	X	
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	-----------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Piping and Valves	RH		X	X	X
Piping and Valves	CC		X	X	X
RHR Heat Exchanger 9B	RH		X	X	X

Fire Hazard Analysis – RHR-F-3B-Z

1.0 Building: RHR, Containment Spray, SI Equip. Vault

2.0 Fire Area or Zone: RHR-F-3B-Z

- 2.1 Area Name: RHR Heat Exchanger – 9A
- 2.2 Location: North Side El. (-) 31'-10" Train A Vault (Vault #1)
- Drawing No: 9763-F-805060, 805078

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	1 Hr.
		East	Concrete	3 Hr.
		West	Concrete/Open	-
3.2	Floor		Concrete/Grating	-
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	1½ Hr./-
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 360 Sq. Ft. Length 20' Width 18' Height 55'

5.0 Volume 19,800 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ___ None ___

7.0 Exhaust Ventilation System: PAB Exhaust System

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ___ No X

- 8.1 Outside Area at Exit Points Yes X No ___

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ___
- 9.2 Airborne Yes ___ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: -----------

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Piping and Valve	RH	X		X	X
Piping and Valve	CC	X		X	X
RHR Heat Exchanger 9A	RH	X		X	X

Fire Hazard Analysis – RHR-F-4A-Z

1.0	Building		RHR, Containment Spray, SI Equip. Vault	
2.0	Fire Area or Zone		RHR-F-4A-Z	
2.1	Area Name		Stairway & Manlift Area	
2.2	Location		South, El. (-) 61'-0" Up to El. 30' –8"	
	Drawing No		9763-F-805060-FP & 805078-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr. / 1½ Hr.
3.5	Others		-	-

4.0 Floor Area 234 Sq. Ft. Length 18' Width 13' Height 91'

5.0 Volume 21,290 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAB Exhaust System

7.1 Percentage of System's Capacity 100% - Recirculated

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points		X
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	-----------

11.0 Fire Loading in Area

11.1 Refer to pages 3 & 4 (Analysis Continued)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Piping & Valves	RH		X	X	X
Piping & Valves	CBS		X	X	X
Cabling	CS		X	X	
Cabling	RH		X	X	
Cabling	CBS		X	X	
Local Remote Shutdown Panel	RH		X	X	X

13.0 Design Basis Fire

13.1 Combustibles in Area (In Situ) — Fire Loading in Area

Oil:	0.79	gallons	118,800	Btu
Grease:		Pounds		
Wood	142.5	Pounds	1,140,480	“
Charcoal:		Pounds		
Chemicals:		Pounds		
Plastics:	7.5	Pounds	114,796	“
Resins:		Pounds		
Other:				

13.2 Total Fire Loading in Area: 5,872 Btu/Sq. Ft.
Total Combustibles: 1,374,076 Btu

14.0 Design Basis Fire Description

(a) Oil leaks from both RHR manlift gearboxes onto top of lift cage.

(b) Fire starts and burns wood/oil and subsequently plastic of manlift.

14.1 DBF Fire Loading 5,872 Btu/Sq. Ft.

14.2 Peak Area/ Zone Temp. During Fire 340 °F

14.3 Duration of Fire 38.2 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1. Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1. Same as 15.1, above.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1. Not applicable (No water suppression in area).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1. Early detection from smoke detectors with alarm to control room.

18.2 Fire Brigade hose stream use will reduce fire duration.

18.3 Fire barriers, doors and dampers will limit fire damage to the zone.

19.0 How is Redundant Safe Shutdown Equipment in the Area Protected

19.1. Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

Fire Hazard Analysis – RHR-F-4B-Z

1.0 Building: RHR, Containment Spray, SI Equip. Vault

2.0 Fire Area or Zone: RHR-F-4B-Z
- 2.1 Area Name: Stairway & Hatch Area
- 2.2 Location: North El. (-) 61'-0" Up to El. 30' –8"
- Drawing No: 9763-F-805060-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr. / 1½ Hr.
3.5	Others		-	-

4.0 Floor Area 234 Sq. Ft. Length 18' Width 13' Height 91'

5.0 Volume 21,290 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: PAB Exhaust System
- 7.1 Percentage of System's Capacity: 100% - Recirculated

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X
- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type
- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: -----------

11.0 Fire Loading in Area
- 11.1 Refer to page 2 of 3

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Piping & Valves	RH	X		X	X
Piping & Valves	CBS	X		X	X
Cabling	CBS	X		X	
Cabling	CC	X		X	
Cabling	CS	X		X	X
Cabling	RH	X		X	
Local Remote Shutdown Panel	RH	X			X

13.0 Design Basis Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	0.79	Gallons	118,800	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Wood	142.5	Pounds	1,140,480	Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	7.5	Pounds	114,796	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 5,872 Btu/Sq. Ft.

Total Combustibles: 1,374,076 Btu

14.0 Design-Basis Fire Description

(a) Oil leaks from both RHR manlift gearboxes onto top of liftcage

(b) Fire starts and burns wood/oil and subsequently plastic of manlift.

14.1	DBF Fire Loading	5,872	Btu/Sq. Ft.
14.2	Peak Area/ Zone Temp. During Fire	340	°F
14.3	Duration of Fire	38.2	Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1. Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1. Same as 15.1, above.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1. Not applicable (No water suppression in area).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1. Early detection from smoke detectors with alarm to control room.

18.2 Fire Brigade hose stream use will reduce fire duration.

18.3 Fire barriers, doors and dampers will limit fire damage to the zone.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1. Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

Fire Hazard Analysis – CB-F-1A-A

1.0 Building: Control Building

2.0 Fire Area or Zone: CB-F-1A-A

- 2.1 Area Name: Switchgear Room "A"
- 2.2 Location: El. 21'-6"
- Drawing No: 9763-F-310431-FP, 310455-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr. *
		South	MCG/Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	MCG/Concrete	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr.
3.5	Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 2,450 Sq. Ft. Length 58' Width 42' Height 27.5'

5.0 Volume 67,400 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System: Switchgear Exhaust

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes X No ______

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: Yard Hydrant

11.0 Fire Loading in Area

- 11.1 Refer to page 4 (analysis continued pages 2 – 5)

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* Door C-100 is Not 3 Hr. Fire Rated. Ref. Deviation No. 5, Sbn-904 Dated Dec. 2, 1985.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
4Kv-SWGR-E5	EDE	X		X	
480v-Subst. E51, E52, E53	EDE	X		X	
460v-MCC-E512, E515, E521, E522, E531, 231	EDE	X		X	
120v-AC Distr Pnls	EDE	X		X	
125v-DC SWGR 11A, 11C	EDE	X		X	
125v-DC Distr Pnls	EDE	X		X	
Battery Chargers BC-1A, BC – 1C	EDE	X		X	
Remote Shutdown Panel CP-108A	MM	X		X	
Emerg. Pwr. Sequen. CP-79	DG	X		X	
UPS I-1A, I-1C, I-1E	EDE	X		X	
Cabling & Controls	CAH	X			
Cabling & Controls	CBA	X		X	
Cabling & Controls	CC	X		X	
Cabling & Controls	CS	X		X	
Cabling	DAH	X		X	X
Cabling	DG	X		X	X

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	EAH	X		X	X
Cabling	EDE	X		X	X
Cabling	EPA	X		X	X
Cabling	FW	X		X	X
Cabling	MS	X		X	X
Cabling	NI	X		X	X
Cabling	PAH	X		X	X
Cabling	RC	X		X	X
Cabling	RH	X		X	X
Cabling	SI	X		X	X
Cabling	SWA	X		X	X
125v-DC-SWGR 11A	EDE	X		X	X
Cabling & Controls	SWA	X		X	
Cabling	CAP	X		X	
Instruments & Cabling	CBS	X		X	
Cabling & Controls	CGC	X		X	
Cabling	COP	X		X	
Cabling	CP	X		X	
Cabling	FAH	X		X	
Cabling	MSD	X		X	

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	NG	X		X	
Cabling	RM	X		X	
Cabling	RMW	X		X	
Cabling	SB	X		X	
Cabling & Controls	SF	X		X	
Cabling	SS	X		X	
Cabling & Controls	SW	X		X	
Cabling	VG	X		X	
Cabling	WLD	X		X	
Cabling	SA	X			
460v-MCC-111, 231	ED	X		X	
Cabling	CAH	X		X	

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:				
Oil:	1	Gallons	62	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	88	Pounds	467	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 529 Btu/Sq. Ft.
Total Combustibles: 1,294,000 Btu

14.0 Design-Basis Fire Description

1. For CB-1-F-1A-A, the entire quantity of oil will be assumed to spill on the floor, as this result in the most limiting fire. In the absence of any curbs or other restrictions, it will spread to a thickness of 1/8" over an area equal to:
   1 gal* (ft^3/7.4805 gal)*(1/0.125in)*(12in/1ft) = 12.8ft^2

2. The ladders are assumed to be not part of the DBF because the plastic will only be assumed to ignite if they meet a temperature of greater than 750°F.

14.1	DBF Fire Loading	11,719	Btu/Sq. Ft.
14.2	Peak Zone Temperature Fire	252.8	°F
14.3	Duration of Fire	4.5	Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Refer to Seabrook Station Fire Protection Safe Shutdown I Capability (10 CFR 50, Appendix R).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with portable extinguishers.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire would be extinguished using hose lines and/or portable extinguishers.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Refer to Seabrook Station Fire Protection Safe Shutdown Capability (10 CFR 50, Appendix R).

Fire Hazard Analysis – CB-F-1B-A

1.0 Building: Control Building

2.0 Fire Area or Zone: CB-F-1B-A
- 2.1 Area Name: Switchgear Room "B"
- 2.2 Location: El. 21'-6"
- Drawing No: 9763-F-310431-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	MCG/Concrete	3 Hr.
		South	Concrete	Outside Wall/3 Hr.
		East	Concrete	3 Hr.
		West	Concrete/MCG	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr./1½ Hr.(Stairs)
3.5	Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 2,450 Sq. Ft. Length 58' Width 42' Height 27.5'

5.0 Volume 67,400 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System: Switchgear Exhaust
- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes X No ______
- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type
- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area
- 11.1 Refer to page 4

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
4kv-Swgr-E6	EDE		X	X	
480v-Subst. E61, E62, E63	EDE		X	X	
460v-MCC-E612, E615, E621, E622, E631	EDE		X	X	
120v-Ac Distr Pnls	EDE		X	X	
125v-DC Swgr 11B, 11D	EDE		X	X	
125v-DC Distr Pnls	EDE		X	X	
Battery Chargers BC-1B, BC – 1D	EDE		X	X	
Remote Shutdown Panel CP-108b	EDE		X	X	
Emerg. Pwr. Sequen. CP-80	EDE		X	X	
UPS I-1B, I-1D, I-1F	EDE		X	X	
Cabling & Controls	CAH		X		
Cabling & Controls	CBA		X	X	
Cabling & Controls	CC		X	X	
Cabling & Controls	CS		X	X	
125-DC-SWGR 11B	EDE		X	X	X
125v-DC-SWG 11D	EDE		X	X	X
120v-AC V Distr. 11F	EDE		X	X	X
125v-DC Distr. 112B	EDE		X	X	X
125v-DC Distr.111D	EDE		X	X	X
480-120v Xfmr 31F	EDE		X	X	X
Aux Relay Panel GN 0	EDE		X	X	X
UPS I-1F	EDE		X	X	X

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Battery Charger BC-1B	EDE		X	X	X
Battery Charger BC-1D	EDE		X	X	X
Fuse Box CP-228	EDE		X	X	X
Instrumentation & Cabling	CBS		X	X	
Cabling & Controls	CGC		X	X	
Cabling	COP		X	X	
Cabling	CP		X	X	
Cabling	PAH		X	X	
Cabling	MSD		X	X	
Cabling	NG		X	X	
Cabling	RW		X	X	
Cabling	RMW		X	X	
Cabling	SB		X	X	
Cabling & Controls	SF		X	X	
Cabling	SS		X	X	
Cabling & Controls	SW		X	X	
Cabling	VG		X	X	
Cabling	WLD		X	X	
Cabling	SA		X		
Msiv, Logic Cabinets CP-183, CP-185	MS		X	X	
Fuse Cabinets	EDE		X	X	
Cabling	CAH		X	X	

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:				
Oil:	1	Gallons	62	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	88	Pounds	467	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:	54 (non IEEE-383 Cable)	Pounds	231	Btu/Sq. Ft.

13.2 Total Fire Loading in Area: 760 Btu/Sq. Ft.
Total Combustibles: 1,861,000 Btu

14.0 Design-Basis Fire Description

1. For CB-F-1B-A, the combustible content of non IEEE-383 qualified cable (cable dolly) is assumed to burn as this is the most limiting fire. Fire loads in CB-F-1B-A are sufficiently separated that they do not need to be considered in the same design basis fire scenario. As shown on drawing EC285783-C-001, the cable is stored in the east of the CB-F-1B-A, whereas the circuit breaker racking tool is installed in the west side of the room (ref. SKM-07160-1000). The cable burns uniformly across its length (burn area = dL = 75.8 ft^2). The cable burns over an area of approximately 4 ft^2, assuming a 2 ft by 2 ft footprint.

2. The ladders are assumed to be not part of the DBF because the plastic will only be assumed to ignite if they meet a temperature of greater than 750°F.

14.1 DBF Fire Loading 141,750 Btu/Sq. Ft.

14.2 Peak Zone Temperature Fire 678 °F

14.3 Duration of Fire 7.3 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Refer to Seabrook Station Fire Protection Safe Shutdown I Capability (10 CFR 50, Appendix R).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with portable extinguishers.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Early warning detectors alarm in the Control Room and alert the Fire Brigade:

18.2 Fire would be limited to cable dolly and the fire extinguished using hose lines and portable extinguishers.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Refer to Seabrook Station Fire Protection Safe Shutdown Capability (10 CFR 50, Appendix R).

Fire Hazard Analysis – CB-F-1D-A

1.0 Building: Control Building

2.0 Fire Area or Zone: CB-F-1D-A

- 2.1 Area Name: Battery Room "A"
- 2.2 Location: El. 21'-6"
- Drawing No: 9763-F-310431-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr.
3.5	Others		-	-

4.0 Floor Area 330 Sq. Ft. Length 22' Width 151' Height 9.5'

5.0 Volume 3,100 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: Battery Room Exhaust

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 Refer to page 3. (analysis continued pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Battery A	EDE	X		X
Cabling	EDE	X		X

13.0 Design Base Fire

13.1

Combustible in Area (In Situ)			Fire Loading in Area	
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	944	Pounds	46,069	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 46,069 Btu/Sq. Ft.
Total Combustibles: 15,202,766 Btu

14.0 Design-Basis Fire Description

(A) All of the plastic battery jars and covers would be engulfed in a fire.

(b) The electrolyte was not added to the jars as they were dry and subject to being burned.

(c) Fire burns without ventilation air as supply and exhaust air duct fire dampers isolate the subject battery room.

14.1 DBF Fire Loading 1,464 Btu/Sq. Ft.

14.2 Peak Temperature 690 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of battery use due to jar destruction.

15.2 Safe shutdown can be accomplished with use of the redundant battery train.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of battery use due to jar destruction.

16.2 Safe shutdown can be accomplished with use of the redundant battery train.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Duration of the fire is short, therefore the 3 hour partitions will prevent the spread to adjacent areas.

18.2 Fire dampers will prevent the spread of fire from the area.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Not applicable.

Fire Hazard Analysis – CB-F-1E-A

1.0	Building			Control Building	
2.0	Fire Area or Zone			CB-F-1E-A	
	2.1	Area Name		Battery Room "C"	
	2.2	Location		El. 21'-6"	
		Drawing No		9763-F-310431-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr.
			South	Concrete	3 Hr.
			East	Concrete	3 Hr.
			West	Concrete	3 Hr.
	3.2	Floor		Concrete	3 Hr.
	3.3	Ceiling		Concrete	3 Hr.
	3.4	Doors		Metal	3 Hr.
	3.5	Others		-	-

4.0 Floor Area 330 Sq. Ft. Length 22' Width 15' Height 9.5'

5.0 Volume 3,100 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System Battery Room Exhaust

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
8.1	Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
9.1	Equipment/Piping	Yes ______	No X
9.2	Airborne	Yes ______	No X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	------

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Battery C	EDE	X		X
Cabling	EDE	X		X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:				
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	944	Pounds	46,069	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 46,069 Btu/Sq. Ft.
Total Combustibles: 15,202,766 Btu

14.0 Design-Basis Fire Description

(A) All of the plastic battery jars and covers would be engulfed in a fire.

(B) The electrolyte was not added to the jars as they were dry and subject to being burned.

© Fire burns without ventilation air as supply and exhaust air duct fire dampers isolate the subject battery room.

14.1 DBF Fire Loading 1,464 Btu/Sq. Ft.

14.2 Peak Zone Temperature Fire 690 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of battery use due to jar destruction.

15.2 Safe shutdown can be accomplished with use of the redundant battery train.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of battery use due to jar destruction.

16.2 Safe shutdown can be accomplished with use of the redundant battery train.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Duration of the fire is short, therefore the 3 hour partitions will prevent the spread to adjacent areas.

18.2 Fire dampers will prevent the spread of fire from the area.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Not applicable.

Fire Hazard Analysis – CB-F-1F-A

1.0	Building			Control Building	
2.0	Fire Area or Zone			CB-F-1F-A	
	2.1	Area Name		Battery Room "B"	
	2.2	Location		El. 21'-6"	
		Drawing No		9763-F-310431-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr.
			South	Concrete	3 Hr.
			East	Concrete	3 Hr.
			West	Concrete	3 Hr.
	3.2	Floor		Concrete	3 Hr.
	3.3	Ceiling		Concrete	3 Hr.
	3.4	Doors		Metal	3 Hr.
	3.5	Others		-	-

4.0 Floor Area 300 Sq. Ft. Length 22' Width 15' Height 9.5'

5.0 Volume 3,100 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System Battery Room Exhaust

7.1 Percentage of System's Capacity 100%

			Yes	No
8.0	8 Hr. Emergency Lighting in Area			X
	8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity			
	9.1	Equipment/Piping		X
	9.2	Airborne		X

			Type
10.0	Fire Protection		
	10.1	Primary	Fire Extinguisher(s)
	10.2	Secondary	Standpipe and Hose Reel
	10.3	Detection	Ionization
	10.4	Other	------

11.0 Fire Loading in Area

11.1 Refer to page 2. (analysis continued pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Battery B	EDE		X	X
Cabling	EDE		X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Combustible	Quantity	Unit	Fire Loading	Unit
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	944	Pounds	46,069	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 46,069 Btu/Sq. Ft.
Total Combustibles: 15,202,766 Btu

14.0 Design-Basis Fire Description

(a) All of the plastic battery jars and covers would be engulfed in a fire.

(b) The electrolyte was not added to the jars as they were dry and subject to being burned.

© Fire burns without ventilation air as supply and exhaust air duct fire dampers isolate the subject battery room.

14.1 DBF Fire Loading 1,464 Btu/Sq. Ft.

14.2 Peak Zone Temperature Fire 690 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of battery use due to jar destruction.

15.2 Safe shutdown can be accomplished with use of the redundant battery train.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of battery use due to jar destruction.

16.2 Safe shutdown can be accomplished with use of the redundant battery train.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Duration of the fire is short, therefore the 3 hour partitions will prevent the spread to adjacent areas.

18.2 Fire dampers will prevent the spread of fire from the area.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Not applicable.

Fire Hazard Analysis – CB-F-1G-A

1.0 Building: Control Building

2.0 Fire Area or Zone: CB-F-1G-A

- 2.1 Area Name: Battery Room "D"
- 2.2 Location: El. 21'-6"
- Drawing No: 9763-F-310431-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr.
3.5	Others		-	-

4.0 Floor Area 330 Sq. Ft. Length 22' Width 151' Height 9.5'

5.0 Volume 3,100 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: Battery Room Exhaust

- 7.1 Percentage of System's Capacity: 100%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points	X	

9.0 Operational Radioactivity

		Yes	No
9.1	Equipment/Piping		X
9.2	Airborne		X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 Refer to page 2. (analysis continued pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Battery D	EDE		X	X
Cabling	EDE		X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Combustible in Area (In Situ)			Fire Loading in Area	
Note:				
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	944	Pounds	46,069	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 46,069 Btu/Sq. Ft.
Total Combustibles: 15,202,766 Btu

14.0 Design-Basis Fire Description

(A) All of the plastic battery jars and covers would be engulfed in a fire.

(B) The electrolyte was not added to the jars as they were dry and subject to being burned.

© Fire burns without ventilation air as supply and exhaust air duct fire dampers isolate the subject battery room.

14.1 DBF Fire Loading 1,464 Btu/Sq. Ft.

14.2 Peak Zone Temperature Fire 690 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of battery use due to jar destruction.

15.2 Safe shutdown can be accomplished with use of the redundant battery train.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of battery use due to jar destruction.

16.2 Safe shutdown can be accomplished with use of the redundant battery train.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Duration of the fire is short, therefore the 3 hour partitions will prevent the spread to adjacent areas.

18.2 Fire dampers will prevent the spread of fire from the area.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Not applicable.

Fire Hazard Analysis – CB-F-2A-A

1.0	Building			Control Building	
2.0	Fire Area or Zone			CB-F-2A-A	
	2.1	Area Name		Cable Spreading Room	
	2.2	Location		El. 50'-0"	
		Drawing No		9763-F-310452-FP, 310461-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr./Outside Wall
			South	Concrete	3 Hr./Outside Wall
			East	Concrete	Outside Wall
			West	Metal	3 Hr.
	3.2	Floor		Concrete	3 Hr.
	3.3	Ceiling		Concrete	3 Hr.
	3.4	Doors		Metal	1 ½ Hr. (Stairs)/ 3 Hrs. Others
	3.5	Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 9,200 Sq. Ft. Length 107' Width 86' Height 23'

5.0 Volume 211,600 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: Cable Spreading Room Exhaust

7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

		Type
10.0	Fire Protection	
10.1	Primary	Deluge Systems
10.2	Secondary	Fire Extinguisher(s)
10.3	Detection	Ionization/Thermal
10.4	Other	Standpipe and Hose Reel

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	CS	X	X	X	
Cabling	SI	X	X	X	
Cabling	EAH	X	X	X	
Cabling	PAH	X	X	X	
Cabling	RC	X	X	X	
Cabling	SB	X	X	X	
Cabling	SW	X	X	X	
Cabling	RH	X	X	X	
Cabling	DG	X	X	X	
Cabling	EDE	X	X	X	
Cabling	NI	X	X	X	
Cabling	EPA	X	X	X	
Cabling	FW	X	X	X	
Cabling	SWA	X	X	X	
Cabling	CAH	X	X	X	
Cabling	MS	X	X	X	
Cabling	RMW		X	X	
Cabling	SB	X	X	X	
Cabling	SF	X	X	X	
Cabling	SS	X	X	X	

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	VG	X	X	X	
Cabling	WLD	X	X	X	
Cabling	IA	X	X		
Cabling	SA	X	X		
Cabling	AS	X	X	X	
Cabling	IC	X	X	X	

Fire Hazard Analysis – CB-F-2B-A

1.0	Building		Control Building	
2.0	Fire Area or Zone		CB-F-2B-A	
	2.1 Area Name		Mechanical Room – North	
	2.2 Location		El. 50'-0"	
	Drawing No		9763-F-310452-FP, 310461-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
	3.1 Walls	North	Concrete	Outside Wall
		South	Metal	3 Hr.
		East	Metal	3 Hr.
		West	Concrete	3 Hr.
	3.2 Floor		Concrete	3 Hr.
	3.3 Ceiling		Concrete	3 Hr.
	3.4 Doors		Metal	3 Hr.
	3.5 Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 1,120 Sq. Ft. Length 26' Width 43' Height 23'

5.0 Volume 25,800 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System Uses air from diesel generator building

7.1 Percentage of System's Capacity 100%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

10.0 Fire Protection — Type

10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	-----------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Fan-FN-19	CBA	X		X
Fan-FN-21A	CBA	X		X
Damper DP-21A	CBA	X		X
Pressure Switches	CBA	X		X
Cabling	CBA	X		X
Fan-FN-20	CBA	X		X
Dampers DP-24A, 24B, 24C	CBA	X		X
Cabling	EDE	X		X

Fire Hazard Analysis – CB-F-2C-A

1.0 Building: Control Building

2.0 Fire Area or Zone: CB-F-2C-A

- 2.1 Area Name: Mechanical Room – South
- 2.2 Location: El. 50'-0"
- Drawing No: 9763-F-310452-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Metal	3 Hr.
		South	Concrete	Outside Wall
		East	Metal	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr.
3.5	Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 1,120 Sq. Ft. Length 26' Width 43' Height 23'

5.0 Volume 25,800 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: Uses air from diesel generator building

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: -----------

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Fan-FN-32	CBA		X	X	X
Fan-FN-33	CBA		X	X	X
Fan-FN-21B	CBA		X	X	X
Pressure Switches	CBA		X	X	X
Dampers DP-21B	CBA		X	X	X
Cabling	CBA		X	X	X

Fire Hazard Analysis – CB-F-3A-A

1.0	Building		Control Building	
2.0	Fire Area or Zone		CB-F-3A-A	
	2.1 Area Name		Control Room **	
	2.2 Location		El. 75'-0"	
	Drawing No		9763-P-500090-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
	3.1 Walls	North	Concrete/MCG	3 Hr./Outside*
		South	Concrete/MCG	Outside/3 Hr.
		East	Concrete	Outside
		West	Concrete/MCG	3 Hr./Outside
	3.2 Floor		Concrete	3 Hr.
	3.3 Ceiling		Concrete	Outside
	3.4 Doors		Metal	3 Hr. /1 ½ Hr.
	3.5 Others		Fireproofed Ceiling Beams	1 ½ Hr.

4.0 Floor Area 6,492 Sq. Ft. Length Varies Width Varies Height Varies

5.0 Volume 167,560 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Control Room Recirculating System

7.1 Percentage of System's Capacity 4.5%

8.0 8 Hr. Emergency Lighting in Area Yes X No ______

8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	-----

11.0 Fire Loading in Area

11.1 Refer to page 3. (analysis continued pages 2- 5)

** (Refer to Comp. Eng. Workspace area description for additional area).

* Door C-300 Leading to Turbine Building Operating Floor is Not 3 Hr. Fire Rated. Ref. Deviation No. 6, Sbn-904 Dated Dec. 2, 1985.

1.0	Building			Control Building	
2.0	Fire Area or Zone			CB-F-3A-A	
	2.1	Area Name		Computer Engineer's Work Space	(Part of Control Room)
	2.2	Location		Col. A-5	
		Drawing No		500090-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	3 Hr.
			East	MCG	3 Hr.
			West	Concrete	Outside
	3.2	Floor		Concrete	3 Hr.
	3.3	Ceiling		Concrete	Outside
	3.4	Doors		Metal	3 Hr.
	3.5	Others		Fireproofed Ceiling Beams	1 ½ Hr.

4.0 Floor Area 493 Sq. Ft. Length 34' Width 5' Height 21'

5.0 Volume 10,353 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Control Room Complex Exhaust

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes X	No ______
8.1	Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
9.1	Equipment/Piping	Yes ______	No X
9.2	Airborne	Yes ______	No X

10.0	Fire Protection	Type
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	-----

11.0 Fire Loading in Area

11.1 Refer to CB-F-3A-A (Control Room) for fire loading

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Relay Rack CP-9	NI	X		X	
Relay Rack CP-10	NI		X	X	
Cabinet CP-152A		X		X	
Cabinet CP-152B			X	X	
Cabinet CP-12		X		X	
Cabinet CP-13			X	X	
Instruments And Controls On Main Control Board And Other	SI	X	X	X	
	RH	X	X	X	
Cabinets And their Associated Cabling	CC	X	X	X	
	DG	X	X	X	
	SW	X	X	X	
	CS	X	X	X	
	RM	X	X	X	
	FW	X	X	X	
	MS	X	X	X	
	EPA	X	X	X	
	CAH	X	X	X	
	SWA	X	X	X	
	EAH	X	X	X	
	SB	X	X	X	
	NI	X	X	X	
	RC	X	X	X	
	ED	X	X	X	
	EDE	X	X	X	

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Process Prot CP-L, 2, 3, 4		X	X	X	
Test Cabinets CP-14, 15		X	X	X	
BOP Process Control Cabinets CP-297A, 297B		X	X	X	
Isolation Cabinet CP-470		X	X	X	
BOP Process Control Cabinet		X			
RVLIS/HELB Cabinet		X	X	X	

13.0 Design Base Fire

13.1

Combustible in Area (In Situ)			Fire Loading in Area	
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:	12,716	Pounds	14,564	Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	5,405	Pounds	10,060[Note1]	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 24,623 Btu/Sq. Ft.
Total Combustibles: 171,933,000[Note1] Btu

14.0 Design-Basis Fire Description

(A) Fire starts in a waste basket in an office

(B) Fire spreads to desk and files within office.

Note 1: Value has been rounded up to the nearest thousands place.

(C) Fire spreads across glass and metal partitions and consumes one half of the office area.

(D) Hot exhaust air from the affected area is transferred to the return air plenum which in turn will close the R.A. fire damper. In short period of time, the heat transfer thru the supply air ductwork into the return air plenum will close the supply air fire damper at which time ventilation is lost.

14.1 DBF Fire Loading 7,196 Btu/Sq. Ft.

14.2 Peak Temperature 690 °F

14.3 Duration of Fire 8.1 Min.

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 The entire control room including the computer area could be rendered uninhabitable due to the smoke.

15.2 Safe shutdown can be accomplished from outside the control room.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 The area contains ionization detectors and in addition is occupied 24 hours per day, therefore the fire will be detected early.

16.2 The use of portable fire extinguishers and hose reels, if necessary, will extinguish the fire before it spreads.

16.3 Damage will be limited to the area where the fire occurs.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable (no water suppression in area).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Early detection due to ionization detection and occupation of space.

18.2 Prompt use of fire extinguishers.

18.3 Three hour fire barrier.

18.4 Major portion of combustibles are contained within steel metal filing cabinets.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Not applicable (See 15.2).

Fire Hazard Analysis – CB-F-3B-A

1.0 Building: Control Building

2.0 Fire Area or Zone: CB-F-3B-A

- 2.1 Area Name: HVAC Equipment & Duct Area
- 2.2 Location: South West El. 75'-0"
- Drawing No: 9763-F-500090-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	MCG	3 Hr.
		South	Concrete	Outside
		East	MCG	3 Hr.
		West	Concrete	Outside
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr.
3.5	Others		Fireproofed Ceiling Beams	1 ½ Hr.

4.0 Floor Area 1,330 Sq. Ft. Length 26' Width 51' Height 21'

5.0 Volume 27,930 Cu. Ft.

6.0 Floor Drains Nuclear ___ Non-Nuclear ___ None X

7.0 Exhaust Ventilation System: Return air – no exhaust

- 7.1 Percentage of System's Capacity: -

8.0 8 Hr. Emergency Lighting in Area Yes X No ___

- 8.1 Outside Area at Exit Points Yes X No ___

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ___ No X
- 9.2 Airborne Yes ___ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: Carbon Monoxide Detector in CBA-F-38, -8038

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
No Equipment Required For Safe Shutdown in This Area					
Air Conditioning AC-3A&B	CBA	X	X	X	
Dampers 26A&B	CBA	X	X	X	
Dampers 27A&B	CBA	X	X	X	
Damper 52	CBA	X	X	X	
Cabling	CBA	X	X	X	
Fans 16A & B	CBA	X	X	X	
Fans F-38	CBA	X		X	
Filter F-8038	CBA		X	X	
Damper 28	CBA	X		X	
Damper 1058	CBA		X	X	

Fire Hazard Analysis – CB-F-3C-A

1.0	Building		Control Building	
2.0	Fire Area or Zone		CB-F-3C-A	
2.1	Area Name		Computer Room	
2.2	Location		El. 75'-0"	
	Drawing No		9763-P-500090-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	MCG	3 Hr.
		East	MCG	3 Hr.
		West	MCG	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr.
3.5	Others		Fireproofed Ceiling Beams	1 ½ Hr.

4.0 Floor Area 1,288 Sq. Ft. Length 46' Width 28' Height 21'

5.0 Volume 27,050 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Control Room Complex Exhaust

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0 Fire ProtectionType

10.1 Primary Halon Fixed Gas Extinguishing System

10.2 Secondary Fire Extinguisher(s)

10.3 Detection Ionization (Monitored Temp. Indication)

10.4 Outsid Fire Area Standpipe and Hose Reel

11.0 Fire Loading in Area

11.1 Refer to Page 2. (analysis continued pages. 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown

No Equipment Required For Safe Shutdown in This Area

Also No Safety Related Equipment in This Area

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Combustible in Area (In Situ)			Fire Loading in Area	
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:	420	Pounds	2,609	Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	2,250	Pounds	22,710	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 25,319 Btu/Sq. Ft.
Total Combustibles: 32,610,000 Btu

14.0 Design-Basis Fire Description

(A) Fire starts in a waste basket in an office.

(B) Fire spreads to desk and files within office.

(C) Fire spreads across glass and metal partitions and consumes one half of the office area.

(D) Indoor air conditioning unit shuts off on high ambient temperature. The exhaust air path is normally closed and no supply air is provided from the outside, therefore the ventilation is lost.

14.1 DBF Fire Loading 6,296 Btu/Sq. Ft.

14.2 Peak Temperature 690 °F

14.3 Duration of Fire 5.3 Min.

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 The entire computer room could be rendered uninhabitable due to smoke.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 The area is protected by a Halon 1301 Fixed Gas Extinguishing System and early warning ionization detectors, therefore the fire will be detected early.

16.2 The use of portable fire extinguishers and hose reels are available for backup.

16.3 Damage will be limited to the area where fire occurs.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 The area is not required for safe shutdown purpose and can be evacuated with no effect on operation of the control room.

17.2 The expended halon and/or products of combustion can be exhausted from the area by manual switch over to the control room complex exhaust system.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Early detection due to ionization detection.

18.2 Prompt total flooding of the area by the Halon 1301 Fixed Gas Extinguishing System.

18.3 Pressurization of the adjacent control room prevents exfiltration from the area.

18.4 Major portion of combustibles are contained within steel metal filing cabinets.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Not applicable

Fire Hazard Analysis – CB-F-S1-0

1.0 Building: Control Building

2.0 Fire Area or Zone: CB-F-S1-0
- 2.1 Area Name: Stairwell
- 2.2 Location: Col. E-4
- Drawing No: 9763-F-310431-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	Outside
		East	Concrete	Outside
		West	Concrete	Outside
3.2	Floor		Concrete	Outside
3.3	Ceiling		Metal	1 ½ Hr.
3.4	Doors			-
3.5	Others		-	-

4.0 Floor Area 150 Sq. Ft. Length 18' Width 8'-4" Height 122'

5.0 Volume 18,075 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear - None -

7.0 Exhaust Ventilation System: None
- 7.1 Percentage of System's Capacity: N/A

8.0 8 Hr. Emergency Lighting in Area Yes X No ______
- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type
- 10.1 Primary: Portable Extinguisher(s)
- 10.2 Secondary: Hose Station
- 10.3 Detection: None
- 10.4 Other: ------

11.0 Fire Loading in Area
- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown

No Equipment Required For Safe Shutdown in This Area

Fire Hazard Analysis – CB-F-S2-0

1.0 Building: Control Building

2.0 Fire Area or Zone: CB-F-S2-0
- 2.1 Area Name: Stairwell
- 2.2 Location: Col. B-1
- Drawing No: 9763-F-310431-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	1 ½ Hr.
3.5	Others		-	-

4.0 Floor Area 226 Sq. Ft. Length 22' Width 10'-4" Height 50'

5.0 Volume 11,330 Cu. Ft.

6.0 Floor Drains Nuclear - Non-Nuclear - None ______

7.0 Exhaust Ventilation System: None
- 7.1 Percentage of System's Capacity: N/A

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X
- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type
- 10.1 Primary: Portable Extinguisher(s)
- 10.2 Secondary: Hose Station
- 10.3 Detection: None
- 10.4 Other: ------

11.0 Fire Loading in Area
- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown

No Equipment Required For Safe Shutdown in This Area

Fire Hazard Analysis – ET-F-1A-A

1.0	Building		Electrical Tunnel	
2.0	Fire Area or Zone		ET-F-1A-A	
2.1	Area Name		Upper Electrical Tunnel – Train "A" *	
2.2	Location		El. 0'-0"	
	Drawing No		9763-F-310453-FP, 310465-FP, 310466-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	3 Hr./Outside
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr./1½ Hr. (Stairs)
3.5	Others		-	-

4.0 Floor Area 2,137 Sq. Ft. Length 48'&Varies Width 38'&Varies Height 25'

5.0 Volume 53,400 Cu. Ft.

6.0 Floor Drains Nuclear ____ Non-Nuclear X None ____

7.0 Exhaust Ventilation System None

7.1 Percentage of System's Capacity -

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Pre-Action System
10.2	Secondary	Fire Extinguisher(s)
10.3	Detection	Ionization/Photoelectric
10.4	Other	--------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

* * Safe Shutdown Cable Requires Fire Protection.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	CAH	X		X	X
Cabling	CC	X		X	X
Cabling	EDE	X		X	X
Cabling	EPA	X		X	X
Cabling	FW	X		X	X
Cabling	MS	X		X	X
Cabling	NI	X		X	X
Cabling	RC	X		X	X
Cabling	SW	X		X	X
Cabling	SWA	X		X	X
Cabling	SI	X		X	
Elect. Penetration	EDE	X		X	X
Dist. Panel PP-6A, C, D, E	RC	X		X	X
Dist Panel PP-8J	ED	X			X
Cabling	CBS	X		X	
Cabling	CAP	X		X	
Cabling	RM	X		X	
Cabling	SS	X		X	
Cabling	NG	X		X	
Cabling	SA	X			

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	IA	X			
Cabling	SB	X		X	
Rad Mon	RM	X		X	
Cabling	CS	X		X	
Fuse Cabinets	EDE	X		X	
Cabling	IC	X		X	
Transformer ED-X-14J	ED	X			

Fire Hazard Analysis – ET-F-1B-A

1.0	Building		Electrical Tunnel	
2.0	Fire Area or Zone		ET-F-1B-A	
	2.1 Area Name		Electrical Tunnel – Train "A" *	
	2.2 Location		El. 0'-0"	
	Drawing No		9763-F-310453-FP, 310466-FP, 310465-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
	3.1 Walls	North	Concrete	3 Hr./Outside
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
	3.2 Floor		Concrete	3 Hr.
	3.3 Ceiling		Concrete	Outside/3 Hr.
	3.4 Doors		Metal	3 Hr./1½ Hr. (Stairs)
	3.5 Others		Exposed Ceiling Beams	-

4.0 Floor Area 1,470 Sq. Ft. Length Varies Width Varies Height Varies

5.0 Volume 33,300 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System Electric Cable Tunnel Exhaust

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
	8.1 Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	Yes ______	No X
	9.2 Airborne	Yes ______	No X

10.0	Fire Protection	Type
	10.1 Primary	Pre-Action System
	10.2 Secondary	Fire Extinguisher(s)
	10.3 Detection	Ionization/Photoelectric
	10.4 Other	------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

* Safe Shutdown Cable Requires Fire Protection

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	CAH	X		X	X
Cabling	CC	X		X	X
Cabling	EDE	X		X	X
Cabling	EPA	X		X	X
Cabling	FW	X		X	X
Cabling	MS	X		X	X
Cabling	NI	X		X	X
Cabling	RC	X		X	X
Cabling	SW	X		X	X
Cabling	SB	X		X	X
Cabling	SWA	X		X	X
Cabling	SI	X		X	
Cabling	CAP	X		X	
Cabling	RM	X		X	
Cabling	SS	X		X	
Cabling	NG	X		X	
Cabling	SA	X			
Cabling	IA	X			
Cabling	IC	X		X	

Fire Hazard Analysis – ET-F-1C-A

1.0	Building			Electrical Tunnel	
2.0	Fire Area or Zone			ET-F-1C-A	
	2.1	Area Name		Lower Electrical Tunnel – Train “B” *	
	2.2	Location		North of Containment El (-) 26’ –0”	
		Drawing No		9763-F-310454-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	3 Hr.
			East	Concrete	3 Hr.
			West	Concrete	3 Hr.
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete	3 Hr.
	3.4	Doors		Metal	3 Hr./1½ Hr. (Stairs)
	3.5	Others		Concrete	-

4.0 Floor Area 2,137 Sq. Ft. Length 48’&Varies Width 38’&Varies Height 25’

5.0 Volume 53,400 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System None

7.1 Percentage of System’s Capacity -

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
	8.1 Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	Yes ______	No X
	9.2 Airborne	Yes ______	No X

10.0 Fire Protection — Type

- 10.1 Primary — Pre-Action System
- 10.2 Secondary — Fire Extinguisher(s)
- 10.3 Detection — Ionization/Photoelectric
- 10.4 Other — ------

11.0 Fire Loading in Area

11.1 Refer to Page 3.

* Safe Shutdown Cable Requires Fire Protection

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	CAH		X	X	
Cabling	CC		X	X	
Cabling	EDE		X	X	
Cabling	EPA		X	X	
Cabling	FW		X	X	
Cabling	MS		X	X	
Cabling	NI		X	X	
Cabling & Instrumentation	RC		X	X	
Cabling	SW		X	X	
Cabling	SWA		X	X	
Cabling	SI		X	X	
Elect. Penetration	EDE		X	X	
Dist. Pahel PP-6B	RC		X	X	
Fuse Cabinets	EDE		X	X	
Excore Xmtr	NI		X	X	
Rad Mon	RM		X	X	
Cabling	CS		X	X	
Cabling	CAP		X	X	
Cabling	CBS		X	X	

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	COP		X	X	
Cabling	NG		X	X	
Cabling	VG		X	X	
Cabling	WLD		X	X	
Cabling	CGC		X	X	
Cabling	RM		X	X	
Cabling	SA		X		
Cabling	IA		X		
Cabling	IC		X	X	

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	12	Pounds	104.3	Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 104.3 Btu/Sq. Ft.
Total Combustibles: 222,864 Btu

14.0 Design-Basis Fire Description

1. For conservatism all the plastic components of both pumps are assumed to ignite and burn.

2. To add conservatism, there are three types of plastic in the components. A series of fire loading calculations using the NRC, NUREG-1805 Fire Dynamics Tools Quantitative Fire Hazard Method for each type of plastic was performed. The bounding maximum burning duration and maximum temperature were determined by taking the maximum duration from all the calculations and the maximum temperature.

3. No credit was given to the CEVA wall that separated the fire location from the remainder of the fire area.

14.1	DBF Fire Loading	104.3	Btu/Sq. Ft.
14.2	Peak Zone Temperature Fire	559.7	°F
14.3	Duration of Fire	6.6	Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Cable will not become involved in the fire. Also, redundant cabling is not in this fire area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with portable extinguishers.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Area is designed with a water spray system; drain paths will remove water.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room and actuate the pre-action sprinkler system valve, allowing water to fill the piping to the closed head sprinklers. The control room alerts the fire brigade.

18.2 The fire would be extinguished using hose lines and/or portable extinguishers and/or area sprinkler system.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Not applicable as no redundant safe shutdown equipment is located in this fire area.

Fire Hazard Analysis – ET-F-1D-A

1.0	Building			Electrical Tunnel	
2.0	Fire Area or Zone			ET-F-1D-A	
	2.1 Area Name			Electrical Tunnel – Train B *	
	2.2 Location			El. (-) 20'-0"	
	Drawing No			9763-F-310454-FP, 310431-FP, 310468-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr./Outside
			South	Concrete	3 Hr.
			East	Concrete	3 Hr.
			West	Concrete	3 Hr.
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete/Firestop	3 Hr./1½ Hr. (Stairs)
	3.4	Doors		Metal	1½ Hr.
	3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 1,890 Sq. Ft. Length Varies Width Varies Height Varies

5.0 Volume 53,600 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System Electric Cable Tunnel Exhausts

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
	8.1 Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	Yes ______	No X
	9.2 Airborne	Yes ______	No X

		Type
10.0	Fire Protection	
	10.1 Primary	Pre-Action System
	10.2 Secondary	Fire Extinguisher(s)
	10.3 Detection	Ionization/Photoelectric
	10.4 Other	------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

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* Safe shutdown cable requires fire protection

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	CAH		X	X	X
Cabling	CC		X	X	X
Cabling	EDE		X	X	X
Cabling	EPA		X	X	X
Cabling	FW		X	X	X
Cabling	MS		X	X	X
Cabling	NI		X	X	X
Cabling	RC		X	X	X
Cabling	PAH		X	X	X
Cabling	SW		X	X	X
Cabling	SWA		X	X	X
Cabling	SI		X	X	
Cabling	CBS		X	X	
Cabling	COP		X	X	
Cabling	NG		X	X	
Cabling	VG		X	X	
Cabling	WLD		X	X	
Cabling	CGC		X	X	
Cabling & Instrumentation	RM		X	X	

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	SB		X	X	
Cabling	SA		X		
Cabling	IA		X		
Cabling	IC		X		

Fire Hazard Analysis – ET-F-S1-0

1.0	Building			Electrical Tunnel	
2.0	Fire Area or Zone			ET-F-S1-0	
	2.1	Area Name		Stairwell *	
	2.2	Location		El. (-)20 &(-)26’	
		Drawing No		9763-F-310453-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	3 Hr.
			East	Concrete	-
			West	Concrete	Outside
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete	Outside
	3.4	Doors		Metal	1½ Hr.
	3.5	Others		-	-

4.0 Floor Area 120 Sq. Ft. Length 14'-6" Width 8'-4" Height 64'

5.0 Volume 7,700 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X (Sump pump in stairwell)

7.0 Exhaust Ventilation System None

7.1 Percentage of System's Capacity N/A

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0	Fire Protection		Type
	10.1	Primary	Portable Extinguisher
	10.2	Secondary	Hose Station
	10.3	Detection	None
	10.4	Other	------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

* Safe Shutdown Cable Requires Fire Protection.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown

No safety related or safe shutdown equipment in this area

Fire Hazard Analysis – DG-F-1A-A

1.0	Building			Diesel Generator Building	
2.0	Fire Area or Zone			DG-F-1A-A	
	2.1	Area Name		Fuel Oil Storage Tank Area	
	2.2	Location		North – El (-)16'-0"	
		Drawing No		9763-F-202068-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	3 Hr.
			East	Concrete	Outside
			West	Concrete	Outside
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete	3 Hr.
	3.4	Doors		Metal	1½ Hr.
	3.5	Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 1,430 Sq. Ft. Length Varies Width Varies Height 33.5'

5.0 Volume 47,900 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System Gravity Ventilation

7.1 Percentage of System's Capacity -

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0	Fire Protection		Type
	10.1	Primary	Redundant Preaction Systems
	10.2	Secondary	Fire Extinguisher(s)
	10.3	Detection	Ionization & Thermal
	10.4	Other	Standpipe and Hose Reel

11.0 Fire Loading in Area

11.1 Refer to page 2. (Analysis continued page 2)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Fuel Oil Storage Tank	DG	X		X	*
Fuel Oil Transfer Pump P38A	DG	X		X	*
FLEX Electric Fuel Transfer Pump A	FLEX	X		-	-
Level Switches	DG	X		X	*
Cabling	DG	X		X	*
Piping & Valves	DG	X		X	*

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Combustible	Quantity	Unit	Fire Loading	Unit
Oil:	75,000	Gallons	7,867,000	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 7,867,000 Btu/Sq. Ft.
Total Combustibles: 1125×10^7 Btu

14.0 Design-Basis Fire Description

See Appendix "A" of this report.

* Required for safe shutdown only on loss of offsite power.

Fire Hazard Analysis – DG-F-1B-A

1.0 Building: Diesel Generator Building

2.0 Fire Area or Zone: DG-F-1B-A

- 2.1 Area Name: Fuel Oil Storage Tank Area
- 2.2 Location: South – El (-)16’-0”
- Drawing No: 9763-F-202068-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	Outside
		East	Concrete	Outside
		West	Concrete	Outside
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	1½ Hr.
3.5	Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 1,430 Sq. Ft. Length Varies Width Varies Height 33.5’

5.0 Volume 47,900 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: Gravity Ventilation

- 7.1 Percentage of System’s Capacity: -

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Redundant Preaction Systems
- 10.2 Secondary: Fire Extinguisher(s)
- 10.3 Detection: Ionization & Thermal
- 10.4 Other: Standpipe and Hose Reel

11.0 Fire Loading in Area

- 11.1 Refer to page 2. (Analysis continued page 2)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Fuel Oil Storage Tank	DG		X	X
Fuel Oil Transfer Pump P38B	DG		X	X
FLEX Electric Fuel Transfer Pump B	FLEX		X	-
Cabling	DG		X	X
Piping & Valves	DG		X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:				
Oil:	75,000	Gallons	7,867,000	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 7,867,000 Btu/Sq. Ft.
Total Combustibles: 1125×10^7 Btu

14.0 Design-Basis Fire Description

See Appendix "A" of this report.

Fire Hazard Analysis – DG-F-2A-A

1.0 Building: Diesel Generator Building

2.0 Fire Area or Zone: DG-F-2A-A
- 2.1 Area Name: Engine Room
- 2.2 Location: North – El. 21'-6"
- Drawing No: 9763-F-202069-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	Outside
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr./1½ Hr. (Stairs)
3.5	Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 3,700 Sq. Ft. Length 88' Width 42' Height 29'

5.0 Volume 107,300 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: Dg Bldg. Exhaust System
- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes X No ______
- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type
- 10.1 Primary: Manual Preaction Providing Area Protection and Auto Preaction in Oil Piping Trench
- 10.2 Secondary: Fire Extinguisher(s)
- 10.3 Detection: Ionization & Ultraviolet/Thermal in Trench
- 10.4 Other: Standpipe & Hose Reel

11.0 Fire Loading in Area
- 11.1 Refer to page 3. (Analysis continued pages 2 – 4)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Starting Air Skid 17A	DG	X		X
Cabling	DG	X		X
Cabling	DAH	X		X
Cabling	CBA	X		X
Diesel Generator Control Cabinet CP-75A	DG	X		X
Diesel Generator Control Cabinet CP-75B	DG	X		X
5Kv Non-Seg. Bus Duct	EDE	X		X
Cabling	SW	X		X
Damper DP-16A	DAH	X		X
Temp Switches	DAH	X		X
Diesel Generator Control Panel CP-36	DG	X		X
Terminal Box HF7	DG	X		
Diesel Generator 1-A & Aux	DG	X		X
Fan-FN-26A	DAH	X		X
Piping & Valves	DG	X		X
460v MCC-E511	EDE	X		X
Cabling & Controls	RC	X		X
Disabling Panel MM-CP-450A	MM	X		X
Backup Control Air Compressor	DG	X		X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	1,627.5	Gallons	62,375	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	38	Pounds	134	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:	55 LF	Cable Trays Stacked 3 High	9,964	Btu/Sq. Ft.

13.2 Total Fire Loading in Area: 72,473 Btu/Sq. Ft.
Total Combustibles: 268,230,000 Btu

14.0 Design-Basis Fire Description

1. The diesel engine is located on the 21’-6” level. The engine is not operating.

2. The fuel oil line connecting the day tank on the 51’-6” level and the diesel engine ruptures.

3. Fuel oil is siphoned from the day tank at a rate of 24 gpm (30 ft. of head in a ½” fuel oil line).

4. Fuel oil is sprayed into the engine room and covers an area of 400 $ft.^2$ with a film of oil 1/16” thick.

5. The oil flows into the trench around the engine.

6. The oil is ignited at the time of the rupture.

7. The oil burns at a rate of 5” per hour and consumes 21 gpm, therefore 3 gpm of unburned oil runs into the trench drain and down to the sump in the fuel oil storage tank vault at the (-) 16’ –0” level below.

8. The fuel oil transfer pump at the (-)16’-0” level continues to fill the day tank.

9. The fuel oil in the engine room is heated by the fire (4200°F flame temperature). The hot oil flowing into the trench will flash upon discharging into the covered sump at the (-)16’-0” level below.

10. The heat from the fire in the covered sump will activate the sump wet pipe sprinklers and the vaults detection and suppression system and alarm in the control room.

11. It is estimated that a time period of 5 minutes lapses between the oil line rupture and ignition of the oil in the sump.

12. The transfer pump will continue to fill the day tank until either the deluge system deactivates the pump or action is taken by plant personnel in response to the alarm.

13. It is estimated that the detectors in the storage tank vault will alarm in 10 Minutes.

14. It requires 62.5 minutes for the tank to empty after the fuel oil transfer pump shuts down, therefore 1500 gallons of oil drains into the engine room. The engine room fire consumes 1312 gallons while 188 gallons of oil drains into the sump below.

15. Estimated minimum fuel oil consumed by the fire and duration of the fire:

A)	Line Rupture to Shut Down of Transfer Pump	15 Min	315 Gal
B)	Complete Discharge of Day Tank Into the Engine Room	62.5 Min 77.5 Min	1312 Gal 1627 Gal

16. Total combustibles

Plastic	494,000 Btu
Oil	230,784,000 Btu
Cable	36,867,000 Btu
Total	268,150,000 Btu

17. A lube oil fire was postulated but found to be less severe than the fuel oil fire, therefore it has not been considered as the design basis fire for the subject area.

14.1	DBF Fire Loading	72,473	Btu/Sq.Ft.
14.2	Duration of Fire	>5 Minutes	
14.3	Peak Temperature	1650	°F

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 The entire area will be engulfed in flame and all equipment and cable will be lost.

15.2 Possible spalling of concrete.

15.3 Only one diesel generator train will be affected and safe shutdown can be Accomplished By the Redundant Diesel Located in Another Fire Area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Possible loss of the equipment and cabling.

16.2 No damage to engine due to water deluge system on oil piping.

16.3 Safe shutdown can be accomplished, if necessary, by the redundant diesel train located in another area.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Area floor drains and trenches will prevent buildup of water. Deluge is directed on piping and floor area, therefore it will not affect other equipment.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Early warning ionization detectors alarming in the control room.

18.2 Thermal detectors setting off the deluge system on the oil piping in the event the fire brigade does not respond in time.

18.3 The entire engine room is within a minimum 3 hour fire rated structure.

18.4 Fire dampers in the ductwork will prevent the spread of fire to equipment room above.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Not applicable. (see 15.3)

Fire Hazard Analysis – DG-F-2B-A

1.0	Building		Diesel Generator Building	
2.0	Fire Area or Zone		DG-F-2B-A	
	2.1 Area Name		Engine Room	
	2.2 Location		South – El. 21’-6”	
	Drawing No		9763-F-202069-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
	3.1 Walls	North	Concrete	3 Hr.
		South	Concrete	Outside
		East	Concrete	3 Hr.
		West	Concrete	Outside
	3.2 Floor		Concrete	3 Hr.
	3.3 Ceiling		Concrete	3 Hr.
	3.4 Doors		Metal	3 Hr./Outside/ 1½ Hr. (Stairs)
	3.5 Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 3,700 Sq. Ft. Length 88' Width 42' Height 29'

5.0 Volume 107,300 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System Dg Bldg. Exhaust System

7.1 Percentage of System's Capacity 100%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area	X	
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

10.0 Fire Protection — Type

10.1	Primary	Manual preaction providing area protection and auto preaction in oil piping trench
10.2	Secondary	Fire Extinguisher(s)
10.3	Detection	Ionization & Ultraviolet/Thermal in Trench
10.4	Other	Standpipe & Hose Reel

11.0 Fire Loading in Area

11.1 Refer to page 3. (Analysis continued pages 2 – 4)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Starting Air Skid 17B	DG		X	X
Cabling	DG		X	X
Cabling	DAH		X	X
Cabling	CBA		X	X
Diesel Generator Control Cabinet CP-76B	DG		X	X
Diesel Generator Control Cabinet CP-76A	DG		X	X
5Kv Non-Seg. Bus Duct	EDE		X	X
Damper DP-16B	DAH		X	X
Temp Switches	DAH		X	X
Diesel Generator Control Panel CP-37	DG		X	X
Diesel Generator 1-B & Aux	DG		X	X
Terminal Box HF8	DG		X	X
Fan-FN-26B	DAH		X	X
Cabling	SW		X	X
Damper DP-16B	DAH		X	X
Cabling	EDE		X	X
Piping & Valves	DG		X	X
460v MCC-E611	EDE		X	X
Cabling & Controls	RC		X	X
Disabling Panel MM-CP-450B	MM		X	X
Backup Control Air Compressor	DG	X		X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	1,627.5	Gallons	62,375	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	38	Pounds	134	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Cables:	268.5	Pounds		
Other:	55 LF	Cable Trays Stacked 3 High	10,726	Btu/Sq. Ft.

13.2 Total Fire Loading in Area: 73,235 Btu/Sq. Ft.
Total Combustibles: 270,963,800 Btu

14.0 Design-Basis Fire Description

1. The diesel engine is located on the 21’-6” level. The engine is not operating.

2. The fuel oil line connecting the day tank on the 51’-6” level and the diesel engine ruptures.

3. Fuel oil is siphoned from the day tank at a rate of 24 gpm (30 ft. of head in a ½” fuel oil line).

4. Fuel oil is sprayed into the engine room and covers an area of 400 ft.^{2} with a film of oil 1/16” thick.

5. The oil flaws into the trench around the engine.

6. The oil is ignited at the time of the rupture.

7. The oil burns at a rate of 5” per hour and consumes 21 gpm, therefore 3 gpm of unburned oil runs into the trench drain and down to the sump in the fuel oil storage tank vault at the (-)16’-0” level below.

8. The fuel oil transfer pump at the (-)16’-0” level continues to fill the day tank.

9. The fuel oil in the engine room is heated by the fire (4200 °F flame temperature). The hot oil flowing into the trench will flash upon discharging into the covered sump at the (-)16'-0" level below.

10. The heat from the fire in the covered sump will activate the sump wet pipe sprinklers and the vaults detection and suppression system and alarm in the control room.

11. It is estimated that a time period of 5 minutes lapses between the oil line rupture and ignition of the oil in the sump.

12. The transfer pump will continue to fill the day tank until either the deluge system deactivates the pump or action is taken by plant personnel in response to the alarm.

13. It is estimated that the detectors in the storage tank vault will alarm in 10 minutes.

14. It requires 62.5 minutes for the tank to empty after the fuel oil transfer pump shuts down, therefore 1500 gallons of oil drains into the engine room. The engine room fire consumes 1312 gallons while 188 gallons of oil drains into the sump below.

15. Estimated minimum fuel oil consumed by the fire and duration of the fire:

A)	Line Rupture to Shut Down of Transfer Pump	15 Min	315 Gal
B)	Complete Discharge of Day Tank Into the Engine Room	62.5 Min 77.5 Min	1312 Gal 1627 Gal

16. Total combustibles

Plastic	494,000 Btu
Oil	230,784,000 Btu
Cable	39,686,200 Btu
Total	270,963,800 Btu

17. A lube oil fire was postulated but found to be less severe than the fire oil fire, therefore it has not been considered as the design basis fire for the subject area.

14.1	DBF Fire Loading	73,235	Btu/Sq.Ft.
14.2	Duration of Fire	>5 Minutes	
14.3	Peak Temperature	1650	°F

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 The area will be engulfed in flame and all equipment and cable will be lost.

15.2 Possible spalling of concrete.

15.3 Only one diesel generator train will be affected and safe shutdown can be accomplished by the redundant diesel located in another fire area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Possible loss of the equipment and cabling.

16.2 No damage to engine due to water deluge system on oil piping.

16.3 Safe shutdown can be accomplished, if necessary, by the redundant diesel train located in another area.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Area floor drains and trenches will prevent buildup of water. Deluge is directed on piping and floor area, therefore it will not affect other equipment.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Early warning ionization detectors alarming in the control room.

18.2 Thermal detectors setting off the deluge system on the oil piping in the event the fire brigade does not respond in time.

18.3 The entire engine room is within a minimum 3 hour fire rated structure.

18.4 Fire dampers in the ductwork will prevent the spread of fire to equipment room above.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Not applicable. (See 15.3)

Fire Hazard Analysis – DG-F-3A-Z

1.0	Building		Diesel Generator Building	
2.0	Fire Area or Zone		DG-F-3A-Z	
2.1	Area Name		HVAC Equipment Area	
2.2	Location		North El. 51'-6"	
	Drawing No		9763-F-202069-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Open	-
		East	Concrete	3 Hr.
		West	MCG	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr.
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 1,555 Sq. Ft. Length 42' Width 37' Height 25'

5.0 Volume 38,880 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System None

7.1 Percentage of System's Capacity -

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points		X
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe & Hose Reel
10.3	Detection	Ionization & Photoelectric
10.4	Other	------

11.0 Fire Loading in Area

11.1 Refer to page 3 of 4

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Fan FN-25A	DAH	X		X
Cabling	DAH	X		X
Damper DP-15A	DAH	X		X
Fan FN-27A	CBA	X		X
Chiller E-230A	CBA	X		X
Fan FN-211A	CBA	X		X
Damper DP-53A	CBA		X	X
Pressure Switches	CBA	X		X
Cabling	CBA	X	X	X
Fan FN-27B	CBA		X	X
Pumps P-434A/P-435A	CBA	X		X
Flow Switch	DAH	X		X
Damper DP-53B	CBA	X		X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	10	Gallons	482	Btu/Sq. Ft.*
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 482 Btu/Sq. Ft.*

Total Combustibles: 1,500,000 Btu

14.0 Design-Basis Fire Description

A) Due to a lack of physical boundary both fire zones, DG-1-3A-Z and DG-F-3B-Z constitute a common fire area.

B) The oil content of control building HVAC system compressor/condensing unit spills over floor and catches fire and burn, completely.

14.1	DBF Fire Loading	11,719	Btu/Sq.Ft.
14.2	Duration of Fire	4 ½	Minutes
14.3	Peak Temperature	1231	°F

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of both air conditioning trains of control room a/c system because of lack of oil.

15.2 Loss of HVAC system to both diesel generator areas as both ventilating fans are located in the affected area and, both fans take suction of hot air from the same plenum.

*Based on floor area of zones DG-F-3A-Z and DG-F-3B-Z (3100 sq. ft.).

15.3 HVAC system cooling capability for both trains of the emergency switch gear battery room and the cable spreading area will not be lost since the fire dampers in supply air stream from diesel generator building will not reach the fuseable link melting temperature to close as a result of the Design Basis Fire (Ref. Calc. SBC-173).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of both trains of control room HVAC system because of lack of oil.

16.2 Possible loss of cooling capability of both diesel generator areas as both train ventilating fans are located in the affected area.

16.3 HVAC system cooling capability for both trains of the emergency switch gear battery room and the cable spreading area will not be lost since the fire dampers in supply air stream from diesel generator building will not reach the fuseable link melting temperature to close as a result of the Design Basis Fire (Ref. Calc. SBC-173).

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable, no automatic water suppression system exists.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 The design base fire will be contained in the fire area bounded by fire rated structures. Both affected zones are contained in the same fire area.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Redundant safe shutdown equipment if any, may be lost. For safe shutdown requirements, refer to Table 3.2.7.41 of the report "Fire Protection of Safe Shutdown Capability" (10 CFR 50, Appendix R).

Fire Hazard Analysis – DG-F-3B-Z

1.0	Building		Diesel Generator Building	
2.0	Fire Area or Zone		DG-F-3B-Z	
2.1	Area Name		HVAC Equipment Area	
2.2	Location		South El. 51'-6"	
	Drawing No		9763-F-202069-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Open	-
		South	Concrete	Outside
		East	Concrete	3 Hr.
		West	MCG	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr.
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 1,555 Sq. Ft. Length 42' Width 37' Height 25'

5.0 Volume 38,880 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System None

7.1 Percentage of System's Capacity -

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points		X
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe & Hose Reel
10.3	Detection	Ionization
10.4	Other	------

11.0 Fire Loading in Area

11.1 Refer to page 2 of 4

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Fan-FN-25B	DAH		X	X
Cabling	DAH		X	X
Damper DP-15B	DAH		X	X
Fan FN-211B	CBA		X	X
Chiller E-230B	CBA		X	X
Pressure Switches	CBA		X	X
Cabling	CBA		X	X
Pumps P-434B-435B	CBA	X		X
Flow Switch	DAH		X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	10	Gallons	482	Btu/Sq. Ft.*
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	27	Pounds	113	Btu/Sq. Ft.*
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 595 Btu/Sq. Ft.*

Total Combustibles: 1,851,000 Btu

- Based on floor area of zones DG-1-3A-Z and DG-1-3B-Z (3110 Sq. Ft.)

14.0 Design-Basis Fire Description

A) Due to a lack of physical boundary both fire zones, DG-F-3A-Z and DG-F-3B-Z constitute a common fire area.

B) The oil content of control building HVAC system compressor/condensing unit spills over floor and catches fire and burn completely.

14.1 DBF Fire Loading 11,719 Btu/Sq.Ft.

14.2 Duration of Fire 4 ½ Minutes

14.3 Peak Temperature 1231 °F

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of both air conditioning trains of control room A/C System because of lack of oil.

15.2 Loss of HVAC system to both diesel generator areas as both ventilating fans are located in the affected area and take suction of hot air from the same plenum.

15.3 HVAC system cooling capability for both trains of the emergency switch gear battery room and the cable spreading area will not be lost since the fire dampers in supply air stream from diesel generator building will not reach the fuseable link melting temperature to close as a result of the Design Basis Fire (Ref. Calc. SBC-173).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of both trains of control room HVAC system because of lack of oil.

16.2 Possible Loss of Cooling Capability of Both Diesel Generator Areas As Both Train Ventilating Fans Are Located in the Affected Area.

16.3 HVAC system cooling capability for both trains of the emergency switch gear battery room and the cable spreading area will not be lost since the fire dampers in supply air stream from diesel generator building will not reach the fuseable link melting temperature to close as a result of the Design Basis Fire (Ref. Calc. SBC-173).

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable, no automatic water suppression system exists.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 The design base fire will be contained in the fire area bounded by fire rated structures. Both affected zones are contained in the same fire area.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 Redundant safe shutdown equipment if any, may be lost. For safe shutdown requirements refer to Table 3.2.7.41 of the report “Fire Protection Safe Shutdown Capability” (10 CFR 50, Appendix R).

Fire Hazard Analysis – DG-F-3C-A

1.0	Building		Diesel Generator Building	
2.0	Fire Area or Zone		DG-F-3C-A	
2.1	Area Name		Fuel Oil Day Tank Area	
2.2	Location		North – El. 51’-6”	
	Drawing No		9763-F-202069-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr.
3.5	Others		-	-

4.0 Floor Area 200 Sq. Ft. Length 23.5’ Width 8.5’ Height 11.0’

5.0 Volume 2,200 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System Gravity

7.1 Percentage of System’s Capacity None

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points		X
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Deluge Systems
10.2	Secondary	Fire Extinguisher(s)
10.3	Detection	Ionization & Thermal
10.4	Other	Standpipe and Hose Reel

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued Pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Fuel Oil Day Tank	DG	X		X
Instruments	DG	X		X
Cabling	DG	X		X
Level Switches	DG	X		X
Piping & Valves	DG	X		X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire		Fire Loading in Area	
Oil:	1,500	Gallons	1,125,000	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 1,125,000 Btu/Sq. Ft.
Total Combustibles: 225×10^6 Btu

14.0 Design-Basis Fire Description

1. The diesel oil day tank ruptures and oil spills on the enclosure floor. Floor drain will remove some of the oil. It is conservatively assumed that some of the oil will burn in the enclosure.

2. The maximum rate of burn equals 5” per hour.

3. The oil may burn in excess of 3 hours, at which time the enclosure is assumed to fail. Consequences of failed enclosure is beyond the scope of this appendix A “FHA” report.

4. During the 3 hours before the failure of the enclosure, 900 gallons of oil is consumed and the remaining oil will be contained within the bottom or stamp section of the enclosure.

14.1	DBF Fire Loading	675,000	Btu/Sq.Ft.	
14.2	Duration of Fire	3	Hours	(Five hours without any means of fire protection)
14.3	Peak Temperature	2,650	°F	

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of the diesel oil day tank and oil.

15.2 Loss of the instruments, lighting and cable in the tank vault.

15.3 Safe shutdown can be accomplished using the redundant diesel fuel oil day tank which is located outside the 3 hour barrier. (The redundant fuel oil day tank may be lost if fire is not controlled within three hours).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Possible loss of the day tank, instruments and oil.

16.2 Safe shutdown can be accomplished using the redundant diesel train which is located outside the 3 hour barrier.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Vault contains a floor drain which discharges into the sump in the storage tank vault at the (-) 16'-0" level, therefore damage due to water is of no consequence.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 In the event the fire brigade cannot extinguish the fire the rate of rise detectors will set off the water deluge fire protection system.

18.3 If deluge system fails then fire will be put out by stand pipe and hose reels.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 There is no redundant safe shutdown equipment in this fire area. (Refer 15.3 above). If in unlikely event both diesel generator day tanks are lost as fire burns beyond three hours, safe shutdown of reactor will be achieved either from control room or RSS panel.

Fire Hazard Analysis – DG-F-3D-A

1.0	Building			Diesel Generator Building	
2.0	Fire Area or Zone			DG-F-3D-A	
	2.1	Area Name		Fuel Oil Day Tank Area	
	2.2	Location		South El. 51'-6"	
		Drawing No		9763-F-202069-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr.
			South	Concrete	3 Hr.
			East	Concrete	3 Hr.
			West	Concrete	3 Hr.
	3.2	Floor		Concrete	3 Hr.
	3.3	Ceiling		Concrete	3 Hr.
	3.4	Doors		Metal	3 Hr.
	3.5	Others		-	-

4.0 Floor Area 200 Sq. Ft. Length 23.5' Width 8.5' Height 11.0'

5.0 Volume 2,200 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System Gravity

7.1 Percentage of System's Capacity None

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
	8.1 Outside Area at Exit Points	Yes ______	No X
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	Yes ______	No X
	9.2 Airborne	Yes ______	No X

10.0	Fire Protection		Type
	10.1	Primary	Deluge Systems
	10.2	Secondary	Fire Extinguisher(s)
	10.3	Detectional	Ionization & Thermal
	10.4	Other	Standpipe and Hose Reel

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued pages 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Fuel Oil Day Tank	DG		X	X
Instruments	DG		X	X
Cabling	DG		X	X
Level Switches	DG		X	X
Piping & Valves	DG		X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire		Fire Loading in Area	
Oil:	1,500	Gallons	1,125,000	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 1,125,000 Btu/Sq. Ft.
Total Combustibles: 225×10^6 Btu

14.0 Design-Basis Fire Description

1. The diesel oil day tank ruptures and oil spills on the enclosure floor. Floor drain will remove some of the oil. It is conservatively assumed that some of the oil will burn in the enclosure.

2. The maximum rate of burn equals 5" per hour.

3. The oil may burn in excess of 3 hours, at which time the enclosure is assumed to fail. Consequences of failed enclosure is beyond the scope of this Appendix A "FHA" report.

4. During the 3 hours before the failure of the enclosure, 900 gallons of oil is consumed. The remaining oil will be contained within the bottom part or sump section of the enclosure.

14.1 DBF Fire Loading 675,000 Btu/Sq.Ft.

14.2 Duration of Fire 3 Hours (Five hours without any means of fire protection)

14.3 Peak Temperature 2,650 °F

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of the diesel oil day tank and oil.

15.2 Loss of the instruments, lighting and cable in the tank vault.

15.3 Safe shutdown can be accomplished using the redundant diesel fuel oil day tank which is located outside the 3 hour barrier. (The redundant fuel oil day tank may be lost if fire is not controlled within three hours).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Possible loss of the day tank, instruments and oil.

16.2 Safe shutdown can be accomplished using the redundant diesel train which is located outside the 3 hour barrier.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Vault contains a floor drain which discharges into the sump in the storage tank vault at the (-) 16'-0" level, therefore damage due to water is of no consequence.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 In the event the fire brigade cannot extinguish the fire the rate of rise detectors will set off the water deluge fire protection system.

18.3 If deluge system fails then fire will be put out by stand pipe and hose reels.

19.0 How the Redundant Safe Shutdown Equipment in the Area is Protected

19.1 There is no redundant safe shutdown equipment in this fire area. (Refer 15.3 above). If in unlikely event both diesel generator day tanks are lost as fire burns beyond three hours, safe shutdown of reactor will be achieved either from control room or RSS panel.

Fire Hazard Analysis – DG-F-3E-A

1.0 Building: Diesel Generator Building

2.0 Fire Area or Zone: DG-F-3E-A

- 2.1 Area Name: Train A, D.G. Air Intake & Exhaust Silencer Area
- 2.2 Location: El. 51'-6"
- Drawing No: 9763-F-202069-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete/MCG	3 Hr.
		East	Concrete/MCG	3 Hr.
		West	Concrete/MCG	Outside/3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr. /1½ Hr. (Stairs)
3.5	Others		-	-

4.0 Floor Area 2,050 Sq. Ft. Length Varies Width Varies Height 25'

5.0 Volume 51,250 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: None

- 7.1 Percentage of System's Capacity: -

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: None
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Air Intake Filter F-36Z	DG	X		X
Exhaust Silencer MM-8A	DG	X		X

Fire Hazard Analysis – DG-F-3F-A

1.0	Building		Diesel Generator Building	
2.0	Fire Area or Zone		DG-F-3F-A	
2.1	Area Name		Train B, D.G. Air Intake & Exhaust Silencer Area	
2.2	Location		El. 51'-6"	
	Drawing No		9763-F-202069-FP	
3.0	Construction of Area		Material	Min. Fire Rating
3.1	Walls	North	Concrete/MCG	3 Hr.
		South	Concrete	Outside
		East	Concrete/MCG	3 Hr.
		West	Concrete/MCG	Outside/3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr. /1½ Hr. (Stairs)
3.5	Others		-	-

4.0 Floor Area 2,050 Sq. Ft. Length Varies Width Varies Height 25'

5.0 Volume 51,250 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System None

7.1 Percentage of System's Capacity -

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

10.1 Primary — Fire Extinguisher(s)

10.2 Secondary — Standpipe and Hose Reel

10.3 Detection — None

10.4 Other — ------

11.0 Fire Loading in Area

11.1 None X (No Further Analysis Required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Air Intake Filter F-36B	DG		X	X
Exhaust Silencer MM-8B	DG		X	X

Fire Hazard Analysis – DG-F-S1-0

1.0 Building: Diesel Generator Building

2.0 Fire Area or Zone: DG-F-S1-0
- 2.1 Area Name: Stairwell
- 2.2 Location: Col. A-9
- Drawing No: 9763-F-202068-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	3 Hr.
		East	Concrete	3 Hr.
		West	Concrete	Outside
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	1½ Hr.
3.5	Others		-	-

4.0 Floor Area 137 Sq. Ft. Length 16’-4” Width 8’-4” Height 43’

5.0 Volume 5,890 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: None
- 7.1 Percentage of System’s Capacity: N/A

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X
- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type
- 10.1 Primary: Portable Extinguisher(s)
- 10.2 Secondary: Hose Station
- 10.3 Detection: None
- 10.4 Other: ------

11.0 Fire Loading in Area
- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in This Area

Fire Hazard Analysis – DG-F-S2-0

1.0 Building: Diesel Generator Building

2.0 Fire Area or Zone: DG-F-S2-0

- 2.1 Area Name: Stairwell
- 2.2 Location: Col. E-9
- Drawing No: 9763-F-202068-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	Outside
		East	Concrete	3 Hr.
		West	Concrete	Outside
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	1½ Hr.
3.5	Others		-	-

4.0 Floor Area 137 Sq. Ft. Length 16'-6" Width 8'-4" Height 11'-6"

5.0 Volume 9,795 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: None

- 7.1 Percentage of System's Capacity: N/A

8.0 8 Hr. Emergency Lighting in Area Yes X No ______

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Portable Extinguisher(s)
- 10.2 Secondary: Hose Station
- 10.3 Detection: None
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in This Area

PAB-F-1A-Z

1.0 Building: Primary Auxiliary Building

2.0 Fire Area or Zone: PAB-F-1A-Z
- 2.1 Area Name: Chiller Pump Area
- 2.2 Location: North Side El 7'-0"
- Drawing No: 9763-805061-FP

3.0 Construction of Area

			Material	Min. Fire Rating*
3.1	Walls	North	Concrete	3 Hr./Outside
		South	Concrete	Outside/3 Hr.
		East	Concrete	3 Hr./Outside
		West	Concrete/Open	3 Hr./-
3.2	Floor		Concrete	-
3.3	Ceiling		Concrete	-
3.4	Doors		Metal	3 Hr./1½ Hr. (Stairs)
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 5,100 Sq. Ft. Length Varies Width Varies Height 16'-0"

5.0 Volume 81,600 Cu. Ft.

6.0 Floor Drains: Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: PAB
- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area: Yes X No ______
- 8.1 Outside Area at Exit Points: Yes X No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping: Yes X No ______
- 9.2 Airborne: Yes ______ No X

10.0 Fire Protection

		Type
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	------

11.0 Fire Loading in Area
- 11.1 Refer to pages 2 and 3.

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* The ceiling of piping tunnel and walkway between Fuel Storage Building and PAB 7' elevation which is also a floor of fire zone CE-F-1-Z (Tab 13) is 3 hr. fire rated.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Cabling	SW	X	X	X
Cabling	CC	X	X	X
Cabling	CS	X	X	X
Cabling	SWA	X	X	X
Cabling	EDE	X	X	X
Cabling	EAH		X	X
Cabling	PAH		X	X
Piping, Valves & Instrumentation	CC	X	X	X
Piping, Valves & Instrumentation	CS	X	X	X
Instrument Rack IR-L7	MM	X	X	X
Cabling	RC		X	X
Cabling	SI		X	X
Terminal Boxes	EDE	X	X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note: Oil Fire

Combustible	Amount	Unit	Fire Loading	Unit
Oil:	6.0	Gallons	176.5	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	28	Pounds	71.4	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 248 Btu/Sq. Ft.

Total Combustibles: 1,264,000 Btu

14.0 Design-Basis Fire Description

(A) Conservatively assume both chiller pumps, chiller, both makeup water pumps and chromated water connection tank pump skid rupture simultaneously and spill over an area of 77 sq. ft. and burn.

(B) To add additional conservatism consider ventilation supply/exhaust air has been isolated.

14.1 DBF Fire Loading 11,688 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire 585 °F

14.3 Duration of Fire 4 ½ Min.

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 The chiller, chiller pumps, chromated water pump, and the reactor makeup water pumps will be lost upon loss of oil.

15.2 Possible loss of some instruments and control devices.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 The chiller pumps, chromated water pump, and the reactor makeup water pumps may be lost.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable as no automatic water suppression system is provided in the zone.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Total combustibles will burn in less than five minutes. all surrounding zones/area are separated by concrete structures (many walls are fire rated), and hence the oil fire on 77 sq. ft. of the total 5100 sq. ft. area will be contained in the affected zone.

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable as no redundant safe shutdown equipment is located in the same fire zone.

PAB-F-1B-Z

1.0	Building		Primary Auxiliary Building	
2.0	Fire Area or Zone		PAB-F-1B-Z	
	2.1 Area Name		Demin. Filter and Valve Maint. Area	
	2.2 Location		West Side – El. (-) 6'0" To 7'0"	
	Drawing No		9763-F-805061-FP	
3.0	Construction of Area		Material	Min. Fire Rating
	3.1 Walls	North	Concrete	-
		South	Concrete	-
		East	Concrete	-
		West	Concrete	3 Hr./-
	3.2 Floor		Concrete	-
	3.3 Ceiling		Concrete	-
	3.4 Doors		Metal	-
	3.5 Others		Exposed Ceiling	-

4.0 Floor Area 2,900 Sq. Ft. Length 82' Width 35.5' Height Varies

5.0 Volume 61,000 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAB

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes		No	X
8.1	Outside Area at Exit Points	Yes	X	No	
9.0	Operational Radioactivity				
9.1	Equipment/Piping	Yes	X	No	
9.2	Airborne	Yes		No	X

10.0	Fire Protection	Type
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	None
10.4	Other	------

11.0 Fire Loading in Area

11.1 None X (No further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No equipment required for safe shutdown in this zone also, no safety related equipment here.

PAB-F-1C-A

1.0	Building		Primary Auxiliary Building	
2.0	Fire Area or Zone		PAB-F-1C-A	
	2.1 Area Name		Charging Pump – 2A Area	
	2.2 Location		East Side – El. 7’0”	
	Drawing No		9763-F-80506l-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
	3.1 Walls	North	Concrete	1 ½ Hr.
		South	Concrete	3 Hr.
		East	Concrete	Outside
		West	MCG	1 ½ Hr.
	3.2 Floor		Concrete	Outside
	3.3 Ceiling		Concrete	1 ½ Hr.
	3.4 Doors		Metal	1 ½ Hr.
	3.5 Others		Fireproofed Ceiling Beams	1 ½ Hr.

4.0 Floor Area 318 Sq. Ft. Length 26.5' Width 12' Height 15.25'

5.0 Volume 4,850 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ____ None ____

7.0 Exhaust Ventilation System PAB

7.1 Percentage of System's Capacity 100%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area	X	
	8.1 Outside Area at Exit Points		X
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	X	
	9.2 Airborne		X

		Type
10.0	Fire Protection	
	10.1 Primary	Fire Extinguisher(s)
	10.2 Secondary	Standpipe and Hose Reel
	10.3 Detection	Ionization
	10.4 Other	------

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued pg. 2, 3 & 4)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Charging Pump P-2A	CS	X		X	X
Piping & Valves	CBS	X		X	X
Piping & Valves	CS	X		X	X
Piping & Valves	CC	X		X	X
Cabling	CS	X		X	X
Pressure Switches	CS	X		X	

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	61	Gallons	28,774	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 28,744 Btu/Sq. Ft.
Total Combustibles: 9,150,000 Btu

14.0 Design-Basis Fire Description

1. Oil reservoir rupture, oil spreads over the entire floor area of the room (318 sq. ft.). The thickness of the oil film is ¼” over the entire floor area.
2. The oil is ignited, burns and is consumed.
3. The space temperature is assumed to be sufficiently high that all the cable in the space will fail. Cable will not contribute to the fire because it is contained within conduit.

14.1 DBF Fire Loading 1,524 Btu/Sq. Ft.

14.2 Fire Duration Less than one minute.

14.3 Peak Temperature 5959 °F (High temp. spike in short duration).

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of the pump due to rupture and loss of oil.

15.2 Loss of the cabling due to fire.

15.3 The adjacent fire area containing a redundant unit is separated by a 3-hour barrier; therefore safe shutdown can be accomplished.

15.4 The structural steel beams and metal partition are covered with a fire protective coating, therefore no damage.

15.5 There will be possible spalling of the concrete.

15.6 The fire will be contained within the area due to its short duration.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of the pump due to rupture and loss of oil.

16.2 Possible loss of cabling to pump.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable (no water suppression in area).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire brigade will extinguish the fire using portable fire extinguishers or fire hoses if necessary.

18.3 Concrete walls and fire proofing on metal partition and exposed steel will limit the fire to the subject area.

18.4 Fire dampers in the ductwork will prevent the spread of fire to adjacent areas.

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable (see 15.3).

PAB-F-1D-A

1.0 Building: Primary Auxiliary Building

2.0 Fire Area or Zone: PAB-F-1D-A

- 2.1 Area Name: Charging Pump – 2B Area
- 2.2 Location: East Side – El. 7'0"
- Drawing No: 9763-F-805061-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	3 Hr.
		East	Concrete	Outside
		West	MCG	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr.
3.5	Others		Fireproofed Ceiling Beams	3 Hr.

4.0 Floor Area 318 Sq. Ft. Length 26.5' Width 12' Height 15.25'

5.0 Volume 4,850 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ____ None ____

7.0 Exhaust Ventilation System: PAB

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes X No ____

- 8.1 Outside Area at Exit Points Yes ____ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ____
- 9.2 Airborne Yes ____ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 Refer to page 2. (analysis continued pg. 2 - 4)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Charging Pump P-2b	CS		X	X	X
Piping & Valves	CBS		X	X	X
Piping & Valves	CS		X	X	X
Piping & Valves	CC		X	X	X
Cabling	CS		X	X	X
Press Switches	CS		X	X	

13.0 Design Base Fire (In Situ)

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	61	Gallons	28,774	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 28,774 Btu/Sq. Ft.
Total Combustibles: 9,150,000 Btu

14.0 Design-Basis Fire Description

1. Oil reservoir rupture, oil spreads over the entire floor area of the room (318 sq. ft.). The thickness of the oil film is ¼" over the entire floor area.
2. The oil is ignited, burns and is consumed.
3. The space temperature is assumed to be sufficiently high that all the cable in the space will fail. Cable will not contribute to the fire because it is contained within conduit.

14.1 DBF Fire Loading 1,524 Btu/Sq. Ft. (3.23 gallons oil consumed in 318 sq. ft.)

14.2 Fire Duration Less than one minute.

14.3 Peak Temperature 5959 °F (High temp. spike in short duration).

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of the pump due to rupture and loss of oil.

15.2 Loss of the cabling due to fire.

15.3 The adjacent fire area containing a redundant unit is separated by a 3-hour barrier; therefore, safe shutdown can be accomplished.

15.4 The structural steel beams and metal partition are covered with a fire protective coating, therefore no damage.

15.5 There will be possible spalling of the concrete.

15.6 The fire will be contained within the area due to its short duration.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of the pump due to rupture and loss of oil.

16.2 Possible loss of cabling to pump.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable (no water suppression in area).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The Control room alerts the fire brigade.

18.2 The fire brigade will extinguish the fire using portable fire extinguishers or fire hoses if necessary.

18.3 Concrete walls and fire proofing on metal partition and exposed steel will limit the fire to the subject area.

18.4 Fire dampers in the ductwork will prevent the spread of fire to adjacent areas.

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable (see 15.3).

PAB-F-1E-A

1.0	Building			Primary Auxiliary Building	
2.0	Fire Area or Zone			PAB-F-1E-A	
	2.1 Area Name			Reciprocating Charging Pump Area	
	2.2 Location			East Side - El. 7’0”	
	Drawing No			9763-F-805061-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1 Walls		North	Concrete	3 Hr.
			South	Concrete	1 ½ Hr.
			East	Concrete	Outside
			West	MCG	1 ½ Hr.
	3.2 Floor			Concrete	1 ½ Hr.
	3.3 Ceiling			Concrete	1 ½ Hr.
	3.4 Doors			Metal	1 ½ Hr.
	3.5 Others			Fireproofed Ceiling	1 ½ Hr.

4.0 Floor Area 272 Sq. Ft. Length 26.5' Width 10.25' Height 15.25'

5.0 Volume 4,100 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAB

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
	8.1 Outside Area at Exit Points	Yes ______	No X
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	Yes X	No ______
	9.2 Airborne	Yes ______	No X

10.0	Fire Protection	Type
	10.1 Primary	Fire Extinguisher(s)
	10.2 Secondary	Standpipe and Hose Reel
	10.3 Detection	Ionization
	10.4 Other	------

11.0 Fire Loading in Area

11.1 Refer to page 2. (analysis continued pg. 2 - 4)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
No Equipment Required For Safe Shutdown in This Area					
Piping Valves	CBS	X		X	
Piping Valves	CC	X		X	

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire		Fire Loading in Area	
Oil:	14.0	Gallons	7721	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 7721 Btu/Sq. Ft.
Total Combustibles: 2,200,000 Btu

14.0 Design-Basis Fire Description

1. Pump ruptures, oil spread over floor covering 605 sq. Ft. Of area (1/8” thick).
2. Oil is ignited and is consumed.
3. The space temperature in the area is assumed to be sufficiently high that all the cable in the space is assumed to fail. Cable will not contribute to the fire because it is contained within conduit.

14.1 DBF Fire Loading 2,275 Btu/Sq. Ft. (2.73 gallons oil consumed in 318 sq. ft.)

14.2 Fire Duration Less than one minute.

14.3 Peak Temperature 5958 °F (High temp. spike in short duration).

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of the pump due to rupture and loss of oil.

15.2 Loss of cabling due to fire.

15.3 The adjacent fire area containing safe shutdown equipment will not be affected.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of the pump due to rupture and loss of oil.

16.2 Possible loss of cabling to pump.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable (no water suppression in area).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Duration of the fire is short, therefore the fire barrier walls will prevent the spread to adjacent pump areas.

18.2 Fire dampers will prevent the spread of fire from the area.

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable (see 15.3).

PAB-F-1F-Z

1.0 Building: Primary Auxiliary Building

2.0 Fire Area or Zone: PAB-F-1F-Z

- 2.1 Area Name: Letdown Degasifier Area
- 2.2 Location: East Side El. 7'0"
- Drawing No: 9763-F-805061-FP

3.0 Construction of Area

		Material	Min. Fire Rating
3.1 Walls	North	Concrete	1 ½ Hr.
	South	Concrete	-
	East	Concrete	Outside
	West	Concrete	-
3.2 Floor		Concrete	-
3.3 Ceiling		Concrete/Grating	-
3.4 Doors		Metal	-
3.5 Others		Exposed Ceiling Beams	-

4.0 Floor Area 9,400 Sq. Ft. Length 23.5' Width 13.33' Height 30'

5.0 Volume 9,400 Cu. Ft.

6.0 Floor Drains: Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: PAB

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area: Yes ______ No X

- 8.1 Outside Area at Exit Points: Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping: Yes ______ No X
- 9.2 Airborne: Yes (Minimal) No ______

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 Refer to page 2. (analysis continued pg. 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No equipment required for safe shutdown in this zone also, no safety related equipment here.

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	1.0	Gallons	478	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 478 Btu/Sq. Ft.
Total Combustibles: 150,000 Btu

14.0 Design-Basis Fire Description

(A) The letdown degasifier reciprocating pump will rupture, the entire contents of oil spills on the floor covering approximately a 13 sq. ft. area and burns completely.

14.1 DBF fire loading 11,538 Btu/Sq. Ft.

14.2 Peak area/zone temperature during fire 505 °F

14.3 Duration of fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of degasifier pump due to loss of oil.

15.2 Possible loss of the cabling and instrumentation/controls in the area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 The consequences are the same as 15.1 and 15.2.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable as no automatic water suppression system is provided.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire brigade will extinguish the fire using portable fire extinguishers or fire hoses if necessary.

18.3 Because the subject fire zone is bounded by a concrete structure and the duration of the fire is less than 5 minutes, the design base fire will be contained in the area. However, with the lack of fire dampers in the supply or exhaust air system, the hot air and smoke will travel through PAB normal exhaust filter unit to the outside. (The air has not been transferred from this zone to any other zones in PAB).

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable. No safe shutdown equipment in the area.

PAB-F-1G-A

1.0 Building: Primary Auxiliary Building

2.0 Fire Area or Zone: PAB-F- 1G-A

- 2.1 Area Name: Electrical Chase & Elec. Tunnel Between Control Bldg & PAB*
- 2.2 Location: El. (-) 26'-0" To El. 35'-3" & 30'08"
  Drawing No: 9763-F-805061-FP. 805062-FP & 805060-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete/MCG	3 Hr.
		East	Concrete	3 Hr./Outside
		West	Concrete/MCG	3 Hr./Outside
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	3 Hr.
3.4	Doors		Metal	3 Hr.
3.5	Others		-	-

4.0 Floor Area 1,120 Sq. Ft. Length 80'-0" Width 14'-0" Height 20'-0"

5.0 Volume 22,400; 31,400; 9000 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: None

- 7.1 Percentage of System's Capacity: N/A

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Pre-Action Systems
- 10.2 Secondary: Fire Extinguisher(s)
- 10.3 Detection: Ionization & Photoelectric
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

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* Safety Related Cable Requires Fire Protection.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	CC	X	X	X	X
Cabling	CS	X	X	X	X
Cabling	EAH	X	X	X	X
Cabling	SI	X	X	X	
Cabling	PAH	X	X	X	X
Cabling	SW	X	X	X	X
Cabling	SWA	X	X	X	
Cabling	RH	X	X	X	
Cabling	RC	X	X	X	
Cabling	CBS	X	X	X	
Cabling	FAH	X	X	X	
Cabling	WLD	X		X	
Cabling	SF	X	X	X	
Cabling	VG	X		X	
Cabling	SS		X	X	
Cabling	NG	X		X	
Cabling	RMW		X	X	
Cabling	CAH	X	X	X	

PAB-F-1J-Z

1.0	Building			Primary Auxiliary Building	
2.0	Fire Area or Zone			PAB-F-1J-Z	
	2.1	Area Name		Aux. Steam Condensate Tank Area	
	2.2	Location		North End PAB El. (-) 6’-0: & (-) 26’-0”	
		Drawing No		9763-F-805061-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr./Outside
			South	Concrete	- /Outside
			East	Concrete	- /3 Hr.
			West	Concrete	3 Hr./Outside
	3.2	Floor		Concrete/Grating	-
	3.3	Ceiling		Concrete	-
	3.4	Doors		Metal	3 Hr./-
	3.5	Others		-	-

4.0 Floor Area 1,980 Sq. Ft. Length Varies Width Varies Height 11' & 18'

5.0 Volume 23,782 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAH

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes	X	No	
8.1	Outside Area at Exit Points	Yes		No	X
9.0	Operational Radioactivity				
9.1	Equipment/Piping	Yes	X	No	
9.2	Airborne	Yes	X	No	

10.0	Fire Protection	Type
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	-----------

11.0 Fire Loading in Area

11.1 Refer to page 2 of 4

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Piping & Valves	CS	X	X	X
Cabling	CS	X	X	X
Piping & Valves	SI	X	X	X
Cabling	SI	X	X	X
Cabling	RC	X	X	X
Cabling	CC	X	X	X
Cabling	CAH	X	X	X
Cabling	VG	X		X
Cabling	CBS	X		X
Cabling	NG	X		X
Cabling	RMW		X	X
Cabling	WLD		X	X
Temperature Elements & Cabling	MM	X	X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	1.0	Gallons	76.0	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	5	Pounds	33	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 109 Btu/Sq. Ft.

Total Combustibles: 215,000 Btu

14.0 Design-Basis Fire Description

(A) The condensate pump oil reservoir will rupture and oil spills on an area of 13 sq. Ft., ignites and burns completely.

14.1 DBF Fire Loading 11,538 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire 309 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of condensate pump as a result of the loss of oil content.

15.2 Because of the non-ducted exhaust air from the area and the lack of fire dampers, smoke and fire will spread into the upper zones of PAB, via PAB-F-1A-Z, PAB-F-2C-Z, PAB-3B-Z.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of the condensate pump as a result of the loss of oil content.

16.2 Area detection system will alarm in control room and early response of the fire brigade will minimize the spread of smoke and fire to the upper zones.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable as no automatic water suppression system exists.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 The subject pumps are located in a pit at elevation of 26'-0". The localized zone is bounded by a concrete structure and most of the fire will be contained. However, because of the lack of isolation of ventilation air and non-ducted exhaust air, fire and particularly smoke will spread to the other parts of the building, including the component cooling heat exchanger and pump area.

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

1. Not applicable. The separation of the safe shutdown equipment is discussed in the report "Fire Protection of Safe Shutdown Capability" (10 CFR 50 Appendix R).

PAB-F-1K-Z

1.0	Building			Primary Auxiliary Building	
2.0	Fire Area or Zone			PAB-F-1K-Z	
	2.1	Area Name		Non-Radioactive Pipe Tunnels & Pine Chase	
	2.2	Location		Northwest Corner - El. (-)6'-O" Up Thru 53'-O"	
		Drawing No		9763-F-805061-FP, 809062-FP & 805063-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	Outside/3 Hr.
			East	Concrete	3 Hr./ -
			West	Concrete	3 Hr. *
	3.2	Floor		Concrete	-
	3.3	Ceiling		Concrete	Outside
	3.4	Doors		Metal	3 Hr./ -
	3.5	Others		-	-

4.0 Floor Area 4,620 Sq. Ft. Length 68'-0" Width 9'-0" & 15' Height Varies

5.0 Volume 75,350 Cu. Ft.

6.0 Floor Drains Nuclear X (El (-)6',5' & 53') Non-Nuclear ______

7.0 Exhaust Ventilation System PAH-FN-L47

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
	8.1 Outside Area at Exit Points	Yes ______	No X
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	Yes ______	No X
	9.2 Airborne	Yes ______	No X

10.0	Fire Protection		Type
	10.1	Primary	Fire Extinguisher(s)
	10.2	Secondary	Standpipe and Hose Reel
	10.3	Detection	None – SBN-439, Dated ½1/85
	10.4	Other	-----------

* Door No. W-400 Leading Into Waste Process Building is Not 3 Hr. Fire Rated Door. Ref. Deviation No. 7, SBN-9o4, Dated Dec. 2, 1985.

11.0 Fire Loading in Area

11.1 None __X__ (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Piping & Valves	SW	X	X	X

PAB-F-2A-Z

1.0	Building			Primary Auxiliary Building	
2.0	Fire Area or Zone			PAB-F-2A-Z	
	2.1	Area Name		Resin Fill Tank Area	
	2.2	Location		South-East El. 25’-0”	
		Drawing No		9763-F-805062-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Open	-
			South	Concrete	3 Hr./Outside
			East	Concrete	3 Hr.
			West	Concrete/Metal	-
	3.2	Floor		Plt/Concrete/Grating	-
	3.3	Ceiling		Concrete/Plt	-
	3.4	Doors		Metal	- /3 Hr. (Stairs)
	3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 1,550 Sq. Ft. Length 43.5' Width 38.5' Height 26'

5.0 Volume 40,400 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAB

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes X	No ______
8.1	Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
9.1	Equipment/Piping	Yes X	No ______
9.2	Airborne	Yes ______	No X

10.0	Fire Protection		Type
	10.1	Primary	Fire Extinguisher(s)
	10.2	Secondary	Standpipe and Hose Reel
	10.3	Detection	Ionization
	10.4	Other	-----

11.0 Fire Loading in Area

11.1 Refer to page 2. (analysis continued page 2 & 3).

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Cabling	SW	X	X	X
Cabling	SWA	X	X	X
Cabling	EDE	X	X	X
Cabling	EAH		X	X
Cabling	PAH	X	X	X
Damper DP-35A	PAH	X		X
Cabling	CS	X	X	X
Cabling	FAH		X	X
Cabling	CC		X	X
Cabling	SF		X	X
Sample Panel CP-482	SS		X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Combustible	Quantity	Unit	Fire Loading	Unit
Note:				
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	106	Pounds	889	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 889 Btu/Sq. Ft.

Total Combustibles: 1,378,000 Btu

14.0 Design-Basis Fire Description

1. For conservatism the ladders are assumed to be in a vertical position. The bottom of both sets of rails are ignited and burn upward.
2. To add conservatism, it is assumed that the fire is self sustaining although the fire is not severe and has a low heat release rate.
3. The fire area will be limited to the length of the ladder and about 2 feet from the wall for an area covering 30 ft. x 2 ft. = 60 sq. ft.

14.1 DBF fire loading 22,967 Btu/Sq. Ft.

14.2 Peak area/zone temperature during fire 147 °F

14.3 Duration of fire > 5 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with portable extinguishers.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire would be extinguished using portable extinguishers and/or hose lines.

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Refer To Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

PAB-F-2B-Z

1.0 Building — Primary Auxiliary Building

2.0 Fire Area or Zone — PAB-F-2B-Z

- 2.1 Area Name — Boric Acid Tank Area
- 2.2 Location — South-West El. 25'-O"
- Drawing No — 9763-F-805062-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete/Metal	-
		South	Concrete	Outside
		East	Concrete/Metal	-
		West	Concrete	3 Hr.
3.2	Floor		Concrete	-
3.3	Ceiling		Concrete	-
3.4	Doors		Metal	3 Hr./ -
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 1,300 Sq. Ft. Length Varies Width Varies Height 26'

5.0 Volume 33,800 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ____ None ____

7.0 Exhaust Ventilation System PAB

- 7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes X No ____

- 8.1 Outside Area at Exit Points Yes X No ____

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ____
- 9.2 Airborne Yes ____ No X

10.0 Fire Protection — Type

- 10.1 Primary — Fire Extinguisher(s)
- 10.2 Secondary — Standpipe and Hose Reel
- 10.3 Detection — Ionization
- 10.4 Other — -----

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Piping & Valves	CS	X	X	X	X
Cabling	CS	X	X	X	
Boric Acid Tanks	CS	X	X	X	

PAB-F-2C-Z

1.0	Building			Primary Auxiliary Building	
2.0	Fire Area or Zone			PAB-F-2C-Z	
	2.1	Area Name		Primary Component Cooling Pump Area	
	2.2	Location		North - El 25'-0"	
		Drawing No		9763-F-805062-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside/3 Hr.
			South	Concrete/Metal/Open	-
			East	Concrete	3 Hr.
			West	Concrete	3 Hr./ -
	3.2	Floor		Concrete	-
	3.3	Ceiling		Concrete	-
	3.4	Doors		Metal	3 Hr./ -
	3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 7,200 Sq. Ft. Length Varies Width Varies Height 26'

5.0 Volume 187,000 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAB

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes X	No ______
8.1	Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
9.1	Equipment/Piping	Yes X	No ______
9.2	Airborne	Yes ______	No X

10.0	Fire Protection		Type
	10.1	Primary	Pre-Action System
	10.2	Secondary	Fire Extinguisher(s)
	10.3	Detection	Ionization & Photoelectric
	10.4	Other	-----

11.0 Fire Loading in Area

11.1 Refer to page 3 (analysis continued pg. 2 - 4)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Pump P-11A, P-11C	CC	X		X
Cabling	CC	X	X	X
Pump P-11B, P-11D	CC		X	X
Piping & Valves	CC	X	X	X
Piping & Valves	SW	X	X	X
Instrument Rack IR-93	MM	X	X	X
Cabling	CS	X	X	X
Cabling	SW	X	X	X
Cabling	SWA	X	X	X
Cabling	EAH	X	X	X
Cabling	SI	X	X	X
Cabling	PAH	X	X	X
Cabling	RM	X	X	X
Terminal Boxes & Cabling	EDE	X	X	X
Piping & Valves	CS	X	X	X
Fan-FN-42A	PAH	X		X
Fan-FN-42B	PAH		X	X
Dampers	PAH	X	X	X
Instruments	PAH	X	X	X
Instruments	PAH	X	X	X

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Radiation Monitors	RM	X	X	X
Cabling	CBS	X	X	X
Cabling	CAP	X	X	X
PCCW HX-CC-E-17A & B	CC	X	X	X
Boron Injection TK-SI-TK-6	SI	X	X	X
Piping & Valves	SI	X	X	X
Cabling	COP	X	X	X
Control Panel CP-443A, B	CC	X	X	X
Temperature Elements & Cabling	MM	X	X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire		Fire Loading in Area	
Oil:	1.75	Gallons	36.5	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	51.5	Pounds	93.0	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 129.5 Btu/Sq. Ft.
Total Combustibles: 932,400 Btu

14.0 Design-Basis Fire Description

1. Oil reservoir ruptures, oil spreads over 16.0 sq. ft. of floor (1/8" thick).
2. Oil ignites, burns and is consumed.

14.1 DBF Fire Loading 11,688 Btu/Sq. Ft.

14.2 Peak Temperature 146 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of pump due to rupture.
15.2 Possible loss of pump cable.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of pump due to rupture.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 A double failure would be required to inadvertently spray water in area.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Duration of the fire is short.
18.2 Total fire loading in zone is light (129.5 Btu/Sq. Ft).

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Spatial separation and metal shield wall.
19.2 The design base fire has neither the duration or intensity to ignite cable or damage equipment.
19.3 Water shields are installed over PCCW pump motors.

PAB-F-3A-Z

1.0	Building			Primary Auxiliary Building	
2.0	Fire Area or Zone			PAB-F-3A-Z	
	2.1	Area Name		Water Cooler Heat Exchanger Area	
	2.2	Location		North El. 53'-0"	
		Drawing No		9763-F-805063-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside/3 Hr.
			South	Metal/Open	-
			East	Concrete	Outside
			West	Concrete	-
	3.2	Floor		Concrete	-
	3.3	Ceiling		Concrete	- /Outside
	3.4	Doors		Metal	3 Hr.
	3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 4,000 Sq. Ft. Length 53' Width 75' Height 26'

5.0 Volume 103,400 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAB

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area		Yes		No	X
	8.1	Outside Area at Exit Points	Yes	X	No	
9.0	Operational Radioactivity					
	9.1	Equipment/Piping	Yes	X	No	
	9.2	Airborne	Yes		No	X

10.0	Fire Protection		Type
	10.1	Primary	Fire Extinguisher(s)
	10.2	Secondary	Standpipe and Hose Reel
	10.3	Detection	Ionization
	10.4	Other	Carbon Monoxide Detector in CAP-F-40

11.0 Fire Loading in Area

11.1 Refer to page 3 of 4

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Piping & Valves	SW	X	X	X
Cabling	SW	X	X	X
PCCW Head Tanks Tk-19A & 19B	CC	X	X	X
Piping & Instruments	CC	X	X	X
Cabling	CC	X	X	X
Dg Heat Exchangers E-42A & 42B	DG	X	X	X
Cabling	CAP	X	X	X
Cabling	COP	X	X	X
Cabling	CS	X	X	X
Terminal Boxes	EDE	X	X	X
Temperature Elements & Cabling	MM	X	X	X
Pressure Switch & Cabling	PAH	X		X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	2.25	Gallons	84	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:	6,600	Pounds	*	Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 84 Btu/Sq. Ft.
Total Combustibles: 37,500 Btu

* Charcoal Fire Loading Was Not Considered in Total Area. See Appendix D.

14.0 Design-Basis Fire Description

(A) The flash tank distillate pump oil reservoir fails and the entire 2.25 gallon of oil spreads over 29 sq. ft. and will ignite and is assumed to burn completely.

14.1 DBF Fire Loading 11,638 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire 240 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of the flash tank distillate pumps as a result of the loss of oil.
15.2 Failure of instruments, controls and cabling within the area of immediate vicinity of the fire.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of the flash tank distillate pumps as a result of the loss of oil.
16.2 The possible loss of instruments, controls and cabling within the area of immediate vicinity of the fire.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable as no automatic water suppression system exists.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 The fire duration is less than five minutes. The fire location is in the north east corner of the zone and is surrounded by outside fire rated concrete structures. Hence, the bulk of the fire will be contained within the zone. However, due to the lack of ventilation exhaust system isolation, the smoke will spread to fire zone PAB-F-3B-Z.

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable. For the separation requirements refer to report "Fire Protection Of Safe Shutdown Capability (10 CFR 50, Appendix R)".

PAB-F-3B-Z

1.0	Building			Primary Auxiliary Building	
2.0	Fire Area or Zone			PAB-F-3B-Z	
	2.1	Area Name		PAB Supply and Exhaust Fan Area	
	2.2	Location		South Side El. 53'-0"	
		Drawing No		9763-F-805063-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Metal/Open	-
			South	Concrete	Outside/3 Hr.
			East	Concrete	Outside/3 Hr.*
			West	Concrete	Outside/ -
	3.2	Floor		Concrete	-
	3.3	Ceiling		Concrete	- /Outside
	3.4	Doors		Metal	3 Hr./ -
	3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 6,600 Sq. Ft. Length 88' Width 75' Height 26'

5.0 Volume 171,600 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System PAB

7.1 Percentage of System's Capacity 100%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping	X	
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization & Photoelectric
10.4	Other	-----

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued pg. 2 & 3)

* 3 Hr. Fire Damper Has Not Been Provided in Exhaust Duct at the Point of Connection To Unit Plant Vent. Ref: Deviation No. 1 SBN-904 Dated 12/2/85

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Piping & Valves	CS	X	X	X
Cabling	CS	X	X	X
Instruments & Cabling	CAP	X		X
Instruments & Cabling	COP	X	X	X
Instruments & Cabling	PAH	X		X
Temperature Elements & Cabling	MM	X	X	X
Instruments & Cabling	CC	X	X	X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil and Class A Fire		Fire Loading in Area	
Oil:	0.5	Gallons	231	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:	50	Pounds	1,231	Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	85	Pounds	172	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 1,633 Btu/Sq. Ft.
Total Combustibles: 1,611,422 Btu

14.0 Design-Basis Fire Description

1. Oil reservoir in the monorail crane hoist ruptures and ½ gallon of oil spills covering 6.4 sq. Ft. of the boric acid storage area floor. The oil runs under two stacked wood pallets, which has a burning area of 24 sq. Ft

2. The oil is ignited and burns along with the pallets.

3. Design basis fire is separated from the fan area by metal partitions.

14.1	DBF Fire Loading	28,386	Btu/Sq. Ft.
14.2	Peak Temperature	1,560	°F
14.3	Duration of Fire	4.8	Minutes.

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of monorail crane.

15.2 Loss of the boric acid storage area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of monorail crane due to loss of oil.

16.2 Possible loss of boric acid storage area.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire brigade will extinguish the fire using portable fire extinguishers or fire hoses if necessary.

18.3 The fire rating of the structure exceeds the duration of the fire.

19.0 How is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable (equipment is not required for safe shutdown).

PAB-F-4-Z

1.0	Building		Primary Auxiliary Building	
2.0	Fire Area or Zone		PAB-F-4-Z	
2.1	Area Name		Filter Area	
2.2	Location		El. 81’-0”	
	Drawing No		9763-P-805063-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	Outside
		East	Concrete	Outside
		West	Concrete	Outside
3.2	Floor		Concrete	-
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	-
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 2,650 Sq. Ft. Length 54' Width 49' Height 25'

5.0 Volume 66,000 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ____ None ____

7.0 Exhaust Ventilation System Mechanical Room

7.1 Percentage of System's Capacity 100%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe & Hose Reel
10.3	Detection	Ionization
10.4	Other	Temperature Elements in Filters/ Carbon Monoxide Detection in PAH-F-16 *

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

* Charcoal Loading For PAH-F-L6 is 25750 Lbs. of Charcoal. CharcoalFire Loading Was Not Considered in Total Area. See Appendix “D’.

12.0 Equipment and Systems in Fire Area/Zone *

Equipment	System	System Train A	System Train B	Safety Related

No safety related or safe shutdown equipment in this zone

* 3 Hr. Fire Damper Has Not Been Provided in Exhaust Duct, 81'-0" Elev. at the Point of Connection To Unit Plant Vent.

* Ref: Deviation No. 1
SBN- 904
Dated 12/02/85

PAB-F-S1-0

1.0 Building: Primary Auxiliary Building

2.0 Fire Area or Zone: PAB-F-S1-0

- 2.1 Area Name: Stairwell
- 2.2 Location: Col. C-1
- Drawing No: 9763-F-805063-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	3 Hrs.
		East	Concrete	3 Hrs.
		West	Concrete	3 Hrs.
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	3 Hrs.
3.4	Doors		Metal	1 ½ Hr.
3.5	Others		-	-

4.0 Floor Area 127 Sq. Ft. Length 15'-4" Width 8'-4" Height 37'

5.0 Volume 4,700 Cu. Ft.

6.0 Floor Drains Nuclear - Non-Nuclear -

7.0 Exhaust Ventilation System: None

- 7.1 Percentage of System's Capacity: N/A

8.0 8 Hr. Emergency Lighting in Area Yes X No ______

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type

- 10.1 Primary: Portable Extinguisher
- 10.2 Secondary: Hose Station
- 10.3 Detection: None
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No safety related or safe shutdown equipment in this zone

PAB-F-S2-0

1.0	Building			Primary Auxiliary Building	
2.0	Fire Area or Zone			PAB-F-S2-0	
	2.1 Area Name			Stairwell	
	2.2 Location			Col. D-6	
	Drawing No			9763-F-805063-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1 Walls	North		Concrete	3 Hrs.
		South		Concrete	Outside
		East		Concrete	3 Hrs.
		West		Concrete	3 Hrs.
	3.2 Floor			Concrete	Outside
	3.3 Ceiling			Concrete	Outside
	3.4 Doors			Metal	1 ½ Hr.
	3.5 Others			-	-

4.0 Floor Area 130 Sq. Ft. Length 15'-8" Width 8'-4" Height 66'

5.0 Volume 8,600 Cu. Ft.

6.0 Floor Drains Nuclear - Non-Nuclear -

7.0 Exhaust Ventilation System None

7.1 Percentage of System's Capacity N/A

8.0 8 Hr. Emergency Lighting in Area Yes X No ___

8.1 Outside Area at Exit Points Yes X No ___

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ___ No X

9.2 Airborne Yes ___ No X

10.0 Fire Protection — Type

10.1 Primary — Portable Extinguisher

10.2 Secondary — Hose Station

10.3 Detection — None

10.4 Other — -----

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No safety related or safe shutdown equipment in this zone

Fire Hazard Analysis – FSB-F-1-A

1.0 Building — Fuel Storage Building

2.0 Fire Area or Zone — FSB-F-1-A

- 2.1 Area Name — -----
- 2.2 Location — El 7’-0”, 10”-0”, 21’-6”, 25”-0”, 64”-0” & 84’-0”
- Drawing No — 9763-F-805058-FP, 805059-FP & 805084-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr./Outside
		South	Concrete	Outside
		East	Concrete	Outside
		West	MCG/Concrete	3 Hr./Outside**
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr./ -
3.5	Others		-	-

4.0 Floor Area 5,350 Sq. Ft. Length 93' Width Varies Height Varies

5.0 Volume 579,100 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System — FSB Normal Exhaust

- 7.1 Percentage of System's Capacity — 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type

- 10.1 Primary — Fire Extinguisher(s)
- 10.2 Secondary — Standpipe & Hose Reel
- 10.3 Detection — Ionization
- 10.4 Other — Carbon Monoxide Detector in FAH-F-41, 74

11.0 Fire Loading in Area

- 11.1 Refer to page 3 (analysis continued on pages 2, 3, 4).

* Walkway and piping tunnel between column A of FSB and column D of PAB has 3 hr. fire rated ceiling.

** 3 hr. fire rated fire damper has not been provided in exhaust duct to the point of connection at plant vent. Ref. To Deviation No. 1 SBN-904 Dated 12/2/85

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Spent Fuel Pool P-10A	SF	X		X
Spent Fuel Pool P-10B	SF		X	X
Piping & Valves	CC	X	X	X
Controls & Instruments	FAH	X	X	X
FAH - FN - 11A & 124	FAH	X		X
FAH - FN – 11B	FAH		X	X
Heaters	FAH	X	X	X
Filters 41, 71	FAH	X	X	X
Dampers	FAH	X	X	X
Cabling	FAH	X	X	X
Cabling	CC	X	X	X
Spent Fuel Pool P-10C	SF	X Note 1	X Note 1	X

Note 1: Capable of being powered from either Train A or Train B

13.0 Total Fire Loading in Area

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Oil:	323.7	Gallons	9,076	Btu/Sq. Ft.
Grease:	79.5	Pounds	268	Btu/Sq. Ft.
Class A:	10,078	Pounds	15,070	Btu/Sq. Ft.
Charcoal:	21,750	Pounds	*	Btu/Sq. Ft.
Chemicals:	0	Pounds	0	Btu/Sq. Ft.
Plastics:	138	Pounds	335	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Cables:	22,803	Pounds	44,754	Btu/Sq. Ft.
ML-2		Pounds		Btu/Sq. Ft.
Hydraulic Fluid	17.5	Gallons	491	Btu/Sq. Ft.

13.2 Total Fire Loading in Area: 69,502 Btu/Sq. Ft.
Total Combustibles: 369,835,500 Btu

14.0 Design-Basis Fire Description

1. One of the four (4) Spent Fuel Pool pumps ruptures, lubrication oil spills on floor. For conservatism, the lubrication oil from the other three (3) adjacent pumps are also considered as combustible; therefore, all four (4) gallons of lubrication oil are assumed spilled on floor covering an area of 40 sq. ft. The entire four (4) gallons of lubrication oil ignite and are consumed. The normal exhaust system fails. Oil thickness is 1/6 inch.
2. Maximum peak temperature throughout the entire fire area will reach 160.6°F based on (ΔT 60.6ºF + 100ºF ambient temperature).

Note 1: Fiberglass ladders not included since ladders will not ignite at the DBF peak temperature.

Note 2: Reactor Coolant Pump (RCP) motor lubrication oil not included since the lubrication oil is contained in a metal reservoir and the RCP motor is not in-service or available for service.

Note 3: Cask crane lubrication oil and hydraulic fluid not included since crane not normally energized and location of lubrication oil reservoir and hydraulic fluid.

* Charcoal fire loading was not considered in total area. See App. "D".

14.1 DBF Fire Loading 15,000 Btu/Sq. Ft.

14.2 Peak Temperature 161 °F

14.3 Duration of Fire 5.775 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of spent fuel pool pump due to loss of oil.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Fire duration will be short with peak temperature of 160ºF; hence, spent fuel pool pump might be lost.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable as no automatic suppression system exists in the area.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire duration is short and will be contained in the subject fire area of concrete structure.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable as pump is not required for safe shutdown.

W-F-1A-Z

1.0	Building			Waste Processing Building	
2.0	Fire Area or Zone			W-F-1A-Z	
	2.1	Area Name		Truck Bay and Drum Storage Area	
	2.2	Location		South Side El. 25'-0"	
		Drawing No		9763-F-805661-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	-
			South	Concrete	Outside
			East	Concrete	-
			West	Concrete	Outside
	3.2	Floor		Concrete	-
	3.3	Ceiling		Concrete	-
	3.4	Doors		Metal	-
	3.5	Others		-	-

4.0 Floor Area 2,050 Sq. Ft. Length 81.5' Width 25' Height Varies

5.0 Volume 87,400 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System WPB Exhaust System

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
	8.1 Outside Area at Exit Points	Yes ______	No X
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	Yes X	No ______
	9.2 Airborne	Yes X	No ______

10.0	Fire Protection		Type
	10.1	Primary	Fire Extinguisher(s)
	10.2	Secondary	Standpipe and Hose Reel
	10.3	Detection	Ionization
	10.4	Other	-----

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued pg. 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in ThisArea

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Class A Fire			
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:	1,400	Pounds	5,464	Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	630	Pounds	4,592	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 10,056 Btu/Sq. Ft.
Total Combustibles: 20,614,076 Btu

14.0 Design-Basis Fire Description

(A) This fire zone is not separated from adjacent fire zones (W-F-1A-Z, W-F-2A-Z, W-F-2B-Z, W-F-2C-Z and W-F-2D-Z) by fire rated walls and hence it is assumed that all combustibles in all these zones will ignite and burn simultaneously. Total combustibles are 28,744,076 Btu spread over 1598 sq.ft. (fire loading 17,988 Btu/ft.^{2}).

(B) These zones are non-safety related and hence additional combustibles due to cable loading will have no significance.

14.1 DBF Fire Loading 17,988 Btu/Sq. Ft.

14.2 Peak Fire Temperature 2,104 °F

14.3 Duration of Fire 28 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 No safe shutdown or safety related equipment in the area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 None

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable. There is no water fire suppression in the subject area.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Spatial separation and the PAB's 3 hour barrier prevents loss of any safe shutdown, or safety-related function.

18.2 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.3 The fire brigade will extinguish the fire using portable fire extinguishers or hose reel, as necessary.

19.0 How the Redundant Safe Shutdown Equipment in the Area Is Protected

19.1 Not applicable (see 15.2).

W-F-1B-Z

1.0 Building: Waste Processing Building

2.0 Fire Area or Zone: W-F-1B-Z
- 2.1 Area Name: Decontamination Area
- 2.2 Location: South Side El. 25’-0”
- Drawing No: 9763-F-805661-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	-
		South	Concrete	Outside
		East	Concrete	Outside
		West	Concrete	-
3.2	Floor		Concrete	-
3.3	Ceiling		Concrete	-
3.4	Doors		Metal	-
3.5	Others		-	-

4.0 Floor Area 500 Sq. Ft. Length 25'-6" Width 19'-6" Height 26'-0"

5.0 Volume 13,000 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: WPB Exhaust System
- 7.1 Percentage of System's Capacity: .01%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X
- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type
- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: -----

11.0 Fire Loading in Area
- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in ThisArea

W-F-2A-Z

1.0	Building		Waste Processing Building	
2.0	Fire Area or Zone		W-F-2A-Z	
	2.1 Area Name		Extruder/Evaporator Area	
	2.2 Location		42’-5” Elev. Cols. “A” To “B” - “2” To “3” +	
	Drawing No		9763-F-805882-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
	3.1 Walls	North	3'-0" Concrete	3 Hrs.
		South	1'-6" & 2'-6" Concrete	None
		East	2'-6" Concrete	None
		West	1'-6" Concrete	None
	3.2 Floor		2'-6" Concrete & Open	None
	3.3 Ceiling		2'-6" Concrete	None
	3.4 Doors		Open Access	None
	3.5 Others		Ladder	None

4.0 Floor Area 491 Sq. Ft. Length 27'/14' Width 18'/10' Height 10'-6"

5.0 Volume 5,156 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System: Waste Solidification Exhaust System

7.1 Percentage of System's Capacity: 3%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points		X
9.0	Operational Radioactivity		
9.1	Equipment/Piping	X	
9.2	Airborne		X

10.0 Fire Protection — Type

- 10.1 Primary: Water Deluge System
- 10.2 Secondary: Standpipe and Hose Reel Station
- 10.3 Detection: Ionization and Thermal
- 10.4 Other: -----

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued pg. 2, 3 & 4)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in ThisArea

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Class A Fire		Fire Loading in Area	
Oil:	2.2	Gallons	672	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 672 Btu/Sq. Ft.
Total Combustibles: 330,000 Btu

14.0 Design-Basis Fire Description

(A) This fire zone is not separated from adjacent fire zones (W-F-1A-Z, W-F-1B-Z, W-F-2A-Z, W-F-2B-Z, W-F-2C-Z & W-F-2D-Z) by fire rated walls and hence it is assumed that all combustibles in all these zones will ignite and burn simultaneously. Total combustibles are 32,155,000 Btu spread over 1598 sq.ft. (fire loading 20,122 Btu/ft.^{2}).

(B) These zones are non-safety related and hence additional combustibles due to cable loading will have no significance.

14.1 DBF Fire Loading 20,122 Btu/Sq. Ft.

14.2 Peak Fire Temperature 3,112 °F

14.3 Fire Duration 10 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of extruder/evaporator function.

15.2 No safe shutdown or safety related equipment in the area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 No consequences.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire brigade will put out the fire with hose reels and/or portable extinguishers.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable (see 15.2).

W-F-2B-Z

1.0	Building			Waste Processing Building	
2.0	Fire Area or Zone			W-F-2B-Z	
	2.1	Area Name		Crystallizer Pump Room	
	2.2	Location		4.2'-5" Elev. Cols. A-3	
		Drawing No		9763-F-805882-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	1'-6" Concrete	3 Hrs.
			South	2'-6" Concrete	None
			East	1'-6" Concrete	None
			West	2'-6" Concrete	None
	3.2	Floor		2'-3" Concrete	None
	3.3	Ceiling		2'-0" Concrete	None
	3.4	Doors		-	-
	3.5	Others		-	-

4.0 Floor Area 187 Sq. Ft. Length 17' Width 11' Height 10'-6"

5.0 Volume 1,964 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System Waste Solidification Exhaust

7.1 Percentage of System's Capacity 3.3%

			Yes	No
8.0	8 Hr. Emergency Lighting in Area			X
	8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity			
	9.1	Equipment/Piping	X	
	9.2	Airborne		X

			Type
10.0	Fire Protection		
	10.1	Primary	Portable Extinguishers
	10.2	Secondary	Stand Pipe System Hose Station
	10.3	Detection	None
	10.4	Other	-----

11.0 Fire Loading in Area

11.1 Refer to page 2.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in ThisArea

13.0 Design Base Fire

Note: Oil Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	1.5	Gallons	1,203	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 1203 Btu/Sq. Ft.
Total Combustibles: 225,000 Btu

14.0 Design-Basis Fire Description

(A) This fire zone is not separated from adjacent fire zones (W-F-1A-Z, W-F-1B-Z, W-F-2A-Z, W-F-2B-Z, W-F-2C-Z and W-F-2D-Z) by fire rated walls and hence it is assumed that all combustibles in all these zones will ignite and burn simultaneously. Total combustibles are 32,155,000 Btu spread over 1598 sq.ft. (fire loading 20,122 Btu/ft.^{2}).

(B) These zones are non-safety related and hence additional combustibles due to cable loading will have no significance.

14.1 DBF Fire Loading 20,122 Btu/Sq. Ft.

14.2 Peak Fire Temperature 3,112 °F

14.3 Duration of Fire 10 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of crystal recirculation pumps.

15.2 No safe shutdown or safety related equipment in the area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Possible loss of cryst. Pumps.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable. There is no water fire suppression in the subject area.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire brigade will put out the fire with hose reels and/or portable extinguishers.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable (see 15.2).

W-F-2C-Z

1.0 Building: Waste Processing Building

2.0 Fire Area or Zone: W-F-2C-Z

- 2.1 Area Name: Asphalt Meter Pump Area
- 2.2 Location: 42'-5" Elev. Cols. A-3
- Drawing No: 9763-F-805882-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	3'-0" Concrete	3 Hrs.
		South	1'-6" Concrete	None
		East	1'-6" Concrete	None
		West	2'-6" Concrete	Outside Wall
3.2	Floor		2'-6" Concrete	None
3.3	Ceiling		2'-6" Concrete	None
3.4	Doors		One (1)	3 Hrs.
3.5	Others		One (1) Locked Mesh Door	None

4.0 Floor Area 150 Sq. Ft. Length 10'-0" Width 15'-0" Height 10'-6"

5.0 Volume 1,575 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System: Waste Solidification Exhaust System

- 7.1 Percentage of System's Capacity: 8.5%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Water Deluge System
- 10.2 Secondary: Standpipe and Hose Reel Station
- 10.3 Detection: Ionization and Thermal
- 10.4 Other: -----

11.0 Fire Loading in Area

- 11.1 Refer to page 2.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in ThisArea

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	4.25	Gallons	4250	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:	Asphalt -5	Gallons	5,000	Btu/Sq. Ft.

13.2 Total Fire Loading in Area: 9,250 Btu/Sq. Ft.
Total Combustibles: 1,387,500 Btu

14.0 Design-Basis Fire Description

(A) This fire zone is not separated from adjacent fire zones (W-F-1A-Z, W-F-1B-Z, W-F-2A-Z, W-F-2B-Z, W-F-2C-Z & W-F-2D-Z) by fire rated walls and hence it is assumed that all combustibles in all these zones will ignite and burn simultaneously. Total combustibles are 32,155,000 Btu spread over 1598 sq.ft. (fire loading 20,122 Btu/ft.^{2}).

(B) These zones are non-safety related and hence additional combustibles due to cable loading will have no significance.

14.1 DBF Fire Loading 20,122 Btu/Sq. Ft.

14.2 Peak Fire Temperature 3,112 °F

14.3 Duration of Fire 10 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of metering function.

15.2 No safe shutdown or safety related equipment in the area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 No consequences.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire brigade will put out the fire with hose reels and/or portable extinguishers.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable (see 15.2).

W-F-2D-Z

1.0	Building			Waste Processing Building	
2.0	Fire Area or Zone			W-F-2D-Z	
	2.1	Area Name		Turntable and Drum Conveyor Area	
	2.2	Location		25'-0" Elev, Cols. "A" - "B" & "2" - "4"	
		Drawing No		F-80566l-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	3'-0" Concrete	3 Hrs.
			South	3'-0" Concrete	None
			East	2'-6" Concrete	None
			West	2'-6" Concrete	None
	3.2	Floor		2'-0" Concrete	None
	3.3	Ceiling		2'-0" Concrete & Open	None
	3.4	Doors		5" Lead	None
	3.5	Others		Ladder	None

4.0 Floor Area 507 Sq. Ft. Length 39'-0" Width 13'-0" Height 17'-0"

5.0 Volume 8,619 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System Waste Solidification Exhaust System

7.1 Percentage of System's Capacity 70%

			Yes		No	
8.0	8 Hr. Emergency Lighting in Area		Yes	______	No	X
	8.1	Outside Area at Exit Points	Yes	X	No	______
9.0	Operational Radioactivity					
	9.1	Equipment/Piping	Yes	X	No	______
	9.2	Airborne	Yes	______	No	X

			Type
10.0	Fire Protection		Type
	10.1	Primary	Water Deluge System
	10.2	Secondary	Standpipe and Hose Reel Station
	10.3	Detection	Ionization and Thermal
	10.4	Other	-----

11.0 Fire Loading in Area

11.1 Refer to page 2.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in ThisArea

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	41.25	Gallons	12,204	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 12,204 Btu/Sq. Ft.
Total Combustibles: 6,187,500 Btu

14.0 Design-Basis Fire Description

(A) This fire zone is not separated from adjacent fire zones (W-F-1A-Z, W-F-LB-Z, W-F-2A-Z, W-F-2B-Z, W-F-2C-Z & W-F-2D-Z) by fire rated walls and hence it is assumed that all combustibles in all these zones will ignite and burn simultaneously. Total combustibles are 32,155,000 Btu spread over 1598 sq.ft. (fire loading 20,122 Btu/ft.^{2}).

(B) These zones are non-safety related and hence additional combustibles due to cable loading will have no significance.

14.1 DBF Fire Loading 20,122 Btu/Sq. Ft.

14.2 Peak Fire Temperature 3,112 °F

14.3 Duration of Fire 10 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of drum conveyor.
15.2 No safe shutdown or safety-related equipment in the area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences -- fire will be extinguished.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 No consequences.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire brigade will put out the fire with hose reels and/or portable extinguishers.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Space Protected

1. Not applicable (see 15.2).

W-F-2E-Z

1.0	Building			Waste Processing Building	
2.0	Fire Area or Zone			W-F-2E-Z	
	2.1	Area Name		Waste Solidification Control Room	
	2.2	Location		25'-0" Elev. Cols. "A-B" & "3"-"4"	
		Drawing No		9763-F-805661-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	3'-0" Concrete	3 Hrs.
			South	3'-0" Concrete	None
			East	2'-0" Concrete	None
			West	2'-6" Concrete	Outside
	3.2	Floor		2'-0" Concrete	None
	3.3	Ceiling		2'-0" Concrete	None
	3.4	Doors		One (1)	3 Hrs.
	3.5	Others		None	-

4.0 Floor Area 477 Sq. Ft. Length 26'-6" Width 18'-0" Height 14'-6"

5.0 Volume 6,917 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System WAH-AC-76 Air Conditioning Unit

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
8.1	Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
9.1	Equipment/Piping	Yes ______	No X
9.2	Airborne	Yes ______	No X

10.0	Fire Protection	Type
10.1	Primary	Portable Extinguisher
10.2	Secondary	Standpipe and Hose Reel Station
10.3	Detection	Ionization
10.4	Other	-----

11.0 Fire Loading in Area

11.1 None X (No Further Analysis Required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in ThisArea

TF-F-1-0

1.0 Building: Tank Farm (RWST)

2.0 Fire Area or Zone: TF-F-1-0

- 2.1 Area Name: Refueling Water Storage Tank (RWST) Area
- 2.2 Location: Between PAB & Waste Processing Building
- Drawing No: 805661-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	22'-0" H x 2'-0" Conc. W/Siding to Roof	3 Hr.
		South	22'-0" H x 2'-0" Conc. Dike	-
		East	2'-0" Concrete	3 Hr. (PAB)
		West	2'-0" Concrete	-
3.2	Floor		Concrete	-
3.3	Ceiling		Buildup Roof	-
3.4	Doors		None	-
3.5	Others		-	-

4.0 Floor Area 3,120 Sq. Ft. Length 65'-0" Width 48'-0" Height 60'-0"

5.0 Volume 187,200 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System WAH-FN-59A&B

- 7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection Type

Ref. Deviation No. 2
SBN-904 Dated 12/2/85

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: None
- 10.4 Other: -----

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Piping, Valves & Instruments	CBS	X	X	X
Cabling	CBS	X	X	X
Piping & Valves	CS	X	X	X
Cabling	CS	X	X	X

SW-F-1A-Z

1.0	Building			Service Water Pump House	
2.0	Fire Area or Zone			SW-F-1A-Z	
	2.1	Area Name		Circulating Water Pump	
	2.2	Location		North Side El 21' – 0"	
		Drawing No		9763-F-202476 – FP, 20247	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Metal	Outside
			South	Concrete	1 ½ Hr.*
			East	Metal	Outside
			West	Metal	Outside
	3.2	Floor		Grating/Concrete	-
	3.3	Ceiling		Concrete/Fiberboard	Outside
	3.4	Doors		Metal	-
	3.5	Others		Exposed Steel Beams	-

4.0 Floor Area 14,800 Sq. Ft. Length 125' Width 118.67' Height 29.83'

5.0 Volume 442,500 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X (Grating)

7.0 Exhaust Ventilation System Wall Exhaust

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
	8.1 Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	Yes ______	No X
	9.2 Airborne	Yes ______	No X

		Type
10.0	Fire Protection	
	10.1 Primary	Fire Extinguisher(s)
	10.2 Secondary	Yard Hydrant
	10.3 Detection	None
	10.4 Other	----

11.0 Fire Loading in Area

11.1 Refer to page 2.

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* 2' -0"X1' –8" Trash Through Penetration Is Not Fire Rated.
Ref. Deviation No. 3 SBN-904 Dated 12/2/85

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related

No Safety Related or Safe Shutdown Equipment in This Area

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	145.5	Gallons	1,475	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	3,577.1	Pounds	3,141.9	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 4,616.9 Btu/Sq. Ft.
Total Combustibles: 68,336,500 Btu

14.0 Design-Basis Fire Description

(A) One of the three (3) circulating water pumps ruptures and the entire contents (32.5 gallon/unit x 1 = 32.5 gallons) of oil will spill down and be contained in the cubicle at pit floor at elevation 4' –0". This will cover an area of approximately 16' –0" x 26' –0" = 416 sq. Ft. The entire contents will ignite and burn.

(B) The oil from one of the three circulating water pump traveling screens spills on the floor and the total of 70.5 gallons of oil will ignite and burn covering an area of 15' -0" x 60' -0" = 900 sq. ft.

14.1 DBF Fire Loading 11, 719 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire 476 °F

14.3 Duration of Fire 4 ½ Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of affected service water pump due to loss of oil. Fire duration is less than 5 minutes and affected pit is separated from adjoining pit by a concrete structure.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Not applicable (neither automatic suppression system nor fire detection system is present). Effect will be the loss of affected pump.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable (automatic suppression system does not exist).

18.0 Containing the Design Basis Fire in the Fire Area/Zone

18.1 The pit of each pump is surrounded by a concrete structure. The fire duration is less than 5 minutes and the pit is 16.0 feet deep.

A fire involving a traveling screen will not spread to other fire zones. The subject fire zone is separated from other zones by a concrete structure. The exception is an opening in the trench loading to SW-F-1E-Z. Exhaust air moment, however, is away from SW-F-1E-Z and therefore the fire will not spread to this fire zone.

19.0 How Is Redundant Safe Shutdown Equipment in Same Area Protected

19.1 There is no safe shutdown equipment in the affected area.

SW-F-1B-A

1.0	Building			Service Water Pump House	
2.0	Fire Area or Zone			SW-F-1B-A	
	2.1	Area Name		Electrical Control Room "A"	
	2.2	Location		Southwest El 22'-0"	
		Drawing No		9763-F-202476-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	3 Hr.
			East	Concrete	1½ Hr.
			West	Concrete	1½ Hr./Outside
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete	3 Hr.
	3.4	Doors		Metal	3 Hr./ -
	3.5	Others		Exposed Steel Beams	-

4.0 Floor Area 725 Sq. Ft. Length 31' Width 23.3' Height 17.5'

5.0 Volume 12,700 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Pressurized Supply

7.1 Percentage of System's Capacity 100%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
	8.1 Outside Area at Exit Points	Yes X	No ______
9.0	Operational Radioactivity		
	9.1 Equipment/Piping	Yes ______	No X
	9.2 Airborne	Yes ______	No X

10.0	Fire Protection		Type
	10.1	Primary	Fire Extinguisher(s)
	10.2	Secondary	Yard Hydrant
	10.3	Detection	Ionization
	10.4	Other	-----

11.0 Fire Loading in Area

11.1 Total Combustibles: 182,000 Btu

11.2 Design Basis Fire: No Design Basis Fire postulated

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
460 Motor Control Centers E514	EDE	X		X
Cabling	EDE	X		X
Cabling	SW	X		X
Cabling	SWA	X	X	X
Temp. Switches	SWA	X	X	X
Cabling	CW	X		

SW-F-1C-A

1.0	Building			Service Water Pump House	
2.0	Fire Area or Zone			SW-F-1C-A	
	2.1	Area Name		Electrical Control Room "B"	
	2.2	Location		Southwest El 22'-0"	
		Drawing No		9763-F-202476-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr.
			South	Concrete	Outside
			East	Concrete	1½ Hr.
			West	Concrete	Outside/1½ Hr.
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete	Outside
	3.4	Doors		Metal	3 Hr./1½ Hr.
	3.5	Others		Exposed Steel Beams	-

4.0 Floor Area 375 Sq. Ft. Length 23.3' Width 16' Height 17.5'

5.0 Volume 6,530 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Pressurized Supply

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

10.1 Primary: Fire Extinguisher (s)

10.2 Secondary: Yard Hydrant

10.3 Detection: Ionization

10.4 Other: -----

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Temp. Switches	SWA	X	X	X	
Cabling	SWA	X	X	X	X
460v-Motor Control Centers E614	EDE		X	X	X
Cabling	SW		X	X	X
Cabling	SWA		X	X	X

SW-F-1D-A

1.0	Building			Service Water Pump House	
2.0	Fire Area or Zone			SW-F-1D-A	
	2.1	Area Name		Fan Room	
	2.2	Location		Southwest El 22'-0"	
		Drawing No		9763-F-202476-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	Outside
			East	Concrete	1½ Hr.
			West	Concrete	Outside
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete	Outside
	3.4	Doors		Metal	-
	3.5	Others		-	-

4.0 Floor Area 110 Sq. Ft. Length 16.5' Width 6.6' Height 17.5'

5.0 Volume 1,925 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Electrical Room Vent System

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0	Fire Protection		Type
	10.1	Primary	Fire Extinguisher (s)
	10.2	Secondary	Yard Hydrant
	10.3	Detection	Ionization
	10.4	Other	-----

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Fan-FN-40A	SWA	X		X
Cabling	SWA	X	X	X
Fan FN-40B	SWA		X	X

SW-F-1E-Z

1.0 Building: Service Water Pump House

2.0 Fire Area or Zone: SW-F-1E-Z

- 2.1 Area Name: Service Water Pump Area
- 2.2 Location: South Side El 21'-0"
- Drawing No: 9763-F-202476-FP & 202478 – FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	1 ½ Hr. *
		South	Concrete	Outside
		East	Concrete	Outside
		West	Concrete	1½ Hr.
3.2	Floor		Grating/Concrete	-
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	1½ Hr.
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 8,500 Sq. Ft. Length 114.6' Width 74' Height 27.25'

5.0 Volume 231,250 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X (Grating)

7.0 Exhaust Ventilation System: Wall Exhaust

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher (s)
- 10.2 Secondary: Yard Hydrant
- 10.3 Detection: Ionization
- 10.4 Other: -----

---

* 2' –0" X 1' –8" Trash Through Penetration Is Not Fire Rated.
Ref: Deviation No. 3 SBN-904 Dated 12/2/85

11.0 Fire Loading in Area

11.1 Refer to page 2 of 3.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Pump P-41A	SW	X		X
Cabling	SW	X	X	X
Pump P-41C	SW	X		X
Piping, Valves & Instruments	SW	X	X	X
Pump P-41B	SW		X	X
Pump P-41D	SW		X	X
Instrument Rack IR - 73	MM	X	X	X
Fans FN – 38A & 38B	SWA	X	X	X
Dampers DP – 39A & 39B	SWA	X	X	X
Temp. Switches	SWA	X	X	X
Cabling	SWA	X	X	X
FLEX Equipment	FLEX			

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire		Fire Loading in Area	
Oil:	357.9	Gallons	6,316.1	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:	5,889.8	Pounds	5,543.3	Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	15,562.1	Pounds	23,800.7	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Cables:	919.6	Pounds	1,136	Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 36,796.1 Btu/Sq. Ft.

Total Combustibles: 312,768,000 Btu

14.0 Design-Basis Fire Description

(A) Two out of a total of four service water pumps rupture. Total oil content of 26.5 gallons spills to the pit floor at elevation 4' –0" and burns completely, covering an area of 342 square feet.

14.1	DBF Fire Loading	11,623	Btu/Sq. Ft.
14.2	Peak Area/Zone Temp. During Fire	804	°F
14.3	Duration of Fire	4.5	Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 The affected circulating water pumps are lost due to loss of oil.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Because of the remote location from the control room, the short duration of fire (less than five minutes and manual fire protection systems consisting of fire hydrant and fire extinguishers, only the affected circulating water pumps may be lost.

17.0 Consequences of in Advertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable (automatic suppression system does not exist).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 The subject zone is surrounded by a concrete structure which separates adjoining fire zones with the exception of the opening however, is away from SW-F-1A-Z, and therefore, the fire will not spread to other fire zone.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 There is no safe shutdown equipment in the subject fire zone.

SW-F-2-0

1.0	Building			Service Water Intake & Discharge Structure	
2.0	Fire Area or Zone			SW-F-2-0	
	2.1	Area Name		Service Water Intake & Discharge Structure	
	2.2	Location		E – 6500, N-10,000 & N-9,990	
		Drawing No		9763 – F – 300245 - FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	Outside
			South	Concrete	Outside
			East	Concrete	Outside
			West	Concrete	Outside
	3.2	Floor		Grating	Outside
	3.3	Ceiling		Concrete	Outside
	3.4	Doors		Tornado/Missile	-
	3.5	Others		-	-

4.0 Floor Area 2,086/1,876 Sq. Ft. Length 75'/67' Width 74'/67' Height 101'/101'

5.0 Volume 210,686/189,476 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System None

7.1 Percentage of System's Capacity N/A

8.0	8 Hr. Emergency Lighting in Area	Yes	______	No	X
8.1	Outside Area at Exit Points	Yes	______	No	______
9.0	Operational Radioactivity				
9.1	Equipment/Piping	Yes	______	No	X
9.2	Airborne	Yes	______	No	X

10.0	Fire Protection	Type
10.1	Primary	Portable Extinguishers
10.2	Secondary	Yard Hydrant
10.3	Detection	None*
10.4	Other	-----

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

* Ref.: Deviation No. 2, SBN-904, Dated Dec. 2, 1985

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
SW-V-44	SW	X	X	X
SW-V-63	SW	X	X	X
Piping & Valves	SW	X		X
Cabling	SW	X		

CT-F-1C-A

1.0	Building			Cooling Tower	
2.0	Fire Area or Zone			CT-F-1C-A	
	2.1 Area Name			Switchgear Room Unit #1 Train "B"	
	2.2 Location			East Side El 22' –0"	
	Drawing No			9763-F -805068-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1 Walls	North		Concrete	Outside
		South		Concrete	3 Hr.
		East		Concrete	Outside
		West		Concrete	1½ Hr.
	3.2 Floor			Concrete	Outside
	3.3 Ceiling			Concrete	1½ Hr.
	3.4 Doors			Metal	3 Hr./1½ Hr.
	3.5 Others			Exposed Ceiling Beams	-

4.0 Floor Area 615 Sq. Ft. Length 25' Width 24.5' Height 22'

5.0 Volume 13,500 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Pressurized Supply

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

10.1 Primary: Fire Extinguisher(s)

10.2 Secondary: Yard Hydrant

10.3 Detection: Ionization

10.4 Other: ------

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued page 2)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Temp. Switches	SWA		X	X	
480v Subst. E64	EDE		X	X	
Cabling	EDE		X	X	
460v – Motor Control Centers MCC-E-641	EDE		X	X	X
Cabling	SW		X	X	X
Cabling	SWA		X	X	

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Combustible	Quantity	Unit	Fire Loading	Unit
Note:				
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	30	Pounds	634	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 634 Btu/Sq. Ft.
Total Combustibles: 390,000 Btu

14.0 Design-Basis Fire Description

1. The combustible portions of the racking tool ignite and burn over an area covering 2 ft. x 2.2 ft = 4.4 ft^2. This is the approximate size of breaker racking tool.
2. The entire combustible content of the tool burns.

14.1 DBF Fire Loading 88,636 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. Fire 165 °F

14.3 Duration of Fire 93 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Train B service water may not be available due to smoke damage. Thermal damage is expected to be minimal.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with manual hose lines.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable. There is no fire suppression in the subject area.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire would be extinguished using portable extinguishers and/or hose lines.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 The redundant Train A equipment and cables are located in a separate fire area.

CT-F-1D-A

1.0	Building			Cooling Tower	
2.0	Fire Area or Zone			CT-F-1D-A	
	2.1	Area Name		Switchgear Room Unit #1 Train "A"	
	2.2	Location		East Side El 22' –0"	
		Drawing No		9763-F -805068	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete	3 Hr.
			South	Concrete	3 Hr
			East	Concrete	Outside
			West	Concrete	1½ Hr.
	3.2	Floor		Concrete	1½ Hr./Outside
	3.3	Ceiling		Concrete	1½ Hr.
	3.4	Doors		Metal	3 Hr./1½ Hr.
	3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 615 Sq. Ft. Length 25' Width 24.5' Height 22'

5.0 Volume 13,500 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Pressurized Supply

7.1 Percentage of System's Capacity 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

		Type
10.0 Fire Protection		
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Yard Hydrant
10.3	Detection	Ionization
10.4	Other	------

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued page 2)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
460v Motor Control Centers E-513	EDE	X		X	
Cabling	EDE	X		X	
Cabling	SW	X		X	X
Cabling	SWA	X		X	
Temp. Switches	SWA	X		X	

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Combustible	Quantity	Unit	Fire Loading	Unit
Note:				
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	27	Pounds	571	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 571 Btu/Sq. Ft.
Total Combustibles: 351,000 Btu

14.0 Design-Basis Fire Description

3. For conservatism the ladders are assumed to be in a vertical position. The bottom of both sets of rails are ignited and burn upward.

4. To add conservatism, it is assumed that the fire is self sustaining although the fire is not severe and has a low heat release rate.

5. The fire area will be limited to the length of the ladder and about 2 feet from the wall for an area covering 20 ft. X 2 ft. = 40 sq. ft.

14.1 DBF Fire Loading 8775 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. Fire 165 °F

14.3 Duration of Fire >> 5 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Train a service water may not be available due to smoke damage. Thermal damage is expected to be minimal.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with manual hose lines.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.3 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.4 The fire would be extinguished using portable extinguishers and/or hose lines.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 The redundant Train B equipment and cables are located in a separate fire area.

CT-F-2B-A

1.0 Building — Cooling Tower

2.0 Fire Area or Zone — CT-F-2B-A

- 2.1 Area Name — Ventilation & Mech. Rooms For Unit #1
- 2.2 Location — East Side El 46' –0"
- Drawing No — 9763-F -805068-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	3 Hr
		East	Concrete	Outside
		West	Concrete	Outside
3.2	Floor		Concrete	1½ Hr./ -
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr./1½ Hr.
3.5	Others		Exposed Ceiling Beams	-

4.0 Floor Area 3,575 Sq. Ft. Length 71.5' Width 50' Height 29.5'

5.0 Volume 105,460 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System — Roof Ventilators

- 7.1 Percentage of System's Capacity — 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary — Fire Extinguisher(s)
- 10.2 Secondary — Yard Hydrant
- 10.3 Detection — Ionization
- 10.4 Other — ------

11.0 Fire Loading in Area

- 11.1 Refer to page 2 (analysis continued page 2 & 3).

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Pump – P – 110A	SW	X		X	
Cabling	SW	X		X	X
Pump – P –110B	SW		X	X	
Piping & Valves	SW	X	X	X	X
Fan FN – 64	SWA	X		X	
Cabling	SWA	X		X	
Fan FN – 63	SWA		X	X	
Damper Dp – 65, 66	SWA		X	X	

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:				
Oil:	26.5	Gallons	1,112	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	43	Pounds	156	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 1,268 Btu/Sq. Ft.

Total Combustibles: 3,975,000 Btu

14.0 Design-Basis Fire Description

1. One of the two (2) Service Water Pumps rupture, oil spills on the floor. For conservatism, the oil from the other pump is added to the spill, therefore a total of 26.5 gallons of oil is assumed spilled.

2. This oil is assumed to cover an area of approximately 350 square feet. It ignites and burns completely.

14.1 DBF Fire Loading 1,112 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire 1658 °F

14.3 Duration of Fire <5 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with portable extinguishers.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire would be extinguished using portable extinguishers and/or fire hoses.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

CT-F-3-0

1.0 Building: Cooling Tower

2.0 Fire Area or Zone: CT-F-3-0

- 2.1 Area Name: Top of Cooling Tower
- 2.2 Location: Outside – Top of Cooling Tower El. 77' –0"
- Drawing No: 9763-F-805068-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	N/A	N/A
		South	N/A	N/A
		East	N/A	N/A
		West	N/A	N/A
3.2	Floor		N/A	N/A
3.3	Ceiling		N/A	N/A
3.4	Doors		-	-
3.5	Others		-	-

4.0 Floor Area N/A Sq. Ft. Length N/A Width N/A Height N/A

5.0 Volume N/A Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System N/A

- 7.1 Percentage of System's Capacity N/A

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Yard Hydrant
- 10.3 Detection: None
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 Approximately 70 gallons of oil in each Train A fan gear reducer and approximately 30 gallons of oil in each Train B fan gear reducer. Outside location no further analysis required.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
No Equipment Required For Safe Shutdown in This Area					
Fan-FN-1-51A	SW	X		X	
Fan-1-FN-51B	SW		X	X	
Fan-2-FN-51B	SW		X	X	
Fan-2-FN-51A	SW		X	X	
Cabling	SW	X	X	X	

CE-F-1-Z

1.0 Building — Containment Enclosure Ventilation Area

2.0 Fire Area or Zone — CE-F-1-Z

- 2.1 Area Name — Cont. Encl. Ventilation Area & Cont. Annulus **
- 2.2 Location — El. 21'-6"
- Drawing No — 9763-P-805051-FP, 805052-FP, 805053-FP, 805055-FP, 805056-FP, and 805059-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	3 Hr./Outside
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr./1½ Hr. (Stairs)
3.5	Others		Fireproofed Cols	-

4.0 Floor Area 1,633 Sq. Ft. $(\pi \times 130' \times 4') \times 125' = 40,825$ Cu. Ft.

3,060 Sq. Ft. Length 112' Width Varies Height 29.5'

Total 4,693 Sq. Ft. = 90,270 Cu. Ft.

5.0 Volume 131,095 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System — PAB Normal Exhaust System

- 7.1 Percentage of System's Capacity — 30%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary — Fire Extinguisher(s)
- 10.2 Secondary — Standpipe & Hose Reel
- 10.3 Detection — Photoelectric/Ionization/None* /Carbon Monoxide Detection in EAH – F– 9. 69.
- 10.4 Other — Yard Hydrant

11.0 Fire Loading in Area

- 11.1 Refer to page 3 *** (analysis continued pages 2 - 4)

** Cont. Encl. Vent Eq. Area and Cont. Annulus Are in Communication with Each Other Thru Structural Openings.

* Cont. Annulus Portion Has No Detection.
Ref. Deviation No. 2, SBN-904, Dated 12/02/85

*** Charcoal Loading For Both EAH-F-9, 69 Total Is 2100 Lbs. Charcoal. Charcoal Fire Loading Was Not Considered in Total Area. See Appendix D.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Cooling Unit AC-2A	EAH	X		X
Cabling	EAH	X	X	X
Cooling Unit AC – 2B	EAH		X	X
Damper DP – 3A	EAH	X		X
Damper DP – 3B	EAH		X	X
Fan FN – 31A	EAH	X		X
Fan FN – 31B	EAH		X	X
Damper DP – 25A	EAH	X		
Damper DP – 25B	EAH		X	
Cabling	PAH		X	X
Damper DP – 35B, 36b	PAH		X	X
Filters F – 9, 69	EAH	X	X	X
Fan FN-4A, B	EAH	X	X	X
Dampers DP – 30A, B	EAH	X	X	X
Dampers DP – 29A, B	EAH	X	X	X
Cabling	SF	X	X	X
Cabling	FAH	X	X	X
Cabling	CC	X	X	X
FN FN – 5A, B	EAH	X	X	X
Damper DP-37A, B	EAH	X	X	X
Instruments	EAH	X	X	X
Piping, Valves, Instruments & Cabling	CAP	X	X	X
Damper DP – 13A, B	FAH	X	X	X

13.0 * No 3 hr. Rated fire damper provided in exhaust duct at the point of connection to the unit plant vent.

** No Automatic Detection in Containment Annulus Area.

* Ref: Deviation No. 1
SBN – 904 Dated 12/2/85

** Ref: Deviation No. 2
SBN – 904 Dated 12/2/85

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note: ___________

Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:	2,100	Pounds	*	Btu/Sq. Ft.
Chemicals:	35	Pounds	97	Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2	Total Fire Loading in Area:	97	Btu/Sq. Ft.
	Total Combustibles:	455.000	Btu

14.0 Design-Basis Fire Description

1. For conservatism the ladders are assumed to be in a vertical position. The bottom of both sets of rails are ignited and burn upward.

2. To add conservatism, it is assumed that the fire is self sustaining although the fire is not severe and has a low heat release rate.

3. The fire area will be limited to the length of the ladders and about 2 feet from the wall for an area covering 24 ft. X 2 ft. = 48 ft.^{2}.

14.1	DBF Fire Loading	7313	Btu/Sq. Ft.
14.2	Peak Area/Zone Temp.During Fire	290	°F
14.3	Duration of Fire	>5	Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with portable extinguishers.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

* Charcoal Fire Loading was not considered in total area. See Appendix D.

18.2 The fire would be extinguished using hose lines and/or portable extinguishers.

19.0 How the Redundant Safe Shutdown Equipment in the Area Is Protected

19.1 Refer to Seabrook Station Fire Protection of Safe Shutdown Capability (10 CFR 50, App. R).

FPH-F-1A-A

1.0 Building — Fire Pump House

2.0 Fire Area or Zone — FPH-F-1A-A
- 2.1 Area Name — Diesel Pump Room - West
- 2.2 Location — EL 21'-0"
- Drawing No — 9763-F-300831-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Metal	Outside
		South	Metal	Outside
		East	Concrete	3 Hr.
		West	Metal	Outside
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	-
3.4	Doors		Metal	3 Hr./ -
3.5	Others		Exposed Steel Beams	-

4.0 Floor Area 825 Sq. Ft. Length 30' Width 27.5' Height 17'

5.0 Volume 14,025 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System — Pump Room Exhaust System
- 7.1 Percentage of System's Capacity — 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X
- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type
- 10.1 Primary — Wet Pipe Sprinkler System
- 10.2 Secondary — Fire Extinguisher(s)
- 10.3 Detection — Thermal
- 10.4 Other — --------

11.0 Fire Loading in Area
- 11.1 Refer to page 2 (analysis continued pg. 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown

No Safety Related Equipment -

No Equipment Required For Safe Shutdown in This Area

13.0 Design Basis Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:	Oil Fire			
Oil:	6	Gallons	1,091	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	732	Pounds	11,535	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 12,626 Btu/Sq. Ft.
Total Combustibles: 10,416,000 Btu

14.0 Design-Basis Fire Description

1. The engine lube oil system ruptures and the entire contents (6 gallons of oil) are sprayed over the pump room covering an area of 91 square feet. Oil film thickness is 1/8”.

2. Oil is ignited, burned and consumed.

14.1 DBF Fire Loading 9,890 Btu/Sq. Ft.

14.2 Fire Area Peak Temperature 1,967 ºF

14.3 Fire Duration 4 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of diesel fire pump engine.

15.2 Loss of controls to pump engine.

15.3 Redundant pump, located in separate fire area.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of diesel fire pump engine due to lose of oil.

16.2 Possible loss of engine controls.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Possible loss of engine controls.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 The fire duration is short, therefore, the structure will contain the fire. The consequences of fire are mitigated further by operation of the sprinkler system.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable. (see 15.1) fire pumps are not required for safe shutdown nor are they safety related.

FPH-F-1B-A

1.0 Building: Fire Pump House

2.0 Fire Area or Zone: FPH-F-1B-A
- 2.1 Area Name: Electric Pump Room
- 2.2 Location: El 21' –0"
- Drawing No: 9763-F-300831-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Metal	Outside
		South	Metal	Outside
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	-
3.4	Doors		Metal	3 Hr./ -
3.5	Others		Exposed Steel Beams	-

4.0 Floor Area 480 Sq. Ft. Length 16' Width 30' Height 17'

5.0 Volume 8,160 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: Pump Room Exhaust System
- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X
- 8.1 Outside Area at Exit Points Yes X No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type
- 10.1 Primary: Wet Pipe Sprinkler System
- 10.2 Secondary: Fire Extinguisher(s)
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area
- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown

No Safety Related Equipment -

No Equipment Required For Safe Shutdown in This Area

FPH-F-1C-A

1.0	Building			Fire Pump House	
2.0	Fire Area or Zone			FPH-F-1C-A	
	2.1	Area Name		Diesel Pump Room East	
	2.2	Location		El 21’-0”	
		Drawing No		9763-F-300831-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Metal	Outside
			South	Metal	Outside
			East	Metal	Outside
			West	Concrete	3 Hr.
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete	-
	3.4	Doors		Metal	3 Hr./ -
	3.5	Others		Exposed Steel Beams	-

4.0 Floor Area 825 Sq. Ft. Length 30' Width 27.5' Height 17'

5.0 Volume 14,025 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: Pump Room Exhaust System

7.1 Percentage of System's Capacity: 100%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points	X	
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne		X

		Type
10.0	Fire Protection	
10.1	Primary	Wet Pipe Sprinkler System
10.2	Secondary	Fire Extinguisher(s)
10.3	Detection	Thermal
10.4	Other	------

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued pg. 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown

No Safety Related Equipment -

No Equipment Required For Safe Shutdown in This Area

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) / Fire Loading in Area

Note:	Oil Fire			
Oil:	6	Gallons	1,091	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	33	Pounds	520	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 1,611 Btu/Sq. Ft.
Total Combustibles: 1,329,000 Btu

14.0 Design-Basis Fire Description

1. the Engine Lube Oil System Ruptures and the Entire Contents (6 Gallons of Oil) Are Sprayed Over the Pump Room Covering An Area of 91 Square Feet. Oil Film Thickness Is 1/8”.

2. Oil Is Ignited, Burned and Consumed.

3. Duration of Fire Is 1 ½ Minutes.

14.1	DBF Fire Loading	9,890	Btu/Sq. Ft.
14.2	Fire Area Peak Temperature	1,916	ºF
14.3	Fire Duration	4	Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of diesel fire pump engine.

15.2 Loss of controls to pump engine.

15.3 Redundant pump, located elsewhere, is unaffected.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of diesel fire pump engine due to loss of oil.

16.2 Possible loss of engine controls.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable (no water suppression in area).

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 The fire duration is short therefore the structure will contain the fire.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable (see 15.3). Fire pumps are not required for safe shutdown nor are they safety related.

TB-F-1A-Z

1.0 Building: Turbine Building

2.0 Fire Area or Zone: TB-F-1A-Z

- 2.1 Area Name: Ground Floor
- 2.2 Location: El 21' –0" Southwest
- Drawing No: 9763-F -202052-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete/Block	-
		South	Concrete/Metal	3 Hr./Outside
		East	-	-
		West	Concrete/Block	3 Hr.
3.2	Floor		Concrete	Outside
3.3	Ceiling		Grating	-
3.4	Doors		Metal	3 Hr.
3.5	Others		-	-

4.0 Floor Area: 21,185 Sq. Ft. / 7,852 Sq. Ft. Length Varies Width Varies Height 25'

5.0 Volume: 21,675 / 196,312 Cu. Ft.

6.0 Floor Drains: Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System: Power Roof Ventilators

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area: Yes X No ______

- 8.1 Outside Area at Exit Points: Yes X No ______

9.0 Operational Radioactivity

- 9.1 Equipment/Piping: Yes ______ No X
- 9.2 Airborne: Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Wet Pipe Sprinkler System
- 10.2 Secondary: Standpipe & Hose Reel
- 10.3 Detection: None
- 10.4 Other: Fire Extinguisher(s)

11.0 Fire Loading in Area

- 11.1 Refer to page 3.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Cabling	EDE	X	X	
Non Seg Bus Feeder For 4160v Swgr E5	EDE	X		
Non Seg Bus Feeder For 4160v Swgr E6	EDE		X	
Air Compressor SA-SKD-137A, SA-SKD-137B, SA-SKD-137C	SA	X	X	
Instruments	SA	X	X	
Piping & Valves	SA	X	X	
Dryer SKD–18A, 18B	IA	X	X	
Cabling	SA	X	X	
Cabling	IA	X	X	
Cabling	FW	X	X	X
Cabling	MS	X	X	X
125 V Dc Switch Gear 12A, 12B	EDE	X		
Pump P-113	FW	X		
Cabling	CO	X		
PAA Skid SKD-900	CAS			
Security Enclosure, 1-SFD-MM-2009	SFD			

13.0 Design Base Fire

13.1

Combustible in Area (In Situ)			Fire Loading in Area	
Note:	Oil Fire			
Oil:	961	Gallons	3,372	Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:	1,677.3 (PAA)	Pounds	420.2	Btu/Sq. Ft.
Plastics:	109	Pounds	33.1	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:		Pounds		Btu/Sq. Ft.
Hydrogen	2,860	Cubic Feet	22	Btu/Sq. Ft.

13.2 Total Fire Loading in Area: 3,847.3 Btu/Sq. Ft.
Total Combustibles: 164,472,075 Btu

14.0 Design-Basis Fire Description

(a) The single largest quantity of oil, 680 gallons, which is associated with hydrogen seal unit, is spilled over a curbed area of 320 square feet and burned completely.

(b) Ventilation supply air thru open louvers and exhaust air thru roof ventilators is passing over the fire area providing oxygen for burning.

(c) Oil fire causes spill and ignition of PAA, contributing to DBF.

14.1 DBF Fire Loading 639,536 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire 222 °F

14.3 Duration of Fire 130 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Hydrogen seal unit is lost because of loss of oil leading to eventual trip.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Hydrogen seal unit may be lost because of loss of oil possibly leading to reactor trip.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Inadvertent actuation of deluge sprinkler system will cause minor flooding. Hydrogen seal unit is unaffected. Floor is sloped for drainage.

18.0 Containing the Design Basis Fire in the Fire Area/Zone

18.1 The entire spill of oil is isolated by a curbed area from surroundings. The fire will be contained locally.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable as no redundant safe shutdown equipment in the vicinity of the affected zone.

TB-F-1B-A

1.0 Building: Turbine Building

2.0 Fire Area or Zone: TB-F-1B-A

- 2.1 Area Name: Battery Room
- 2.2 Location: El 21' –0" SW Corner
- Drawing No: 9763-F-202052

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete/Block	3 Hr.
		South	Concrete/Block	3 Hr.
		East	Concrete/Block	3 Hr.
		West	Concrete/Block	3 Hr.
3.2	Floor		Concrete	3 Hr.
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	3 Hr.
3.5	Others		Fireproof Ceiling Beams	3 Hr. *

4.0 Floor Area 450 Sq. Ft. Length 28'-0" Width 16'-0" Height 14'-4"

5.0 Volume 6,422 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System: Wall Exhaust Fan

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe & Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: Yard Hydrant

11.0 Fire Loading in Area

- 11.1 Refer to page 2 of 3

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* Fire Proofing Not Required By Steel Analysis.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Battery B-2A, B	ED	X		

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note: Class A Material Fire

Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	1,888	Pounds	67,568	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 67, 568 Btu/Sq. Ft.
Total Combustibles: 30,405,532 Btu

14.0 Design-Basis Fire Description

(A) Fire Starts Involving the Battery Cells.

(B) the Fire Spreads To Involve All Battery Cells.

(C) This Area Is Cut-Off From the Main Turbine Ground Floor By Fire Rated Construction. A Fire Is Not Expected To Propagate Beyond This Area.

14.1 DBF Fire Loading 67.568 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire >750 °F

14.3 Duration of Fire >5 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of batteries.

15.2 Refer to Seabrook Station Safe Shutdown Capability "Appendix R" analysis.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of one of two batteries.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable. No water suppression in area.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Area is separated from the main turbine building ground floor by fire rated barriers.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 See 15.0 above.

TB-F-1C-Z

1.0	Building			Turbine Building	
2.0	Fire Area or Zone			TB-F-1C-Z	
	2.1	Area Name		Relay Room	
	2.2	Location		Northwest El. 21' –0"	
		Drawing No		9763-F -202052	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete/Block	-
			South	Concrete/Block	-
			East	Concrete/Block	-
			West	Concrete/Block	3 Hr.
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete Plank	-
	3.4	Doors		Metal	3 Hr.
	3.5	Others		-	-

4.0 Floor Area 2,600 Sq. Ft. Length 80'-0" Width 32'-6" Height 14'-0"

5.0 Volume 36,400 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X None ______

7.0 Exhaust Ventilation System TAH-FN-127 & TAH-FN-67

7.1 Percentage of System's Capacity 7.6%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
8.1	Outside Area at Exit Points	Yes ______	No X
9.0	Operational Radioactivity		
9.1	Equipment/Piping	Yes ______	No X
9.2	Airborne	Yes ______	No X

10.0	Fire Protection	Type
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe & Hose Reel
10.3	Detection	Ionization
10.4	Other	------

11.0 Fire Loading in Area

11.1 Refer to page 2 of 3.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Control Panel CP-84	SY	X	X		X
Cabling	EDE	X	X		X
Control Panel CP-85	SY	X	X		X
Control Panel CP-86	SY	X	X		X
Control Panel CP-87	SY	X	X		X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note: Class A Material Fire

Material	Quantity	Unit	Fire Loading	Unit
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	544	Pounds	32,650	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 32,650 Btu/Sq. Ft.
Total Combustibles: 8,800,000 Btu

14.0 Design-Basis Fire Description

A. Fire starts in one of the two battery rooms.

B. The fire spreads to involve all the battery cells within the room.

14.1 DBF Fire Loading 36,300 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire 1,040 °F

14.3 Duration of Fire 41 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of battery function.

15.2 Refer to Seabrook Station Safe Shutdown Capability "Appendix R" analysis.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Loss of one of two batteries.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable. No water suppression in zone.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Batteries are not separated from relay room by fire-rated construction. Effects from battery fire may propagate to relay room. See 15.0 above.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 See 15.0 above.

TB-F-2-Z

1.0 Building: Turbine Building

2.0 Fire Area or Zone: TB-F-2-Z

- 2.1 Area Name: Mezzanine (*Hallway*[*])
- 2.2 Location: El 50' –0" SW Corner (*El 75' –0" SW Corner)*
- Drawing No: 9763-F –202053-FP *(9763-F –202054-FP)*

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	- / *(Concrete)*	- *(-)*
		South	Concrete/Metal *(Concrete/Metal)*	3 Hr./Outside *(3 Hr./Outside)*
		East	- *(-)*	- *(-)*
		West	Concrete *(Concrete)*	3 Hr./Outside *(Outside)*
3.2	Floor		Grating *(Concrete)*	- *(-)*
3.3	Ceiling		Concrete *(-)*	- *(-)*
3.4	Doors		Metal *(Metal)*	3 Hr./ - *(3 Hr.)*
3.5	Others		-	- *(-)*

4.0 Floor Area 3,250 *(650)* Sq. Ft. Length 50' *(10')* Width 65' *(65')* Height 25' *(25')*

5.0 Volume 81,250 *(16,250)* Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System: Power Roof Ventilator

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes X No ______

- 8.1 Outside Area at Exit Points Yes X No *(X)*

9.0 Operational Radioactivity (Hallway & Mezzanine)

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Wet Pipe Sprinkler System
- 10.2 Secondary: Fire Extinguisher(s)
- 10.3 Detection: None
- 10.4 Other: Standpipe & Hose Reel

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

[*] Entries for Hallway in parenthesis and italicized for differentiation

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Control Panel CP-414 Control Panel CP-558	FP	X		
Cabling	CBA	X		
Cabling	EDE	X		
Cabling	SA	X		
Cabling	MS	X	X	X

TB-F-3-Z

1.0	Building		Turbine Building	
2.0	Fire Area or Zone		TB-F-3-Z	
	2.1 Area Name		SAS & Computer Rooms, Start-Up & Turbine Erector's Office – Electronic Work Area	
	2.2 Location		El 75' –0" SW Corner	
	Drawing No		9763-F –202054-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
	3.1 Walls	North	Concrete	-
		South	Concrete	-
		East	Concrete	-
		West	Metal	Outside/3 Hr.
	3.2 Floor		Concrete	-
			Class I Interior Floor Finish	
	3.3 Ceiling		Concrete	-
	3.4 Doors		Metal	-
	3.5 Others		-	-

4.0 Floor Area 4,030 Sq. Ft. Length 62' Width 65' Height 25'

5.0 Volume 100,750 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System Office Air Conditioning System

7.1 Percentage of System's Capacity 10%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No X

9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type (Sprinkler system above rooms)

10.1 Primary — Fire Extinguisher(s)

10.2 Secondary — Standpipe & Hose Reel

10.3 Detection — Ionization & Photoelectric

10.4 Other — ------

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued pg. 2 & 3)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown

No Safety Related Equipment Required For Safe Shutdown in This Zone

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note: Class A Material Fire

Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:	4,500	Pounds	12,630	Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:		Pounds		Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 12,630 Btu/Sq. Ft.
Total Combustibles: 36,000,000 Btu

14.0 Design-Basis Fire Description

A. Fire starts in an office waste paper basket.

B. Fire spreads throughout the entire fire zone consuming all combustibles (class a material).

C. The affected zone is isolated from ventilation air by the fire damper, allowing only partial combustibles to burn.

14.1 DBF Fire Loading 12,630 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. During Fire 690 °F

14.3 Duration of Fire Eight (8) Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 Loss of occupancy of the offices and electronic work room.

15.2 There is no safe shutdown nor safety related equipment in the zone. Therefore, the consequences of a design basis fire will not be serious.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 Possible loss of occupancy of the subject area.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable. No water suppression in area.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Separation from the control room by a three-hour-rated fire barrier prevents loss of any safety-related function..

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable (see 15.2)

PP-F-1A-Z

1.0 Building: Mechanical Penetration Area

2.0 Fire Area or Zone: PP-F-1A-Z

- 2.1 Area Name: Radioactive Piping Area
- 2.2 Location: Northeast Corner – El. (-) 34’ –6”, (-) 20’ –0”
- Drawing No: 9763-F -311429-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete	-
		East	Concrete	3 Hr.
		West	Concrete/Open	-
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	-
3.4	Doors		-	-
3.5	Others		-	-

4.0 Floor Area 450 Sq. Ft. Length 36' Width Varies Height 22'

5.0 Volume 9,900 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System EAH (Non-Ducted)

- 7.1 Percentage of System's Capacity 33%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ----

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Piping & Valves	CS	X	X	X	X
Piping & Valves	RC	X	X	X	
Piping & Valves	RH	X	X	X	
Piping & Valves	CBS	X		X	
Cabling	RH	X	X	X	
Cabling	CBS	X		X	
Cabling	CS	X	X	X	X
Cabling	RC	X	X	X	
Instrumentation	SI	X		X	

PP-F-1B-Z

1.0 Building: Mechanical Penetration Area

2.0 Fire Area or Zone: PP-F-1B-Z

- 2.1 Area Name: Radioactive Piping Area
- 2.2 Location: El. (-) 26' –0" & (-) 34' –6"
- Drawing No: 9763-F -311429-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete/Open	-
		South	Concrete/Open	-
		East	Concrete	3 Hr.
		West	Concrete/Open	-
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	-
3.4	Doors		-	-
3.5	Others		-	-

4.0 Floor Area 441 Sq. Ft. Length Varies Width Varies Height 16' & 22'

5.0 Volume 7,704 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System EAH (Non-Ducted)

- 7.1 Percentage of System's Capacity 33%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ----

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Piping & Valves	RH		X	X	X
Cabling	SI	X	X	X	
Cabling	CS	X	X	X	
Piping & Valves	CBS	X	X	X	
Piping & Valves	RC	X		X	
Piping & Valves	SI	X	X	X	
Cabling	RH		X	X	
Cabling	RC	X		X	
Instruments	SI	X		X	
Piping & Valves	VG	X		X	
Cabling	VG	X		X	
Piping & Valves	WLD	X		X	
Instrument Rack IR-13A	MM	X		X	
Temperature Elements & Cabling	MM	X	X	X	

PP-F-2A-Z

1.0 Building: Mechanical Penetration Area

2.0 Fire Area or Zone: PP-F-2A-Z

- 2.1 Area Name: Radioactive Piping Area
- 2.2 Location: Northwest Corner – El. (-) 34' –6"
- Drawing No: 9763-F-311429-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	3 Hr.
		South	Concrete/Open	-
		East	Concrete/Open	-
		West	Concrete	3 Hr.
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	-
3.4	Doors		None	-
3.5	Others		-	-

4.0 Floor Area 252 Sq. Ft. Length 18' Width 14' Height 35'-6"

5.0 Volume 8,946 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System EAH (Non-Ducted)

- 7.1 Percentage of System's Capacity 33%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe & Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ----

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	SI	X		X	
Cabling	CS	X		X	X
Cabling	CBS	X		X	
Cabling	RH	X		X	
Cabling	RC	X		X	

PP-F-2B-Z

1.0	Building			Mechanical Penetration Area	
2.0	Fire Area or Zone			PP-F-2B-Z	
	2.1	Area Name		Radioactive Piping Area	
	2.2	Location		Southwest – El. (-) 26’ –0”	
		Drawing No		9763-F-311429-FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
	3.1	Walls	North	Concrete/Open	-
			South	Concrete	-
			East	Concrete/Open	-
			West	MCG	3 Hr.
	3.2	Floor		Concrete	Outside
	3.3	Ceiling		Concrete	-
	3.4	Doors		Metal	3 Hr.
	3.5	Others		-	-

4.0 Floor Area 157 Sq. Ft. Length 16'-6" Width 9'-6" Height 16'

5.0 Volume 2,512 Cu. Ft.

6.0 Floor Drains Nuclear X Non-Nuclear ______ None ______

7.0 Exhaust Ventilation System EAH (Non-Ducted)

7.1 Percentage of System's Capacity 33%

8.0	8 Hr. Emergency Lighting in Area	Yes ______	No X
8.1	Outside Area at Exit Points	Yes ______	No X
9.0	Operational Radioactivity		
9.1	Equipment/Piping	Yes X	No ______
9.2	Airborne	Yes X	No ______

10.0	Fire Protection	Type
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe & Hose Reel
10.3	Detection	Ionization
10.4	Other	----

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	CC		X	X	X
Cabling	CS	X	X	X	
Cabling	RH		X	X	
Cabling	CBS	X	X	X	
Cabling	RC	X		X	
Cabling	SI	X	X	X	

PP-F-3A-Z

1.0	Building		Mechanical Penetration Area	
2.0	Fire Area or Zone		PP-F-3A-Z	
2.1	Area Name		Radioactive Piping Area	
2.2	Location		Northeast Corner, El. (-) 11' –2 ½ "	
	Drawing No		9763-F-311429-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete/Open	3 Hr./ -
		South	Concrete	-
		East	Concrete	3 Hr.
		West	Concrete	-
3.2	Floor		Concrete	-
3.3	Ceiling		Concrete/Open	-
3.4	Doors		-	-
3.5	Others		-	-

4.0 Floor Area 450 Sq. Ft. Length 36' Width Varies Height 12'

5.0 Volume 5,400 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System EAH (Non-Ducted)

7.1 Percentage of System's Capacity 33%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area		X
8.1	Outside Area at Exit Points		X
9.0	Operational Radioactivity		
9.1	Equipment/Piping	X	
9.2	Airborne	X	

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	----

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	CS	X	X	X	X
Instrumentation	SI		X	X	
Piping & Valves	SI	X	X	X	
Piping & Valves	CBS		X	X	
Cabling	SI	X	X	X	
Cabling	CBS		X	X	

PP-F-3B-Z

1.0 Building: Mechanical Penetration Area

2.0 Fire Area or Zone: PP-F-3B-Z

2.1 Area Name: Radioactive Piping Area

2.2 Location: West Central - El. (-) 34' –6" To (-) 11' –2 ½ ", (-) 26' –0"

Drawing No: 9763-F –311429- FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	-
		South	Concrete/Open	-
		East	Concrete	-
		West	Concrete	3 Hr.
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	-
3.4	Doors		-	-
3.5	Others		-	-

4.0 Floor Area 199 Sq. Ft. Length 26'-6" Width 7'-6" Height 35'-6"

5.0 Volume 7,065 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System EAH (Non-Ducted)

7.1 Percentage of System's Capacity 33%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes X No ______

9.2 Airborne Yes X No ______

10.0 Fire Protection — Type

10.1 Primary: Fire Extinguisher(s)

10.2 Secondary: Standpipe and Hose Reel

10.3 Detection: Ionization

10.4 Other: ------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	CS		X	X	X
Cabling	RH		X	X	
Cabling	CBS		X	X	

PP-F-4B-Z

1.0	Building			Mechanical Penetration Area	
2.0	Fire Area or Zone			PP-F-4B-Z	
2.1	Area Name			Non-Radioactive Piping Area	
2.2	Location			El. (-) 8' –0" & (-) 11' –2 ½ "	
	Drawing No			9763-F –311429- FP	
3.0	Construction of Area				
				Material	Min. Fire Rating
3.1	Walls		North	Concrete/Open	-
			South	Concrete/Open	- /Outside
			East	Concrete	3 Hr./ -
			West	Concrete/MCG	- /3 Hr.
3.2	Floor			Concrete	Outside
3.3	Ceiling			Concrete/Open	-
3.4	Doors			Metal	3 Hr.
3.5	Others			-	-

4.0 Floor Area 555 Sq. Ft. Length Varies Width Varies Height Varies

5.0 Volume 5,307 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System EAH (Non-Ducted)

7.1 Percentage of System's Capacity 33%

		Yes	No
8.0	8 Hr. Emergency Lighting in Area	X	
8.1	Outside Area at Exit Points		X
9.0	Operational Radioactivity		
9.1	Equipment/Piping		X
9.2	Airborne	X	

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Standpipe and Hose Reel
10.3	Detection	Ionization
10.4	Other	------

11.0 Fire Loading in Area

11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Piping & Valves	CC	X	X	X	X
Cabling	CC	X	X	X	X
Piping & Valves	CBS		X	X	
Cabling	CBS		X	X	
Cabling	CS		X	X	X

PP-F-5B-Z

1.0 Building: Mechanical Penetration Area

2.0 Fire Area or Zone: PP-F-5B-Z

- 2.1 Area Name: Radioactive Piping Area
- 2.2 Location: South End - El. (-) 34' –6" , (-) 26' –0" & 8' –0"
- Drawing No: 9763-F –311429- FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete/Open	-
		South	Concrete	Outside
		East	Concrete	3 Hr.
		West	Concrete	3 Hr.
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	-
3.4	Doors		-	-
3.5	Others		-	-

4.0 Floor Area 294 Sq. Ft. Length Varies Width Varies Height Varies

5.0 Volume 4,629 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System EAH (Non-Ducted)

- 7.1 Percentage of System's Capacity 33%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type

- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Standpipe and Hose Reel
- 10.3 Detection: Ionization
- 10.4 Other: ------

11.0 Fire Loading in Area

- 11.1 None X (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
No Equipment Required For Safe Shutdown in This Zone					
Piping & Valves	CS	X		X	
Instrumentation	SI	X		X	
Cabling	CS	X		X	
Cabling	SI	X		X	

NES-F-1A-Z

1.0	Building		Non-Essential Switchgear Room	
2.0	Fire Area or Zone		NES-F-1A-Z	
2.1	Area Name		Non-Essential Switchgear Area	
2.2	Location		North of Control Building, El. 21' –6" & 37' –6"	
	Drawing No		9763-F -310289-FP	
3.0	Construction of Area			
			Material	Min. Fire Rating
3.1	Walls	North	Concrete/Block	3 Hr.
		South	Concrete	3 Hr. *
		East	Concrete/Block	3 Hr.
		West	Concrete/Block	Outside
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete/Plank	Outside
3.4	Doors		Metal	3 Hr./Outside
3.5	Others		-	-

4.0 Floor Area 3,552 Sq. Ft. Length 96' Width 37' Height 27'

5.0 Volume 95,904 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear X (El. 37' –6" Only)

7.0 Exhaust Ventilation System SGA

7.1 Percentage of System's Capacity 100%

		Yes		No
8.0	8 Hr. Emergency Lighting in Area	Yes	X	No ______
8.1	Outside Area at Exit Points	Yes	X	No ______
9.0	Operational Radioactivity			
9.1	Equipment/Piping	Yes	______	No X
9.2	Airborne	Yes	______	No X

		Type
10.0	Fire Protection	
10.1	Primary	Fire Extinguisher(s)
10.2	Secondary	Yard Hydrant
10.3	Detection	Ionization
10.4	Other	----

11.0 Fire Loading in Area

11.1 Refer to page 2 (analysis continued page 2)

* Door C-100 Is Not 3 Hr. Fire Rated. (no further analysis required)
Ref. Deviation No. 5, SBN-904, Dated Dec. 2, 1985.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related	Required For Safe Shutdown
Cabling	EDE	X			X
Cabling	ED	X			X
Cabling	RC	X			X

13.0 Design Base Fire

13.1 Combustible in Area (In Situ) — Fire Loading in Area

Note:				
Oil:		Gallons		Btu/Sq. Ft.
Grease:		Pounds		Btu/Sq. Ft.
Class A:		Pounds		Btu/Sq. Ft.
Charcoal:		Pounds		Btu/Sq. Ft.
Chemicals:		Pounds		Btu/Sq. Ft.
Plastics:	30	Pounds	110	Btu/Sq. Ft.
Resins:		Pounds		Btu/Sq. Ft.
Other:				

13.2 Total Fire Loading in Area: 110 Btu/Sq. Ft.
Total Combustibles: 390,000 Btu

14.0 Design-Basis Fire Description

1. The combustible portions of the racking tool ignite and burn over an area covering 2 ft. x 2.2 ft = 4.4 ft^2. This is the approximate size of breaker racking tool.
2. The entire combustible content of the tool burns.

14.1 DBF Fire Loading 88,636 Btu/Sq. Ft.

14.2 Peak Area/Zone Temp. Fire 144 °F

14.3 Duration of Fire 93 Minutes

15.0 Consequences of Design Basis Fire without Fire Protection

15.1 A fire could result in loss of CST level instrumentation due to loss of ED-I-4, ED-PP-5, ED-CP-932, MM-CP-153; loss of RC pump switchgear control power (ED-SWG-1 and ED-SWG-2); loss of Pressurizer heaters C, D and control group power (ED-US-11 and ED-US-23) and loss of offsite power from EDE-SWG-5.

16.0 Consequences of Design Basis Fire with Fire Protection

16.1 No consequences. Fire will be extinguished with manual hose lines.

17.0 Consequences of Inadvertent or Careless Operation or Rupture of Fire Protection System

17.1 Not applicable. There is no fire suppression in the subject area.

18.0 Containing Design Basis Fire in the Fire Area/Zone

18.1 Fire detectors initiate an alarm in the control room. The control room alerts the fire brigade.

18.2 The fire would be extinguished using portable extinguishers and/or hose lines.

19.0 How Is Redundant Safe Shutdown Equipment in the Same Area Protected

19.1 Not applicable – Only Train A cables are located in NES-F-1-A-Z.

CST-F-1-0

1.0 Building: Condensate Storage Tank

2.0 Fire Area Or Zone: CST-F-1-0
- 2.1 Area Name: Condensate Storage Tank
- 2.2 Location: E-6, 100 N-10, 200
- Drawing No: 9763-F -310248-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	Outside
		East	Concrete	Outside
		West	Concrete	Outside
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	Outside
3.4	Doors		Metal	-
3.5	Others		-	-

4.0 Floor Area 468/150 Sq. Ft. Length 48'/30' Width 8'/3' Height 13'/7'

5.0 Volume 6,084/1,050 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System: None
- 7.1 Percentage of System's Capacity: N/A%

8.0 8 Hr. Emergency Lighting in Area Yes X No ______
- 8.1 Outside Area at Exit Points Yes XA No ______

9.0 Operational Radioactivity
- 9.1 Equipment/Piping Yes X No ______
- 9.2 Airborne Yes X No ______

10.0 Fire Protection — Type
- 10.1 Primary: Fire Extinguisher(s)
- 10.2 Secondary: Yard Hydrant
- 10.3 Detection: None*
- 10.4 Other: ______

11.0 Fire Loading In Area
- 11.1 None X (no further analysis required)

* Ref. Deviation No. 2, SBN-904, Dated Dec. 2, 1985

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
CO-LT-4096 A	CO	X	X	X
CO-LISL-4052 A & B	CO	X	X	X
Instrumentaion & Cabling	CO	X		
Condensate Storage Tank TK-25	CO	X	X	X
Piping & Valves	CO	X	X	X

MUA-F-1-0

1.0 Building: Make Up Air - East

2.0 Fire Area Or Zone: MUA-F-1-0

- 2.1 Area Name: Make Up Air East
- 2.2 Location: E-6, 300 N-10, 200
- Drawing No: 9763-F -310248-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	Concrete	Outside
		South	Concrete	Outside
		East	Concrete	Outside
		West	Concrete	Outside
3.2	Floor		Concrete	Outside
3.3	Ceiling		Concrete	Outside
3.4	Doors		Manhole Cover	Outside
3.5	Others		-	-

4.0 Floor Area 205 Sq. Ft. Length 14'-4" Width 14'-4" Height 8'-9"

5.0 Volume 1,790 Cu. Ft.

6.0 Floor Drains Nuclear ______ Non-Nuclear ______ None X

7.0 Exhaust Ventilation System: Control Building Make Up Air

- 7.1 Percentage of System's Capacity: 100%

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

- 8.1 Outside Area at Exit Points Yes ______ No X

9.0 Operational Radioactivity

- 9.1 Equipment/Piping Yes ______ No X
- 9.2 Airborne Yes ______ No X

10.0 Fire Protection — Type

- 10.1 Primary: Portable Extinguishers
- 10.2 Secondary: Yard Hydrant
- 10.3 Detection: None *
- 10.4 Other: ______

11.0 Fire Loading In Area

- 11.1 None X (no further analysis required)

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* Ref. Deviation No. 2, SBN-904, Dated Dec. 2, 1985.

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
RM-RM-6506A	CBA	X	X	X
RM-RM-6506B	CBA	X	X	X
Radiation Monitor	RM	X	X	X
Cabling	RM	X	X	X
Cabling	CBA	X	X	X

DCT-F-*

1.0 Building: Ductbanks

2.0 Fire Area or Zone: DCT-F-1A-0, 1B-0, 2A-0, 2B-0, 3B-0, 4A-0, 4B-0, 5A-0 5B-0, 6-0, 7-0

2.1 Area Name: Ductbanks

2.2 Location: Site

Drawing No: 9763-F-310828-FP; 320251-FP; 300245-FP; 310254-FP; 310248-FP; 310249-FP; 320252-FP

3.0 Construction of Area

			Material	Min. Fire Rating
3.1	Walls	North	N/A	N/A
		South	N/A	N/A
		East	N/A	N/A
		West	N/A	N/A
3.2	Floor		N/A	N/A
3.3	Ceiling		N/A	N/A
3.4	Doors		N/A	N/A
3.5	Others		N/A	N/A

4.0 Floor Area N/A Sq. Ft. Length ______ Width ______ Height ______

5.0 Volume ________ Cu. Ft.

6.0 Floor Drains: N/A

7.0 Exhaust Ventilation System: N/A

7.1 Percentage of System's Capacity: N/A

8.0 8 Hr. Emergency Lighting in Area Yes ______ No X

8.1 Outside Area at Exit Points Yes ______ No ______

9.0 Operational Radioactivity

9.1 Equipment/Piping Yes ______ No ______

9.2 Airborne Yes ______ No ______

10.0 Fire Protection — Type

Ref: Deviation No. 2
SBN-904 Dated 12/2/85

10.1 Primary: N/A

10.2 Secondary: N/A

10.3 Detection: N/A

10.4 Other: ___

11.0 Fire Loading In Area

11.1 None __X__ (no further analysis required)

12.0 Equipment and Systems in Fire Area/Zone

Equipment	System	System Train A	System Train B	Safety Related
Cabling	EDE	X	X	X
Cabling	SW	X	X	X
Cabling	SWA	X	X	X
Cabling	CC		X	X
Cabling	SI		X	X
Cabling	RC		X	X
Cabling	CS		X	X
Cabling	PAH		X	X
Cabling	EAH		X	X
Cabling	CBA	X	X	X
Cabling	RM	X	X	X

F.2 RESULTS OF FIRE HAZARD ANALYSIS

This section presents the detailed results of an analysis of the consequences of a fire in each designated fire area and zone. These details are presented on standardized "Fire Hazard Analysis" forms which consolidate all desired information for each designated area and zone. Information provided includes, as applicable to a particular fire area or zone, the type of construction, combustibles, fire protection/detection, safety-related systems* and description of equipment within the area, radioactivity within the area, consequences of a fire with and without suppression, consequences of inadvertent operation or rupture of fire protection equipment, means for containing and inhibiting fires, and protection of redundant equipment within the fire area. The fire load within the total fire area or zone can be found on line 13.2 of the form; the worst fire load within the floor area covered by the combustibles is found on line 14.1.

For-areas which do not include any safety-related system components, analyses were still made to determine if the effects of a fire within such areas could jeopardize adjacent areas containing safety-related systems.

Table 4 identifies by tab the various fire areas and zones located in each building.

Abbreviations of equipment and system used in the fire hazard analysis are as follows:

Abbreviation	System
ASH	Auxiliary Steam Heating
CAH	Containment Air Handling
CAP	Containment Air Purge
CBA	Control Building Air Handling
CBS	Containment Building Spray
CC	Component Cooling Water - Primary
CL	Chlorination
COP	Containment on-line Purge
CP	Rod Control and Position
CS	Chemical and Volume Control
DAH	Diesel Generator Air Handling
DF	Drains - Floor
DG	Diesel Generator System

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* See page C-1 for the criterion used for "safe shutdown."

Abbreviation	System
DM	Demineralized Water
EAH	Containment Enclosure Air Handling
ED	Electrical Distribution
EDE	Electrical Distribution - Emergency
FO	Fuel Oil
FP	Fire Protection
FPA	Fire Pumphouse Air Handling
FW	Feed Water or Emergency Feedwater
HWS	Heating Water System
IA	Instrument Air
MS	Main Steam
NG	Nitrogen Gas
NI	Nuclear Instrumentation
PAH	PAB Air Handling
PW	Potable Water
RC	Reactor Coolant
RH	Residual Heat Removal
RM.	Radiation Monitor
RPI	Rod Position Indicator
SB	Steam Generator Blowdown
SI	Safety Injection
SS	Sampling System
SW	Service Water
WLD	Nuclear Equipment/Floor Drains

The details on the specific areas and zones analyzed are found behind the tabs listed below:

Table 4

	Buildings	Fire Area	Fire Zones	Tab
1.	Containment Bldg.		C-F-1-Z C-F-2-Z C-F-3-Z	1.
2.	Emergency Feedwater Pump Building	EFP-F-1-A		2.
3.	Main Steam & Feedwater Pipe Enclosure		MS-F-1A-Z MS-F-1B-Z MS-F-2A–Z MS-F-2B-Z MS-F-3A-Z MS-F-3B-Z MS-F-4A-Z MS-F-5A-Z	3.
4.	RHR Containment Spray, SI Equipment Vault		RHR-F-1A-Z RHR-F-1B-Z RHR-F-1C-Z RHR-F-1D-Z RHR-F-2A-Z RHR-F-2B-Z RHR-F-3A-Z RHR-F-3B-Z RHR-F-4A-Z RHR-F-4B-Z	4.
5.	Control Building	CB-F-1A-A CB-F-1B-A CB-F-1D-A CB-F-1E-A CB-F-1F-A CB-F-1G-A CB-F-2A-A CB-F-2B-A CB-F-2C-A CB-F-3A-A CB-F-3B-A CB-F-3C-A		5.

Table 4

	Buildings	**Fire Area**	**Fire Zones**	**Tab**
6.	Electrical Tunnels	CB-F-S1-0		6.
		CB-F-S2-0		
		ET-F-1A-A		
		ET-F-1B-A		
		ET-F-1C-A		
		ET-F-1D-A		
		ET-F-S1-0		
7.	Diesel Generator Building	DG-F-1A-A	DG-F-3A-Z	7.
		DG-F-1B-A	DG-F-3B-Z	
		DG-F-2A-A		
		DG-F-2B-A		
		DG-F-3C-A		
		DG-F-3D-A		
		DG-F-3E-A		
		DG-F-3F-A		
		DG-F-S1-0		
		DG-F-S2-0		
8.	Primary Auxiliary Building	PAB-F-1C-A	PAB-F-1A-Z	8.
		PAB-F-1D-A	PAB-F-1B-Z	
		PAB-F-1E-A	PAB-F-1F-Z	
		PAB-F-1G-A	PAB-F-2A-Z	
		PAB-F-S1-0	PAB-F-2B-Z	
		PAB-F-S2-0	PAB-F-2C-Z	
			PAB-F-3A-Z	
			PAB-F-3B-Z	
			PAB-F-4-Z	
			PAB-F-1J-Z	
			PAB-F-1K-Z	
9.	Fuel Storage Building	FSB-F-1-A		9.

Table 4

	Buildings	**Fire Area**	**Fire Zones**	**Tab**
10.	Waste Processing Building		W-F-1A-Z W-F-1B-Z TF-F-1-0 W-F-2A-Z W-F-2B-Z W-F-2C-Z W-F-2D-Z W-F-2E-Z	10.
11.	Service Water Pump House	SW-F-1B-A SW-F-1C-A SW-F-1D-A SW-F-2-0	SW-F-1A-Z SW-F-1E-Z	11.
12.	Service Water Cooling Tower	CT-F-1C-A CT-F-1D-A CT-F-2B-A CT-F-3-0		12.
13.	Containment Enclosure Ventilation Area		CE-F-1-Z	13.
14.	Fire Pump House	FPH-F-1A-A FPH-F-1B-A FPH-F-1C-A		14.
15.	Turbine Building	TB-F-1B-A	TB-F-1A-Z TB-F-1C-Z TB-F-2-Z TB-F-E-Z	15.
16.	Mechanical Penetration Area		PP-F-1A-Z PP-F-2A-Z PP-F-1B-Z PP-F-2B-Z PP-F-3A-Z PP-F-3B-Z PP-F-4B-Z PP-F-5B-Z	16.
17.	Non-Essential Switch-Gear Room		NES-F-1A-Z	17.
18.	Condensate Storage Tank	CST-F-1-0		18.
19.	Make-Up Air, East	MUA-F-1-0		19.

Table 4

	Buildings	Fire Area	Fire Zones	Tab
20.	Ductbanks	DCT-F-1A-0		20.
		DCT-F-1B-0		
		DCT-F-2A-0		
		DCT-F-2B-0		
		DCT-F-3B-0		
		DCT-F-4A-0		
		DCT-F-4B-0		
		DCT-F-5A-0		
		DCT-F-5B-0		
		DCT-F-6-0		
		DCT-F-7-0		

[redacted]

[redacted]

[redacted]

Design Basis Fire

1. Diesel oil spills onto the floor of the storage room and is ignited.

2. The flame spreads in all directions (unless obstructed) from the point of ignition at a rate of 3 in./sec. (1).

3. The burning rate is 8.3 inches of depth per hour (2).

4. The fire burns at the rate until 50% of the initial oxygen supply is gone (3).

5. The burning rate decreases linearly from the 50% moment to zero when 100% of the initial oxygen supply in exhausted.

Assumptions

1. The heat value of the oil is taken a 19,000 Btu/lb. (4).

2. The specific heat of all gases is taken as that of air at standard conditions.

3. The products of combustion are taken to be carbon monoxide and water. This is a very conservative assumption in that it uses oxygen at a slower rate than would an assumption of carbon dioxide product. The heat value in such a case would be much lower in this case than 19,000 Btu/lb., which assumes complete combustion.

4. Heat transfer to passive heat sinks has been considered. Heat transfer coefficients were calculated on the basis of blackbody radiation for the bare concrete walls and ceiling and steel fuel oil tank directly exposed to the flame, turbulent convection for the remainder of the tank, 1 Btu/hr Ft.^{2} - °F outside the room.

Dimensional Parameters

1. Room size is 40.5 ft. x 40 ft. and 33.5 ft height.

2. Diameter of the tank is 20 ft. and the length of the straight part is 28 ft.

3. Area of the vent is 4 sq. ft.

4. Heat transfer surfaces exposed to direct radiation are 1,429 sq. ft. concrete ceiling (4 ft. thick), 1,393 sq. ft, concrete walls (3.5 ft. thick) and 909 sq. ft. steel (½ inch thick), convective heat transfer being considered for the rest of the tank surface.

Method Of Analysis

1. Flow to and from the room is calculated based on room pressure by the computer code CONTEMPT, which also calculates the room temperature and pressure transients, as well as the temperature profiles in the concrete.

2. Credit is taken for the depletion of oxygen due to venting during the early, maximum burn, stage of fire in the following manner:

   (a) Based on assumptions listed above, the rate of heat addition to the room is $39.17t^2$ Btu/sec. (t in seconds), and at 19,000 Btu/lb, the mass addition rate is $2.06 \times 10^{-3} t^2$ lb/sec.

   (b) Conservatively using standard conditions, there are 3,058 lbs. air initially of which 710 lb. is oxygen.

   (c) The mass and energy addition rates in (a), above are inputted to CONTEMPT which is run 100 or so seconds of fire at maximum burn. From the output of this run R(t) the venting rate from the room, and M(t) the total lbs. of air in the room are ascertained as tabular functions of time.

   (d) Based on the oil consumption rate, $2.06 \times 10^{-3}\ t^2$ lb/sec., a typical diesel fuel oil composition (5) and combustion products consisting Of CO and H_2O, the oxygen consumption rate due to combustion is found to be $3.96 \times 10^{-3} t^2$ lb/sec.

   (e) The equation:

   $$\frac{d\,0(t)}{dt} = -3.96\ X\ 10^{-3} t^2 - \frac{R(t)}{M(t)}\,0(t)$$

   which determines 0(t), the time-dependent mass of oxygen in the room, is numerically integrated to find the time at which 50% of the initial amount of oxygen is exhausted.

   (f) The period of maximum burn rate is thus obtained as the time of 50% oxygen remaining in the room.

3. After the maximum burning time, although the venting rate is considerable at that time, no credit is taken for further loss of oxygen through this means. The fire burns at a linearly decreasing rate until the remaining oxygen is consumed. It is recognized that during the late stages of the fire, as the room cools, air will actually be drawn into the room through the vent sustaining some combustion. It should be noted, however, that the mechanism is self-defeating and that air can enter only when the temperature of the room is dropping, thus the peak temperatures will never be approached again. A slow, smoldering condition will result.

RESULTS

Case I: Without Spray Actuation

In the case when the spray fails to actuate, the room pressure reaches a maximum of 4.2 psig at 29 seconds when 50% of the oxygen is exhausted, and the room temperature peaks at l,582°F at 41 seconds. Figure 1 shows the transient pressure/temperature responses. The ceiling concrete temperature reaches a maximum of 774°F at 135 seconds. The fire continues to burn till 237 seconds. Figure 2 shows the temperature profiles through ceiling concrete.

Case II: With Spray Actuation

In the case when the spray with a flow rate of 625 gpm at 90°F temperature actuates automatically when the room temperature reaches 200 °F, the situation greatly improves. The spray starts at approximately 18 seconds when the rate of rise of pressure/temperature is significantly reduced resulting in much less severe transients. No credits have been considered for removal of heat due to vaporization of spray water which is expected to reduce the consequences further.

The room pressure reaches a maximum of 0.9 psig at 37 seconds when 50% of the oxygen is exhausted, and the room temperature peaks at 611°F at 41 seconds. Figure 3 shows the transient pressure/temperature responses. The fire continues for 157 seconds. The ceiling concrete temperature reaches a maximum of 316°F at 70 seconds and the temperature profiles are presented in Figure 4.

References

1. Mackinven, R., Hansel, J.G., and Glassman, I., "Influence of Laboratory Parameters on Flame Spread Across Liquid Fuels". Combustion Science & Technology, Volume 1 - pp. 293-306, 1970

2. Blinor, V.1., and Khidiakor, G.N., "Certain Laws Governing Diffusive Burning of Liquids", Fire Research Abstract and Review, Volume - 1 pp. 41-44, 1958

3. Zabetokis, G.M., "Flammability Characteristics of Combustible Gases and Vapors", Bulletin 627, Bureaus of Mines, U.S. Dept. of Interior, 1965

4. Perry, J.H., et al.; Chemical Engineering Handbook, 4th Edition, pp.142-143, McGraw-Hill 1963

5. Marks' Handbook of Mechanical Engineering, p. 7-22, California Fuel Oil (other oils with higher carbon and hydrogen fractions consume oxygen more rapidly). (The corresponding heat rate for this oil was not used.)

Design Basis Fire

1. RCP lube oil leaks from the pump, is heated close to its flash point while traveling over piping, falls to the floor of the containment and is ignited.

2. The oil spill is limited to an area of 150 ft^2.

3. The entire 265 gallons of lubricating oil in the pump burns.

Assumptions

1. The heat value of the oil is 150,000 Btu/gal.

2. The burning rate is equivalent to 5.0 inches of depth per hour.

3. Heat transfer to passive heat sinks has been considered. A heat transfer coefficient of 2 Btu/ft^2-hr-^{0}F, characteristic of laminar convection, was conservatively used for transfer to the steel and concrete within the containment and to the containment walls. No radiative heat transfer has been accounted for.

4. Heat removal by active heat sinks (Fan coolers) was also considered. The five fan coolers just balance the containment sensible heat generation rate (5.85 x 10^6 Btu/hr) at 120°F containment atmosphere temperature. At a temperature of 300°F, the total capacity of the fan coolers is 25 x 10^6 Btu/hr (or 19.15 x 10^6 Btu/hr in excess of containment sensible heat generation rate). In actuality, the capacity is somewhat higher, thus that used is conservative.

5. The burning of the oil would add approximately 1900 lbs. to the containment atmosphere mass. This is neglected. Doing so yields a slightly higher peak temperature and an insignificantly lower peak pressure. The temperature transient is more severe and therefore the omission is conservative.

6. The initial temperature and pressure of the containment atmosphere are 120^{0}F and 15.2 psia, respectively.

7. Each Seabrook Station reactor coolant pump contains approximately 240 gallons of oil. Each collection tank has a capacity of 320 gallons. The tanks were sized to hold the entire inventory of one pump plus 25%. However, if the lube oil systems for two pumps were to fail simultaneously, there would be an excess of 160 gallons of oil per tank. In order to contain this excess oil, a seismically designed dike will be built around the tank. The tanks and their dikes are located such that the excess oil does not present a fire hazard to any safety-related equipment. Additionally, there is no ignition source near the diked area. (Ref.: SBN-762, dated February 8, 1985.)

Method of Analysis

1. Based on the assumptions above, the duration of the fire is calculated to be 34 minutes with a constant heat addition rate of 1.169 x 10^6 Btu/hr.

2. The computer code CONTRAST-S was used to calculate the temperature and pressure transients due to the fire.

Results

The maximum temperature obtaining in the containment is 253°F and the maximum pressure is 4 psig. Both peaks occur at 34 minutes, at which time the fire burns itself out. The temperature transient is shown in Figure 1 and the pressure transient is shown in Figure 2. Both temperature and pressure decay rapidly as soon as burning stops.

RESUME

ALFRED S. BOCCHINO

United Engineers & Constructors Inc.

EDUCATION	B.S.M.E., 1939, University of Alabama
PROFESSIONAL	Delaware New Jersey
ENGINEERING	Missouri Pennsylvania
REGISTRATION	New Hampshire
MEMBERSHIPS	American Society of Mechanical Engineers New Jersey Society of Professional Engineers National Society of Professional Engineers Society of Fire Protection Engineers
SUMMARY	Over thirty-three years of experience in the engineering and design of power plants, manufacturing facilities, chemical plants and oil refineries. Developed the scope of various projects, specified equipment and supervised the engineering and design of fire protection systems and mechanical facilities, both process and service. Especially competent in plant fire protection including water supply, fire pumps, yard mains, automatic sprinkler system, etc. and the plant service area consisting of plumbing and drainage, waste treatment facilities, dust collection, central vacuum cleaning systems, heating, ventilating, air conditioning and special nuclear related air cleaning systems. Responsible for the coordination of the engineering and design for complete service and fire protection facilities of several power plants, both fossil and nuclear, and manufacturing plants. Responsibility in the nuclear field included preparation of preliminary safety analysis reports, final safety analysis reports, environmental reports, fire protection system design, and other licensing activities for pressurized water reactors (PWR) and High Temperature Gas-Cooled Reactors (HTGR) power plants.
EXPERIENCE	United Engineers & Constructors Inc. Philadelphia. Pennsylvania 19101

October 1975 to present	Consultant - Mechanical Services Engineer Responsible for the review, comment and approval of Mechanical Services related work, including plant fire protection, on fossil and nuclear power plants designed by UE&C. The Branch Technical Position APCSB 9.5-1 and Regulatory Guide 1.120 are used as guides in the review of fire protection for safety-related systems and equipment.
May 1972 to October 1975	Supervising Discipline Engineer Project - Delmarva Power & Light Company, Summit Power Station, Summit Bridge, Delaware, two 770 Mw HTGR Units No. 1 and Unit No. 2. Responsible for engineering the heating, ventilating and air conditioning systems; plant fire protection system, including yard hydrant system complete with water storage and pumping facilities, building standpipe systems, sprinkler systems, pre-action sprinkler systems, deluge systems, specified use of CO_2 and Halon extinguishers. This project was not completed.
January 1971 to November 1974	Supervising Discipline Engineer Project - Philadelphia Electric Company, Eddystone Generating Station, two 400 Mw crude oil-fired peaking generating units Nos. 3 and 4. Responsibilities same as for period May 1972 to October 1975. In addition, engineered automatic foam fire protection system for crude oil spill areas resulting from possible oil pipe rupture.
July 1970 to January 1974	Supervising Discipline Engineer Project - Atlantic City Electric Company, B. L. England Station. Conversion of Low existing coal-burning units to burn crude oil. Design of new 150 Mw crude oil-fired plant. Units Nos. 1, 2 and 3. Responsibilities same as for period May 1972 to October 1975. In addition engineered (1) foam fire protection system for crude oil storage tanks; (2) a combustible gas detection system for continuously detecting and indicating the presence of combustible gas fumes in selected plant areas; (3) special ventilating systems for removal of gas fumes from burner areas.

December 1970 to July 1973	Supervising Discipline Engineer Project - Public Service Electric & Gas Company, Sewaren Generating Station; two 400 Mw oil-fired peaking units, Unit Nos. 7 and 8. Responsibilities same as for period May 1972 to October 1975. This project was not completed.
March 1971 to February 1973	Supervising Discipline Engineer Project - Puerto Rico Water Resources Authority, Aguirre Nuclear Plant, Unit No. 1, P.W.R. units. Provide consulting engineering services on plant service facilities. This project was not completed.
April 1969 to June 1972	Supervising Discipline Engineer Project - Delmarva Power & Light Company, Vienna Power Station; 150 Mw oil-fired generating unit, Unit No. 8. Responsibilities same as for period May 1972 to October 1975, except no Halon extinguishing equipment.
August 1967 to September 1969	Supervising Discipline Engineer Project - Delmarva Power & Light Company, Indian River Power Station; 150 Mw coal-fired Unit No. 3. Responsibilities same as for period May 1972 to October 1975, except no pre-action systems, Halon extinguishing equipment water supply or pumping equipment.
September 1966 to February 1971	Mechanical Supervising Engineer Project - Alleghony Power System, Hatfield Power Station, three 500 Mw coal-fired units, Units Nos. 1, 2 and 3. Responsibilities same as for period May 1972 to October 1975, except no Halon extinguishing equipment.
November 1965 to December 1973	Mechanical Supervising Engineer Project - Consolidated Edison Company of New York, Indian Point Generating Station, Units Nos. 2 and 3, P.W.R. units. Responsibilities same as for period May 1972 to October 1975, except no Halon extinguishing equipment. Fixed foam systems used on turbine oil storage tanks and associated equipment.

April 1965 to July 1966	Mechanical Supervising Engineer Project - Pickands Mather & Company, Taconite Harbor Power Station, Unit No. 3, coal-fired. Extended yard fire protection and building standpipe system. Specified deluge spray system for transformers.
April 1964 to March 1968	Mechanical Supervising Engineer Project - Union Electric Company, Sioux Power Plant, Units Nos. 1 and 2, 500,000 kw capacity coal-fired units. Responsibilities same as for period May 1972 to October 1975, except no Halon extinguishing equipment.
June 1964 to February 1965	Mechanical Supervising Engineer Project - United States Steel Corporation, Clairton Works. Addition to Boiler House No. 3. Extended yard fire protection system, added transformer deluge water spray systems.
March 1961 to November 1962	Mechanical Supervising Engineer Project - Connecticut Light & Power Company, Norwalk Harbor Station; 165,000 kw capacity, Unit No. 2, coal-fired. Responsibilities same as for period JuLy 1972 to October 1975, except no pre-action sprinkler systems, Halon extinguishing equipment or water supply and pumping equipment.
May 1961 to March 1962	Mechanical Supervising Engineer Project - Texas Electric Company, Handley Station; 35,000 kw capacity, gas-fired outdoor plant. Responsibilities same as for period May 1972 to October 1975, except no pre-action sprinkler systems, standpipe systems or Halon extinguishing equipment.
September 1960 to May 1961	Mechanical Supervising Engineer Project - National Aniline Division, Allied Chemical Corporation, Polyamide Fiber Plant, Hopewell, Virginia. Responsibilities same as for period May 1972 to October 1975, except no pre-action sprinkler systems or Halon extinguishing equipment.

February 1960 to September 1960	Mechanical Supervising Engineer Project - Western Electric, Kansas City, Missouri, Electronic Facilities covering l 1/2 million square feet of building area. Responsibilities same as for period May 1972 to October 1975, except no pre-action sprinkler systems or Halon extinguishing equipment.
October 1957 to February 1960	Mechanical Supervising Engineer Project - Connecticut Light & Power Company, Norfolk Harbor Station, 150,000 kw capacity, Unit No. 1, coal-fired. Responsibilities same as for period May 1972 to October 1975, except no pre-action sprinkler systems or Halon extinguishing equipment.
June 1957 to October 1957	Mechanical Supervising Engineer Project - Connecticut Light & Power Company, Devon Generating Station; 112,000 Kw capacity, Unit No. 8, coal-fired. Responsibilities same as for period May 1972 to October 1975, except no pre-action sprinkler systems or Halon extinguishing equipment.
May 1955 to June 1957	Mechanical Supervising Engineer Project - Delaware Power & Light Company, Indian River Power Station; two 85,000 Kw units, Units Nos. 1 and 2, coal-fired. Responsibilities same as for period May 1972 to October 1975, except no pre-action sprinkler systems or Halon extinguishing equipment.
August 1939 to May 1955	This time period is no longer relevant to the matter at hand and is not included in this resume.

RESUME

EDWARD A. SAWYER

Fire Protection Coordinator

Yankee Atomic Electric Co.

EDUCATION	1977 - Series of short intensive courses on Fire Protection for Nuclear Power Plants, Fire Protection for Nuclear Power Plant Operating Personnel, and Fire Hazard Analysis for Nuclear Power Plant. All given by NATLSCo and Professional Loss Control, Inc.
	September 1976 - December 1976 - Worcester Polytechnical Institute. Engineering Methodology for Building Fire Safety Evaluation.
	August 1976 - University of Wisconsin-Extension. Fire Safety Design for Buildings.
	1965 - Northeastern University - BS in Electrical Engineering.
MEMBERSHIPS	Society of Fire Protection Engineers National Fire Protection Association
EXPERIENCE	Yankee Atomic Electric Company
July 1976 to Present	Fire Protection Coordinator directly responsible for the overall preparation and implementation of the fire prevention and protection programs for three operating nuclear power plants - Yankee Rowe, Vermont Yankee, and Maine Yankee. Specifically responsible for the performance of the fire hazard analysis at the plants, and the development and implementation of recommendations concerning the updating and backfitting of the plants to the applicable requirements contained in Appendix A to the Branch Technical Position on Fire Protection, APCSB 9. 5-1, Regulatory Guide 1. 120, and any further NRC requirements in the area of fire protection. Responsible for insuring, the development of fire prevention and protection procedures, including programs for the training of the plant staff and plant fire brigade. Responsible for ultimate review and approval of the design of Seabrook Station and NEP 1 and 2 with respect to coordination of design with fire protection requirements.

Responsible for the ultimate review and approval of the fire hazard analysis and the Fire Protection Reevaluation Report. Responsible for dealing with the insurers for the operating plants in matters relating to fire protection.

August 1974 to July 1976	Project Manager on the Central Maine Power Company Nuclear Project directly responsible for coordinating the development of project design and engineering schedules with the principal contractors, administration of the Project Engineers under my direction, developing, monitoring and controlling project costs: including dealing with insurers of the project; generally responsible for the licensing of the project and for engineering, design, and quality assurance activities related to the work of the principal contractor organizations associated with the project.
January 1972 to August 1974	Electrical Project Engineer on the Seabrook Nuclear Power Station. Duties consisted of supervision of the Electrical Engineering effort of the A/E and Yankee in PSAR submittal and in plant design, and responsibility to the Project Manager for licensing activities, engineering coordination, notification of any cost or schedular problems, including dealing with NELPIA in areas of fire protection design. Project Engineer on the engineering, construction and testing of an Advanced Off-Gas Control System for the Vermont Yankee Nuclear Power Plant. Duties consisted of supervising the engineering, scheduling and cost control efforts of the A/E and Yankee personnel; and following of the construction effort and test effort for the system.
November 1971 to January 1972	Assistant to the Project Engineer for Vermont Yankee Nuclear Power Plant. Duties consisted of aiding in plant licensing, plant licensing, writing of plant Environmental Report.
September 1970 to November 1971	<u>Vermont Yankee Nuclear Power Plant</u> Technical Assistant to the Plant Maintenance Supervisor. Duties consisted of aiding Maintenance Department personnel in preparing the p-l-ant for commission, ranging from work on Microwave Communications, Metering, and Relaying to work on large motors, switchgear, and power transformers.

January 1968 to September 1970	Yankee Atomic Electric Company Engineer in the Project group for the Vermont Yankee Nuclear Power Plant. The Project group coordinated the work done on the plant by the Architect Engineer, Nuclear Steam Supplier, and the various other vendors and suppliers. Work was mainly in the Electrical and Instrumentation coordination and design, with some excursions into Nuclear and Mechanical areas, including working with NELPIA in developing fire protection systems.
April 1963 to June 1965	New England Electric System Brayton Point Generating Station, Somerset, Massachusetts. Co-op employment as Assistant to the Electrical Department Foreign of a 500 M Thermal Generating Plant - Maintenance planning, job planning, parts ordering, responsibility for maintenance of fire protection systems.

YAEC 1571

HAZARDS ANALYSES OF SEABROOK STATION

CHARCOAL FILTER UNITS

Seabrook Station
Public Service Company of New Hampshire
New Hampshire Yankee Division

Revision 1

November 1991

Prepared by David M. Pepe 10-3-86 Date

Reviewed by Alexander R. Klein 10-8-86 Date

Approved by William J. Cloutier 10/9/86 Date

REVISION 1		
PREPARED BY\DATE	REVIEWED BY\DATE	APPROVED BY\DATE
[signature] 11-21-91	[signature] 11/22/91	[signature] 11-22-91

Yankee Atomic Electric Company
Nuclear Services Division
1671 Worcester Road
Framingham, Massachusetts 01701

TABLE OF CONTENTS

INTRODUCTION

This report describes a Hazards Analysis conducted on Seabrook Station's filter units, which contain charcoal beds/cells. Table 1 identifies Seabrook's nine (9) filter units and their location.

BACKGROUND

Seabrook's approach to a charcoal fire within the filter units is fire prevention and detection as outlined within the guidelines of Item II.B(3) of 10CFR50, Appendix R, which states, "specify measures for fire prevention, fire detection, fire suppression, and fire containment, and alternative shutdown capability as required for each fire area containing structures, systems, and components important to safety in accordance with NRC guidelines and regulations."

To address internal charcoal fires, an analysis was conducted on all Seabrook filter units, which contain charcoal beds/cells, to determine the maximum temperatures of the charcoal adsorber sections, due to decay heat from iodine and its daughter product decay without air flow. This analysis showed that the overall maximum temperature would be limited to 170°F. Additional analyses indicate that the maximum temperature for the HEPA filters (due to decay heat from the particulate iodines accumulated in these filters) will be limited to 187°F. These temperatures are well below the maximum limit of 300°F recommended in ANSI-N509-1980. Thus, there is no possibility of an internal charcoal fire due to decay heat.

Seabrook's charcoal adsorber filters are also protected from external fires since they are contained in a combination of heavy metal casing, wire debris screens, and fire retardant HEPA filters as recommended in Regulatory Guide 1.52, Design, Testing, and Maintenance Criteria for Post-Accident Engineered - Safety Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants, Revision 2, March 1978.

Further, transient combustibles are limited administratively. Any welding or open flame sources will be controlled and limited. A fire watch will be maintained per plant administrative procedures during these activities. These precautions will prevent external sources from causing internal combustion to the charcoal beds/cells.

However, a fire hazard analysis is developed in this report to address the effects of a postulated charcoal fire in the filter units and its impact on equipment needed for safe shutdown. A realistic, but conservative approach was used to model the charcoal fires since charcoal is a slow burning medium.

DISCUSSION

The following assumptions were used in this hazard analysis.

1. Fire will be detected by reliable and early warning system.

2. From detection, which is alarmed in Control Room, Operations per Operating Procedures will shutdown air flow to the filter units. Assume five minutes time from alarm conditions to shutdown of air flow. Charcoal is assumed to be ignited in this time frame.

3. The Fire Brigade will respond to the charcoal filter within 20 minutes from notification by the Control Room for all protected plant areas except Containment. This notification is per Operating Procedures. For a fire within Containment, the Fire Brigade will respond within 90 minutes. (See Engineering Evaluation EE-05-033, Revision 00.)

4. Ignition of the charcoal starts at the top of the charcoal bed/cell. This is assumed conservative since a fire located lower in the bed/cell would burn the retaining mesh and drop the charcoal from the air flow path precluding rapid fire propagation.

5. Since a fire cannot be started due to internal decay heat, the fire must be started from an external source. Assume an outside source is carried into the filter unit. All the units have HEPA filters on the inlet before the charcoal bed. Each HEPA filter section assembly is made up of a grouping of HEPA filter elements 24" x 24" x 11-1/2". Each element is a throwaway, extended medium, dry-type filter, which are open face, rectangular, fire-resistance type design for radioactive service. Assume the source carried internal by air flow totally ignites one HEPA filter element, 2' x 2'. This 2' x 2' filter element is assumed to ignite a 4 $ft.^2$ area of the charcoal bed/cell.

6. Air flow through the charcoal bed/cell is assumed to be from the start of ignition. 4 $ft.^2$ area of charcoal will burn under air flow condition for a period of 5 minutes time. At this point forced air flow has stopped and the resulting fire will be analyzed under natural draft air flow.

7. Air flow velocity through the charcoal during forced ventilation is 40 feet per minute which is Seabrook's charcoal bed/cell design velocity.

8. Further assumptions are used in Appendix I, "Evaluation of Charcoal Filter Unit Fires at Seabrook Station," 9-29-86 by Professional Loss Control, Inc. and are noted in that Appendix.

The Hazard Analysis consist of 3 parts, (1) Determination of charcoal bed burning rates, (2) a heat transfer model of the charcoal beds/cells and (3) effects of the heat transfer on safe shutdown equipment.

(1) <u>Determination of Charcoal Bed Burning Rates</u>

A charcoal fire test was conducted by NUCON in their ASTM D3466 Test Rig. Data from this test was used by Professional Loss Control, Inc. (PLC) in their unsteady state heat transfer model of each of Seabrook's filter units, which contain charcoal beds/cells, excluding CBA-F-38 and CBA-F-8038. Each Seabrook filter was reviewed separately. NUCON's ASTM D3466 Test conducted for Seabrook used the same type of charcoal used in Seabrook's charcoal beds/cells. The test normally is performed at 100 feet per minute air velocity, however, 40 FPM velocity was used which is Seabrook's filter design velocity. The bed depth is normally 1.0 inch deep.

For Seabrook's test a 2.0 inches deep bed was used which is the limit of the ASTM D3466 apparatus. Seabrook's bed depth is 4.0 inches. Use of the test data by PLC is conservative since the test was conducted under forced air flow over a one hour period. Seabrook's filter unit heat transfer model assumes five minutes time from charcoal ignition to shutdown of air flow; where-as air flow will be shutdown five minutes after detection of a potential fire, which most likely occurs before sufficient temperature is available to ignite the charcoal.

A fire wind tunnel (FWT) test was conducted by NUCON on a 24 inch x 24 inch face area carbon adsorber specimen. The depth of the bed tested was 4.0 inches. Again, the charcoal used was the same type used at Seabrook, 2% KI and 2% TEDA impregated carbon.

The charcoal was ignited by preheating inlet air to the charcoal specimen. The specimen started burning approximately 6 minutes after CO production levels of 50 ppm were measured. Air flow was then continued for an additional 5 minutes, then stopped. Inlet and outlet temperatures were then monitored for one hour. Seabrook's anticipated alarm setpoint for CO is 50 ppm and the normal background level is 2 ppm.

The purpose of the FWT test was to look at the actual test size modeled by PLC under fire conditions.

Air flow conditions under forced ventilation were the same for the FWT test versus Seabrook's filter unit design velocity. Once the ventilation was stopped and natural drafting began, the FWT test was no longer similar to Seabrook because of duct configuration differences. Seabrook's filter units have outlet dampers, long HVAC duct runs, and in some cases inlet dampers which are isolated once the filter fans are shutdown. Thus, natural drafting through Seabrook's filters would be small. The FWT test with natural drafting indicates the charcoal fire will contain itself to a limited fire with decreasing temperature after stopping forced ventilation.

Results of the FWT test show, under conditions used in the PLC model, carbon loss for a test duration of one hour was 4.53 lbs which is approximately 10% of the test dry carbon weight. Also that CO levels increase well above normal environment levels long before a fire starts.

(2) Heat Transfer Model

The PLC unsteady heat conduction analysis looked at each charcoal filter unit, except CBA-F-38 and CBA-F-8038, to determine the net heat transfer to the filter housing surface based on charcoal temperature data supplied by NUCON. Radiation and convection heat transfer was also considered in PLC's analysis.

Radiation Heat Transfer from the fire was considered, taking into account the geometry of each of the filter units. The HEPA filters have a nominal 24" x 24" outside dimensions with a 22" x 22" steel mounting frame opening, which limits the burning material to one HEPA filter size. The burning charcoal surface area was conservatively assumed to be a 24-inch square. The larger burning surface area accounts for any fire propagation under the five minute forced ventilation period. The temperatures used in the analysis were measured within the charcoal bed on the outlet side. The highest of any of the temperatures measured was also used. Radiation Heat Loss from the steel housing to its surroundings was also considered.

For convective heat transfer, forced convection within the filter housing was neglected. If accounted for, the forced air stream would be heated and enhance the heat removal from the housing. Therefore, this assumption is conservative. Free convection heat transfer was considered on the outside of the filter housing.

Attachment II gives the detailed methodology and results of the analysis.

The following conclusions are drawn from a fire involving the charcoal beds/cells in the filter units.

1. The worst case maximum localized steel plate housing temperature was calculated to be 704°F. This temperature is substantially below that required for structural failure of the steel housing.

2. Structural failure of any steel beam or column in the vicinity of these filter units cannot be caused by heat transfer from the filter housing.

3. The maximum radiant heat emissive flux from the housing at 704°F, calculated to be less than 10 KW/m^2, is less than half the critical radiant flux necessary to ignite the worst case cable jacket materials as determined by EPRI sponsored tests at Factory Mutual Research Corporation (EPRI NP-1200, Part 1).

(3) Safe Shutdown Equipment Review

From the conclusions of the heat transfer model there would be no structural steel failures in the vicinity of Seabrook's charcoal filters. Thus no safe shutdown equipment would be effected due to steel failures. Equipment further than three feet from the filter units also would not be effected based on the maximum heat flux from the housing.

An evaluation of safe shutdown equipment was conducted looking at the equipment within and including three feet from each of the filter units.

CBA-F-38, 8038 - No charcoal fire modeling was done on these filters. It is assumed that a charcoal fire will cause loss of all equipment within its fire area (i.e., CB-F-3B-A). Seabrook's present Appendix R Safe Shutdown Study shows this to be acceptable. Also there is no concern of damage to structural steel since all this steel in this fire area is fire proofed.

CAP-F-40 - There is no safe shutdown equipment used during a fire in this fire area, PAB-F-3A-Z, within and including three feet of CAP-F-40.

CAH-F-40 - There is no safe shutdown equipment used during a fire in this fire area, C-F-3-Z, within and including three feet of CAH-F-40.

EAH-F-9, 69 - There is no safe shutdown equipment used during a fire in this fire area, CE-F-1-Z, within and including three feet of EAH-F-9,69.

FAH-F-41, 74 - There is no safe shutdown equipment used during a fire in this fire area, FSB-F1-A.

PAH-F-16 - There is no safe shutdown equipment used during a fire in this fire area PAH-F-4-Z, within and including three feet of PAH-F-16.

CONCLUSION

The hazards posed by the heating of the steel housing from a charcoal bed/cell filter fire, under the operational guidelines to shutdown forced ventilation of the filter in question, will not jeopardize the safe shutdown of Seabrook Station.

TABLE 1

Filter ID	Safety/Non	Meets RG 1.52	Area Detection	Fire Area
EAH-F-9	Safety	Yes	Yes	CE-F-1-Z Containment Enclosure EL 21' 6"
EAH-F-69	Safety	Yes	Yes	CE-F-1-Z Containment Enclosure EL 21' 6"
FAH-F-41	Safety	Yes	Yes	FSB-F1-A Fuel Building EL 84' 0"
FAH-F-74	Safety	Yes	Yes	FSB-F1-A Fuel Building EL 84' 0"
CAH-F-8	Non	No	Yes	C-F-3-Z Containment
PAH-F-16	Non	No	Yes	PAB-F-4-Z Primary Auxiliary Building EL 81' 0"
CAP-F-40	Non	No	Yes	PAB-F-3A-Z Primary Auxiliary Building EL 53' 0"
CBA-F-38	Safety	Yes	Yes	CB-F-3B-A Control Room HVAC Equipment Room EL 75'
CBA-F-8038	Safety	Yes	Yes	CB-F-3B-A Control Room HVAC Equipment Room EL 75'

Attachment I to
Hazards Analyses of
Seabrook Station
Charcoal Filter Units,
YAEC 1571

PROFESSIONAL LOSS CONTROL, INC.

Evaluation of Charcoal Filter Unit Fires at Seabrook Station

September 29, 1986

Prepared by: James A. Milke, P.E.

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Table of Contents

INTRODUCTION

This report describes an engineering analysis conducted to characterize the hazard of a fire involving the charcoal filter units at the Seabrook station. An unsteady-state heat conduction analysis has been performed to predict the local temperature rise in the plate steel housing exposed to a charcoal filter fire for each of seven air handling units.

BACKGROUND

Charcoal filter beds are installed in the seven (7) air handling units identified in Table 1. Inside the housing are numerous charcoal filter bed cells. The number of cells within a housing enclosure ranges from 4 to 28. The charcoal ignition source is assumed to be external to the unit. The configuration of air cleaning systems is such that the charcoal absorbers are preceded by HEPA filters. The HEPA filter mounting frame is a steel structure with 22 inch x 22 inch openings. Therefore, no larger burning material than one HEPA filter size could enter the carbon bed. Anything larger would be stopped by the HEPA mounting frame structure even if it would penetrate the preceding components. This was the reason for the selection of a 24 inch x 24 inch exposure to a single carbon cell for both the FST test and subsequent engineering analysis.

An unsteady-state heat conduction analysis was performed on the steel housing. Since the heat conduction within the steel plate occurs very rapidly, a lumped heat capacity approach could be applied to simplify the mathematics involved. The steel housing was considered to receive radiant heat from the burning charcoal bed. Radiative and convective heat losses from the steel housing to the surroundings were included. A detailed description and the equations for the analysis are included in Appendix A.

TABLE 1

DIMENSIONS OF CHARCOAL SECTION OF UNITS

Unit	A	B	C
PAH-F-16	5'1"	12'2"	26'7"
EAH-F-9 EAH-F-69	5'1"	5'6"	3'6"
FAH-F-41 FAH-F-74	5'1"	10'3"	14'8"
CAP-F-40	5'1"	10'0"	9'11"
CAH-F-8	2'6"	5'4"	8'0"

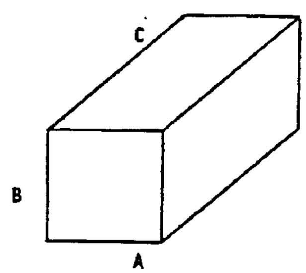


TABLE 2

(Table 1 from September 15, 1986, "Iodine Adsorber Fire Test" by Nuclear Consulting Services, Inc.)

08PU942

Test Date
3 Sept 1986

Carbon ignition followed by residual heating (i.e. air flow continued but heat off).

Method: ASTM D3466 except: 40 FPM, 2 inch bed depth and fast heat up

Material: Dry air and NUSORB KITEG II Lot 45/10

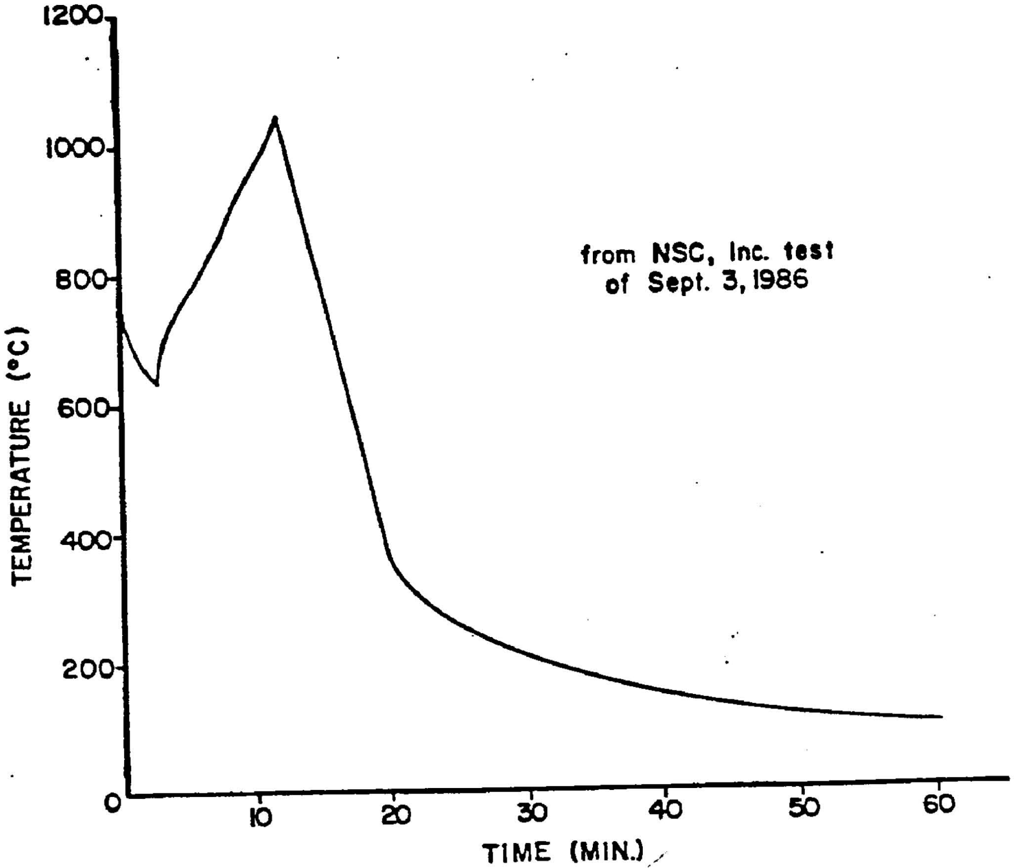
Starting condition: 25°C

Ignition occurred at an upper bed (outlet) temperature of approximately 400°C, lower bed (inlet) temperature of 285°C, air inlet temp. 285°C.

Temperatures after ignition:

Time (Min.)	Within Carbon Bed Outlet Side (°C)	Inlet Side (°C)	
0:15	790	255	
1:00	700	920	
2:00	650	850	
3:00	640	800	
4:00	730	800	
5:00	760	805	
6:00	790	790	
7:00	835	780	
8:00	860	790	
9:00	920	790	
10:00	950	780	
11:00	980	730	
12:00	1050	800	purple smoke
15:00	780	450	
20:00	375	250	
30:00	210	150	
60:00	100	135	

FIGURE 1



Temperature History in Charcoal Bed

DISCUSSION

The temperature rise of the steel housing on the seven charcoal filter units of concern is presented in Tables 3 through 7. As noted in the tables, the maximum localized housing temperature for Units PAH-F-16 (see Table 3), CAP-F-40 (see Table 5), FAH-F-41 and FAH-F-74 (see Table 6), are within 50°F of one another (between 411 and 461°F). The surface temperatures present a minimal hazard to fixed equipment or cabling unless mounted directly on the housing, as well as to personnel, unless they came into contact with the enclosure itself.

The maximum localized temperature predicted for Units EAH-F-9 and EAH-F-69 is 704°F (see Table 4). The increased temperature is due to the reduced size of the housing, which includes less steel through which the heat can be diffused. Still, this temperature would not appear to be at a level or exist for a sufficiently long duration to pose a serious exposure condition, unless the materials of concern are in direct contact with the housing.

Finally, because of the different air flow arrangement, the maximum temperature to the top of the enclosure for CAH-F-8 is 638°F (see Table 7). This temperature is due to the relatively small size of the enclosure unit as well as the location of the exposed side being the top of the enclosure. Being located on the top, the convective heat losses are substantially reduced from that of a side.

As noted in the tables, the analysis was terminated at 60 minutes. Extending the duration beyond 60 minutes is not necessary since the steel temperature is declining 15 to 20 minutes into the incident with no action other than shutting down the related fan within 5 minutes of the fire initiation.

TABLE 3

LOCAL HOUSING TEMPERATURE VS. TIME IN UNIT PAH-F-16

UNIT PAH-F-16 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)	UNIT PAH-F-16 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)
1	94	31	351
2	104	32	342
3	115	33	334
4	128	34	326
5	142	35	318
6	159	36	309
7	178	37	301
8	199	38	293
9	223	39	285
10	249	40	277
11	278	41	270
12	310	42	262
13	337	43	255
14	359	44	248
15	376	45	241
16	390	46	234
17	399	47	227
18	406	48	221
19	409	49	214
— 20	411 —	50	208
21	410	51	202
22	408	52	197
23	404	53	191
24	400	54	186
25	394	55	181
26	388	56	176
27	381	57	171
28	374	58	167
29	366	59	163
30	359	60	158

TABLE 4

LOCAL HOUSING TEMPERATURE VS.
TIME IN UNITS EAH-F-9 and EAH-F-69

UNITS EAH-F-9, EAH-F-69 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)	UNITS EAH-F-9, EAH-F-69 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)
1	121	31	544
2	152	32	532
3	186	33	520
4	222	34	508
5	261	35	497
6	303	36	486
7	349	37	475
8	398	38	464
9	449	39	454
10	503	40	444
11	559	41	434
12	617	42	424
13	657	43	415
14	684	44	406
15	698	45	398
— 16	704	46	390
— 17	704	47	382
18	699	48	374
19	691	49	367
20	682	50	360
21	670	51	353
22	659	52	347
23	646	53	341
24	633	54	335
25	620	55	329
26	608	56	324
27	595	57	319
28	582	58	315
29	569	59	310
30	556	60	306

TABLE 5

LOCAL HOUSING TEMPERATURE VS.
TIME IN UNITS FAH-F-41 and FAH-F-74

UNIT FAH-F-41, FAH-F-74 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)	UNIT FAH-F-41, FAH-F-74 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)
1	96	31	369
2	106	32	359
3	118	33	350
4	132	34	340
5	148	35	331
6	167	36	321
7	188	37	312
8	212	38	303
9	239	39	294
10	269	40	285
11	302	41	276
12	339	42	267
13	369	43	259
14	394	44	251
15	412	45	243
16	426	46	235
17	436	47	227
18	442	48	220
19	445	49	213
20	445	50	206
21	443	51	199
22	440	52	192
23	435	53	186
24	428	54	180
25	421	55	174
26	414	56	169
27	405	57	163
28	397	58	158
29	388	59	153
30	378	60	148

TABLE 6

LOCAL HOUSING TEMPERATURE VS. TIME IN UNIT CAP-F-40

UNIT CAP-F-40 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)	UNIT CAP-F-40 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)
1	97	31	382
2	109	32	372
3	122	33	363
4	137	34	353
5	155	35	343
6	175	36	334
7	197	37	325
8	222	38	316
9	251	39	306
10	282	40	298
11	316	41	289
12	354	42	280
13	385	43	272
14	410	44	264
15	429	45	256
16	443	46	248
17	452	47	241
18	458	48	234
19	461	49	227
20	460	50	220
21	458	51	213
22	454	52	207
23	449	53	201
24	443	54	195
25	435	55	189
26	427	56	184
27	419	57	178
28	410	58	173
29	401	59	169
30	391	60	164

TABLE 7

LOCAL HOUSING TEMPERATURE VS.
TIME IN CAH-F-8 UNIT

UNIT CAH-F-8 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)	UNIT CAH-F-8 TIME (MIN)	MAXIMUM LOCAL HOUSING TEMP. (DEG F)
1	106	31	486
2	124	32	472
3	144	33	459
4	168	34	445
5	197	35	432
6	229	36	419
7	266	37	406
8	307	38	393
9	354	39	380
10	405	40	368
11	460	41	356
12	519	42	344
13	565	43	332
14	597	44	321
15	619	45	310
16	632	46	299
17	637	47	288
18	637	48	278
19	633	49	268
20	626	50	258
21	617	51	248
22	606	52	239
23	594	53	230
24	582	54	221
25	569	55	213
26	555	56	204
27	542	57	196
28	428	58	189
29	514	59	181
30	500	60	174

CONCLUSIONS

Based upon conservative, worst case calculations, the following conclusions are drawn from a fire involving the charcoal cells in the air handling units:

1. The worst case maximum localized steel plate housing temperature was calculated to be 704°F. This temperature is substantially below that required for structural failure of the steel housing.

2. Structural failure of any steel beam or column in the vicinity of these filter units cannot be caused by heat transfer from the filter housing.

3. The maximum radiant heat emissive flux from the housing at 704°F, calculated to be less than 10 kW/m^2, is less than half the critical radiant flux necessary to ignite the worst case cable jacket materials as determined by EPRI sponsored tests at Factory Mutual Research Corporation (EPRI NP-1200 part 1).

Therefore, the hazards posed by the heating of the steel housing from a charcoal bed filter cell fire will not jeopardize the safe shutdown of the plant.

File Ref: SE-02-02-103

Section F-3 Appendix D
Hazards Analyses of Seabrook Station
Charcoal Filter Units

APPENDIX A

APPENDIX A

ANALYSIS METHODOLOGY

The unsteady heat conduction analysis used for this study is described in detail in this appendix. A lumped heat capacity approach was utilized, valid as long as the heat conduction is sufficiently fast, as compared to the rate of heat transfer to the object (the appropriateness of the lumped heat capacity approach is reviewed later in this appendix).

Figure A-1 depicts the heat transfer to the steel housing. The net heat transfer to the steel acts to increase the internal energy of the steel, resulting in a temperature rise. This can be described in equation [1] as:

$$\rho c_p V \frac{dT_s}{dt} = Q_{RF} - Q_{RL} - Q_c \qquad [1]$$

where:

Q_{RF} = Radiative heat transfer from fire (W)

Q_{RL} = Radiative heat loss from steel to surroundings (W)

Q_c = Convective heat loss from steel to surroundings (W)

T_s = Steel temperature (°C)

t = Time (sec.)

ρ = Steel density (7700 kg/m^3)

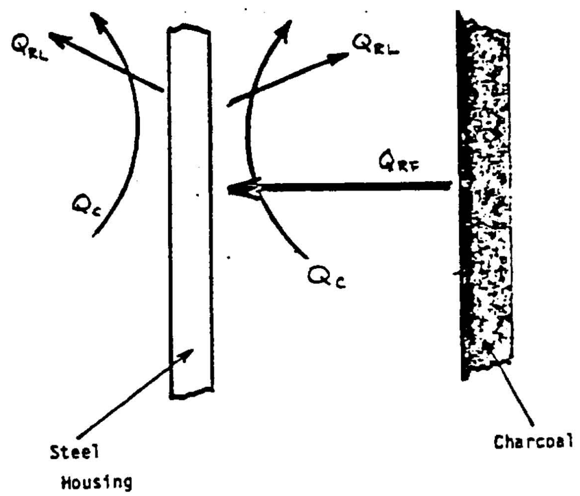
C_p = Steel specific heat (520 J/kg °C)

V = Steel volume (m^3)

It should be noted that conductive losses through the steel to the remainder of the housing have been neglected. This assumption is conservative by ignoring heat which diffuses throughout the assembly.

Figure A - 1

Heat Transfer Process



Q_c = convection heat loss

Q_{RL} = radiation heat loss

Q_{RF} = radiation from fire

The three terms involving radiation or convection heat transfer will now be described.

Radiation Heat Transfer from Fire

In general, radiation heat transfer between two finite, non-black bodies is given by:

$$Q_{RF} = \frac{\sigma (T_c^4 - T_s^4)}{\frac{1-e_c}{e_c A_c} + \frac{1}{A_c F_{cs}} + \frac{1-e_s}{e_s A_s}} \quad [2]$$

where:

σ = Stefan-Boltzmann Constant (5.67×10^{-8} W/m^2°K)
T_c = Charcoal temperature (°K)
T_s = Steel temperature (°K)
e_c = Charcoal emissivity (assume .75)
A_c = Area of burning charcoal (m^2)
F_{cs} = View factor (assume 1.0)
e_s = Steel emissivity conservatively approximated as 0.8 (1)
A_s = Area of steel (m^2)

The surface area of steel directly exposed to the radiant heat from the charcoal filter bed cell fire varied for the five distinct Unit types. For each unit, the area can be calculated as the product of dimensions "A" and "B" from Table 1, except for Unit CAH-F-8 where the area is the product of dimensions "A" and "C".

The view factor can be determined using graphs and view factor algebra. Because of the steel area being appreciably greater than the exposing charcoal bed area, the view factor was approximated as 1.0. It should be noted that since the steel and charcoal are finite in size, the view factor is actually slightly less than 1.0. Estimation of the view factor of 1.0 is conservative, i.e., this will lead to a greater steel temperature.

The charcoal emissivity is assumed to be 0.75, as suggested by Evans and Emmons (2). The burning charcoal surface area (A_C) was conservatively assumed to be 0.465 m^2 (26 inches square) which is larger than the maximum possible fire exposure (22 inches square) to the charcoal bed. The charcoal temperature is a function of time, as provided in the test report summarized in Table 2 of this report (3). The temperatures used in this analysis were measured within the charcoal bed on the outlet side. This set of temperatures was the highest of any of the temperatures measured, thereby yielding a conservative prediction of the steel temperature. This is also conservative since the temperature used is an interior temperature as opposed to a surface temperature (which the radiation is dependent on) which would be cooler.

Radiative Heat Loss

Since the temperature of the surroundings of the steel housing, other than the burning charcoal filter bed cell, is assumed to be unaffected by the fire, the surroundings will remain cool in comparison to the steel plate. As a result, radiation heat transfer will occur from the steel to the surroundings, resulting in a net heat loss from the steel. Since the surroundings are infinite in size as compared to the housing, the radiative heat loss is given by:

$$Q_{RL} = e_S A_S \sigma (T_S^4 - T_R^4) \quad [3]$$

where:

T_R = Room temperature (°K)

T_S, e_S and σ were defined previously for equation [2]. A room temperature of 27°C (81°F) was arbitrarily selected for use in the calculations.

The radiative heat loss is assumed to occur on both sides of the steel housing.

Convective Heat Loss

As long as the surrounding air temperature is less than the steel temperature, free convection heat transfer will occur. Due to the forced air flow of 40 ft/min. through the charcoal filter bed and within the housing during the first five minutes after ignition, forced convection heat transfer also can be expected. The addition of forced convection will lead to an enhanced convective heat loss from the steel. For the purpose of this analysis, the forced convection was neglected, since the forced air stream can be expected to be heated, as documented in the test report. It should be noted that the heated air temperature is expected to be less than the steel temperature. Thus, neglecting the forced convection heat transfer is conservative.

The free convection heat transfer will occur due to the heating of the air adjacent to the steel plate, resulting in air movement due to a buoyancy change. Equation [4] describes the free convection heat loss.

$$Q_c = hA_s(\Delta T) \qquad [4]$$

where:

h = Convection heat transfer coefficient ($W/m^2\ °K$)

ΔT = Temperature difference between steel and ambient air (°K).

The convection coefficient can be approximated as 4.5 $W/m^2\ °K$ (1). This value can be checked use empirically derived values for the coefficient, where the convecting fluid is air (1).

$$h = \begin{cases} 0.95\ (\Delta T)^{1/3} & \text{for vertical plate} \\ 1.43\ (\Delta T)^{1/3} & \text{for horizontal plate} \end{cases} \qquad [5]$$

The condition of a horizontal plate is present for unit CAH-F-8. The value of the convection coefficient will be reviewed after the steel temperature is estimated, so that the temperature difference can be evaluated.

In the case of the units where the exposed housing surface is vertical (PAH-F-16, EAH-F-9, EAH-F-69, FAH-F-41, FAH-F-74 and CAP-F-40), the free convection heat transfer is assumed to occur on both sides of the housing. Unit CAH-F-8, with the exposed horizontal surface, the free convection is assumed to occur only from the top surface. Free convection will also exist from the lower surface, but at a much reduced rate due to the convecting air moving in opposition to smoke produced by the burning charcoal. In all cases, the ambient air temperature is arbitrarily assumed to be 27°C (81°F).

Solution for Steel Temperature

The steel temperature can be determined by substituting equations [2], [3] and [4] into equation [1]. The derivative, $\frac{dT_s}{dt}$, can be replaced by $\frac{\Delta T_s}{\Delta t}$. An iterative solution technique can be applied to determine T_s after a time duration of interest. For this study, a total time of 60 minutes was considered. In general, the equation for T_s is given as:

$$\Delta T_s = \frac{\Delta t}{\rho c_p V}\left[\frac{\sigma (T_c^4 - T_s^4)}{\frac{1-e_c}{e_c A_c} + \frac{1}{A_c} + \frac{1-e_s}{e_s A_s}} + e_s A_s \sigma (T_s^4 - T_R^4) - 4.5 A_s (T_s - T_R)\right] \quad [6]$$

Since estimates for the steel temperature are now available, the validity of two key assumptions can be checked. One assumption considered the rate of conduction heat transfer within the steel to be much greater than the radiation and convection heat transfer on the steel boundary. The second assumption stated that the convection heat transfer coefficient was 4.5 $W/m^2\,°K$. The second assumption will be addressed first, since the examination of the first assumption requires the convection coefficient to be known.

The convection heat transfer coefficient can be determined from equation [5]. Considering the temperature difference to be 200°C (an approximate average temperature difference during the 60-minute exposure), the convection coefficient is actually 5.5 W/m^2 °K for the vertical plate and 8.43 W/m^2 °K for the horizontal plate. Thus, use of the value of 4.5 W/m^2 °K for the convection coefficient underestimated the convective heat loss, yielding greater steel temperatures. Since the assumption of 4.5 W/m^2 °K is shown to be conservative, without grossly underestimating the convective heat loss, the assumption is considered valid.

The validity of the first and more important assumption can now be assessed. The comparison of rates of conduction to convection and radiation heat transfer can be performed by evaluating the parameter, HL/k as noted in equation [7]:

$$\frac{HL}{k} < 0.1 \qquad [7]$$

where:

- H = Combined radiation and convection heat transfer coefficient (W/m^2 °K)
- L = Characteristic dimension of steel (m)
- k = Steel thermal conductivity (W/m °K)

The combined radiation and convection heat transfer coefficient is given as:

$$H = h_C + h_{RL} + h_{RF} \qquad [8]$$

where:

$$h_C = 4.5\ W/m^2\ °K$$

$$h_{RL} = \frac{Q_{RL}}{T_S - T_R}$$

$$h_{RF} = \frac{Q_{RF}}{T_C - T_S}$$

h_{RL} can be re-expressed as:

$$h_{RL} = \frac{Q_{RL}}{T_S - T_R} = \frac{e_S A_S \sigma (T_S^4 - T_R^4)}{T_S - T_R}$$

Similarly, h_{RF} is:

$$h_{RF} = \frac{\sigma (T_C^4 - T_S^4)}{\left(\frac{1-e_C}{e_C A_C} + \frac{1}{A_C} + \frac{1-e_S}{e_S A_S}\right)(T_C - T_S)}$$

Assuming an average steel temperature of 500 °K, average charcoal temperature of 1000 °K, and room temperature of 300 °K h_{RL} and h_{RF} can be evaluated, using the values for all other parameters which were previously presented.

h_{RL} = 56.8 W/m^2K
h_{RF} = 36.4 W/m^2K

Thus, the sum of the heat transfer coefficients is 97.7 W/m^2 °K.

The characteristic dimension of the steel (L) is the ratio of the volume to the surface area. In this case the characteristic dimension is the plate thickness, i.e., 0.001 m (1/4 inch).

Assuming the steel conductivity is estimated as 25 W/mK,

$$\frac{HL}{K} = \frac{97.7 \times .001}{25} = 0.004 < 0.1$$

Thus, the assumption of the rate of heat conduction being substantially greater than that of the convection and radiation heat transfer is appropriate.

The convective and radiative losses can also be compared to assess the sensitivity of the analysis to the selected room temperature. For illustration purposes if the assumed room temperature is increased from 81 °F to 120 °F (27 °C to 49 °C), the maximum localized housing temperature increases by only approximately 20 °F.

Selected References

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Section F-3 Appendix D
Hazards Analyses of Seabrook Station
Charcoal Filter Units

APPENDIX B

Fire Research, 1 (1977) 57 - 66 57

Combustion of Wood Charcoal

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SUMMARY

The dynamics of burning of wood charcoal in an air stream is examined both experimentally and theoretically. To simplify the theory, an experimental arrangement approximating a one dimensional phenomenon was adopted. The theory includes conduction in the solid, chemical reactions and heat release at the surface, and heat and mass transfer in the gas boundary layer above the surface. The molar CO/CO_2 ratio is measured. The theory predicts surface temperature, solid temperature distribution and burning rate within experimental error. An effective reaction rate formula is developed.

INTRODUCTION

This study is a step toward understanding the details of the extinguishment of wood fires by water. To avoid the complications in chemistry during the pyrolysis that wood undergoes as it burns, the initial study reported here is for the burning of wood charcoal. The burning of wood charcoal offers a simplified chemistry while maintaining a physical structure closely related to the original wood, and is an important process in a wood fire as well.

The wood charcoal used in this experiment was commercially available and produced from basswood (Tilia americana). When wood charcoal is burned, the burning surface becomes complicated by a system of cracks generated in the combustion process, and by a fiberous array of residual ash (see Fig. 1). Considering these complications, it is not surprising that little quantitative work on the combustion of wood charcoal has been done in the past. Most basic studies of carbon combustion utilize graphite which is easily obtained more chemically pure and physically uniform. Notable among the studies of graphite combustion is the extensive work performed by Nagle and Strickland-Constable [1] in which an expression for the chemical rate of reaction of pyro graphite with oxygen was developed. One might consider initially burning graphite to avoid the ash and cracking problems. However the low porosity (relative to charcoal) and the consequent large changes of properties makes such tests of little value for the present problem. In fact, graphite will not burn in the present apparatus.

The primary goal of this investigation is to predict the burning characteristics of wood charcoal from basic physical principles. Hopefully this same model will prove adequate to describe more complex cases and in particular will be helpful in the study of extinguishment. Thus it is advantageous to set up an experiment that is easily modeled. One finds that if an isolated piece of wood charcoal is ignited, it will not continue to burn unless one blows an oxidizer, *i.e.* air, on to it. A particularly useful way to blow air on it and at the same time to produce a nearly one dimensional phenomenon, is to locate the burning surface in a stagnation point flow field. In the laminar case, the stagnation point flow field develops a uniform boundary layer thickness over the impingement plane and thus uniform transport phenomenon can be expected. Unfortunately, in order to maintain combustion, air must be blown at the charcoal burning surface at high mainstream velocities; velocities that are high enough to make the flow turbulent. The degree to which the boundary layer thickness for a turbulent stagnation point flow field remains uniform, as in the

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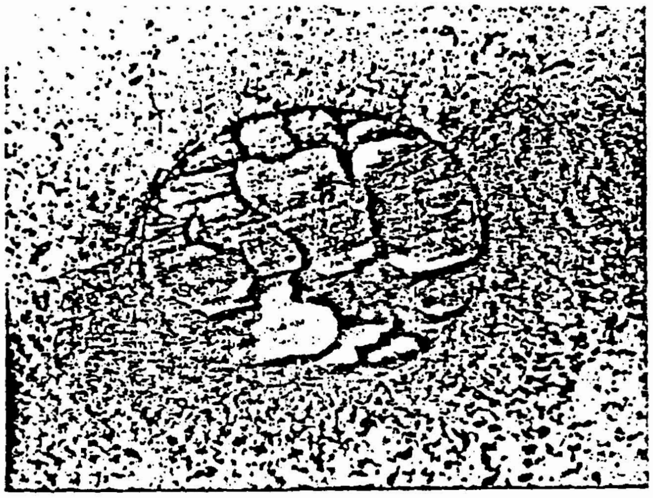

Fig. 1. Burning surface of a charcoal cylinder showing cracks and some ash cover. The circular cross-section of the surface appears elliptical because the camera was held at an angle to the axis of the cylinder to keep it out of the air flow field.

case of the laminar flow was not investigated, but the experimental results were found to be well approximated by a one dimensional theory.

The model of the burning process used here assumes that an overall reaction between carbon and oxygen takes place on the projected surface area (*i.e.* not counting the additional areas within cracks or pores; the cracks cover about 0.5% of the projected area while the pores are very small complex and constitute about 80% of the volume) to produce carbon dioxide and carbon monoxide. The energy and mass balances at the surface require a knowledge of the convective heat and mass transfer rates, the radiative heat exchange, and the conduction into the solid.

Heat transfer coefficients were measured by the cooling of a copper slug in the place of the charcoal sample. The results are presented in dimensionless form.

Mass transfer coefficients were measured by the evaporation of water from a wet porous slug in the place of the charcoal sample. The results are presented in dimensionless form and are compared with the heat transfer results.

The radiation is computed by assuming a surface emmissivity for charcoal of 0.75. This value falls within the range of literature values for "rough carbon" as for example ref. 2.

The heat conduction into the charcoal is the heat required to heat the charcoal from the ambient temperature to the surface temperature.

Finally the ratio of carbon monoxide to carbon dioxide produced during charcoal combustion was measured by a mass spectrometer analysis of grab samples. The results are compared with literature values.

BURNING RATE AND SURFACE TEMPERATURE: EXPERIMENTAL APPARATUS AND RESULTS

The wood charcoal obtained from basswood used in this experiment is that commercially sold by William Dixon Co. of Carlstadt, New Jersey, in solid blocks with

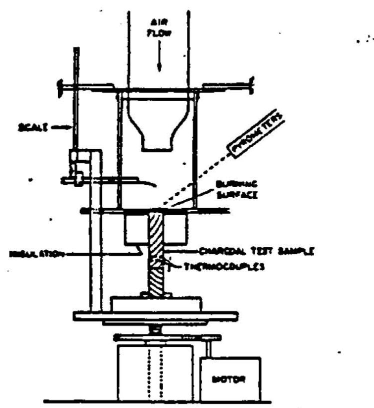

Fig. 2. Schematic diagram of apparatus.

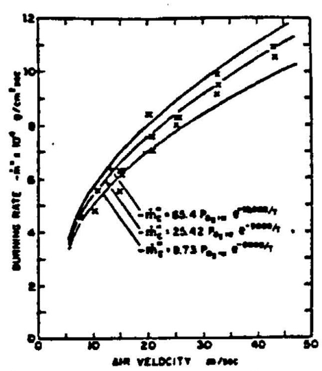

Fig. 3. Charcoal burning rate vs. mainstream air velocity; ×, experimental data; —, predicted burning rate for various kinetic parameter values.

approximate dimensions 17 × 10 × 3.5 cm.

Bulk densities ranged from 0.26 to 0.34 g/cm^3 and ash content from 0.5 to 1.5% by weight. No correlation of ash concentration with the charcoal density was observed. The densities of the test charcoal fall in the same range as the densities which result from a fire, although the latter are usually riddled with cracks—large and small—while the experimental samples were free of cracks before the test and during the test only small surface cracks appeared.

To make the measurements of burning rate, surface temperature, and internal temperature distribution of a wood charcoal cylinder burning in a stagnation point flow, the apparatus schematically represented in Fig. 2 was assembled. A charcoal cylinder approximately 2.7 cm in diameter and initially 11.4 cm in height is shown burning surrounded by insulating material. This insulation is essential if the phenomenon is to be one dimensional. The charcoal cylinder is cut from a larger block of charcoal such that the grain direction is perpendicular to the axis of the cylinder. As the burning surface regresses towards the bottom of the cylinder, the motor driven platform assembly with manually operated speed control pushes the core up at the same rate as the surface is regressing. The burning surface is thus maintained at the same level as the top surface of the insulation on which the air flow impinges setting up the stagnation point flow field. Mainstream air velocities measured at the exit of the nozzle up to 45 m/sec were available. The insulation plate was held a fixed distance of two nozzle diameters from the exit of the nozzle by a larger aluminum plate with a circular opening centered on the axis of the flow.

The internal temperature distribution in the burning charcoal sample was measured by thermocouples implanted near the bottom end of the cylinder. As the burning surface regressed, the thermocouples would come closer to the burning surface eventually passing through it. From measurements of the surface positions, internal temperature information from the thermocouples could be related to their distance from the burning surface. To measure the surface position with respect to the platform, the pin on the end of a scale was lowered periodically to the surface. Contact of the pin was determined visually by observing the pin through the magnifying optics system of the pyrometer. When the pin was not in use, it was swung out of the flow field since its wake in the flow when located more than a few pin diameters above the burning surface was an unacceptably large disturbance. Aside from being used as a telescope, a disappearing filament type pyrometer was one of the pyrometers used to measure the temperature of the burning sur-

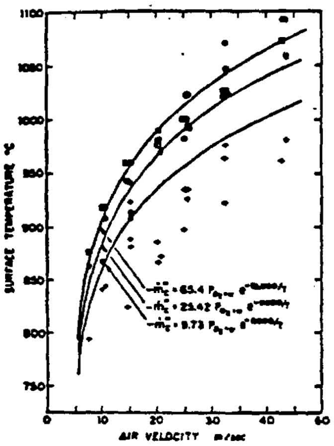

Fig. 4. *Surface temperature vs. mainstream air velocity*; ○, filament pyrometer; ○, infrared pyrometer; •, thermocouple; —, predicted temperature for various kinetic parameter values.

face independent of the readings obtained from the thermocouples.

Figure 3 shows the experimental results for the steady state burning rate of the charcoal as a function of the mainstream air velocity. The burning rate of the charcoal is calculated as the product of the rate of regression of the burning surface and bulk density of the charcoal cylinder measured in room air. The carbon content of the charcoal was determined to be approximately 93% by weight. The remainder included residual hydrogen and oxygen in the charcoal structure, moisture, adsorbed gases, and ash. Thus the charcoal burning rate measured differs slightly from a carbon burning rate.

The lowest recorded mainstream air velocity at which the charcoal would self-sustain its own combustion was 7.7 m/sec. Repeated tries to burn cylinders at a mainstream velocity of 4.4 m/sec failed. After ignition on each of these trials, extinguishment began at the circumference of the burning surface near the insulation and progressed inward towards the center. This sequence of events reveals the influence of some heat loss to the insulation ring. For the purpose of analysis of these data, a self extinction velocity of 5.5 m/sec will be used.

The corresponding measurements of the burning surface temperature measured with the thermocouples and two pyrometers as a function of the mainstream air velocity are shown in Fig. 4. Pyrometer measurements are based on a surface emissivity of 0.75, which is representative of carbon surfaces at temperatures around 900 °C. The maximum temperature measured by an implanted thermocouple was generally below the measurements made by the pyrometers. This is not unexpected as near the surface it was common for the leads of the 0.025 cm diameter chromel-alumel wire threaded radially through the cylinder to be exposed by surface irregularities to the cooling effects of the air flow.

The disappearing filament type optical pyrometer manufactured by Pyrometer Instrument Company was used to measure the temperature of specific small areas of the burning surface where ash cover was a minimum. The area chosen to be measured and balancing of the instrument was left to the judgement of the operator.

The infrared pyrometer was a Barnes Engineering Co., Infrascope Mark I. This instrument was set up to give a continual reading of the average temperature in a ¼ cm^2 area in the center of the burning surface. Its record provided an indication of an effective surface temperature including the influence of the ash layer. Because of fluxuations caused by pieces of ash cover being swept away in the air flow and changing surface crack patterns, some judgement was exercised in assigning one value of temperature characterizing the output. Generally the uncertainity associated with these measurements is ±15 °C.

Close examination of the pyrometer data reveals that the measurements made with the infrared pyrometer, influenced by the ash layer, are approximately 25 °C lower than those made with the filament pyrometer, measuring temperatures in areas of minimum ash concentration, for low air velocities. With increasing air velocity, the two sets of data blend together. This trend indicates the decreasing influence of the ash layer at higher air velocities, as it is swept from the surface more easily than at lower velocities. At the highest air velocity, 43 m/sec, the measurements with the infrared pyrometer are recorded as higher than those with the filament pyrometer. This could indicate that the chosen emissivity for the burning surface is too low. Assuming that the influence of the ash is negligible at this high air velocity, the value of the surface emissivity that brings both pyrometer measurements into agreement at 43 m/sec and 1055 °C is 0.85. It is also likely that the differences in temperature recorded are simply the result of uncertainties in the measurements as they approach the limits of accuracy for the measurements.

BURNING RATE AND SURFACE TEMPERATURE: THEORETICAL MODEL

As mentioned in the introduction, a one dimensional model is adequate for these experimental results. It is desirable to know the detailed chemical kinetic mechanism involving reactions at the carbon surface, in cracks and pores, and in the gas phase. Unfortunately sufficiently detailed chemical data was not found. The graphite reaction kinetic formula of Nagle and Strickland-Constable [1] was tried but as expected was wholly inadequate (low by a factor of about 50). A measurement of the local density near the charcoal surface suggests some burning in the pores and cracks (up to 10%). With charcoal there is no significant burning out in the boundary layer or else the fire could be "blown out" as is the case with burning polymethylmethacrylate. The absence of such major boundary layer burning does not preclude minor reactions in the boundary layer nor major reactions in the gas phase very close to the charcoal surface.

In the absence of applicable chemical data, we will assume an overall reaction and reaction kinetics formula applicable to the charcoal projected surface area. Thus we assume an effective surface reaction:

$$C + xO_2 \rightarrow aCO + bCO_2 \qquad (1)$$

where

$$a + b = 1 \qquad (2)$$

$$x = \frac{a}{2} + b \qquad (3)$$

As discussed later the CO to CO_2 molar ratio is given by

$$a/b = 4.3\exp(-3390/T) \qquad (4)$$

and the reaction rate is assumed in the form of a first order Arrhenius reaction.

$$-\dot{m}''_C = Ap_{O_2,w}\exp(-E/RT) = Kp_{O_2,w} \qquad (5)$$

Prediction of the burning rate and surface temperature of the charcoal in steady state combustion is done by solving simultaneously two independent equations relating the burning rate and surface temperature. The first equation involves an energy balance at the burning surface equating the energy generated in the above chemical reaction to that lost through heat transfer. The burning rate of the charcoal based on the surface energy balance is given by:

$$-\dot{m}''_C = [h(T_w - T_a) + \epsilon\sigma(T_w^4 - T_a^4)] \Big/ \Big[-a\Delta H^\circ_{CO} - b\Delta H^\circ_{CO_2} + \Big(c_C + x\frac{M_{O_2}}{M_C}c_{O_2} - a\frac{M_{CO}}{M_C}c_{CO} - b\frac{M_{CO_2}}{M_C}c_{CO_2}\Big) \times (T_w - T^\circ) - c_C(T_w - T_a)\Big] \qquad (6)$$

In eqn. (6), the value of h is given as shown later by:

$$Nu = hd/k = 3.5(RePr)^{0.38} \qquad (7)$$

The second equation relating the burning rate and surface temperature is eqn. (5) which however requires the oxygen partial pressure at the burning surface. The oxygen partial pressure at the surface $p_{O_2,w}$ is determined from the conservation of species equations at the burning surface. For oxygen this takes the form:

$$h_m(Y_{O_2,a} - Y_{O_2,w}) + \dot{m}''_C Y_{O_2,w} = -\dot{m}''_C \frac{M_{O_2}}{M_C} x \qquad (8)$$

Similar balances for all the other species are needed to determine the composition of the mixture of gases at the burning surface in order to find the oxygen partial pressure. For this calculation the transport rate per unit concentration difference of each species is considered equal to that for oxygen. As described later, the mass transfer coefficient is given by

$$Sh = h_m d/\rho_{aw} D = 2.7(ReSc)^{0.4} \qquad (9)$$

The oxygen partial pressure at the surface is thus found to be

$$p_{O_2,w} = p\left[1+\frac{\frac{M_{O_2}}{M_{N_2}}h_m Y_{N_2,a}-\frac{M_{O_2}}{M_C}\dot{m}''_C b-\frac{M_{O_2}}{M_C}\dot{m}''_C a}{\dot{m}''_C x\frac{M_{O_2}}{M_C}+h_m Y_{O_2,a}}\right]^{-1} \quad (10)$$

Substitution of this expression into eqn. (5) yields the second equation relating the burning rate and the surface temperature after some manipulation as:

$$-\dot{m}''_C = \frac{M_C}{M_{O_2}(x-1)}\left[\left(Kx\frac{M_{O_2}}{M_C}p+h_m Y_{O_2,a}+\frac{M_{O_2}}{M_{N_2}}h_m Y_{N_2,a}\right) - \left\{\left(Kx\frac{M_{O_2}}{M_C}p+h_m Y_{O_2,a}+\frac{M_{O_2}}{M_{N_2}}h_m Y_{N_2,a}\right)^2-4h_m Y_{O_2,a}K\frac{M_{O_2}}{M_C}(x-1)p\right\}^{1/2}\right] \quad (11)$$

Solutions for the steady burning rate and surface temperature satisfying eqns. (6) and (11) were found as a function of the mainstream air velocity and values for all the parameters in the reaction rate expression eqn. (5). In all the predictions, a pressure of 1 atm and an ambient temperature of 20.4 °C representing the average value during all the tests yielding the data recorded in Figs. 3 and 4 was used.

The most powerful piece of information obtained from the data in terms of predicting values of the rate parameters A and E/R was the determination of the self-extinction velocity. From experiments, the minimum air velocity at which the charcoal will sustain its own combustion can only be said to be between 4.4 and 7.7 m/sec. For determining appropriate values of the parameters A and E/R, assumed to be constant, the value of the air velocity set as the self-extinction velocity was 5.5 m/sec. Choosing a value for E/R, a corresponding value for A can be found such that no solution to eqns. (6) and (11) representing steady burning exists at air velocities below 5.5 m/sec. Following this procedure, the lines on Figs. 3 and 4 show the calculated results for burning rate and surface temperature for three values of E/R—8000, 9000 and 10,000—assuming an emissivity for the burning surface of 0.75. The corresponding value of A is given in each case. Comparing the calculation to the experimental data, one can see that in all cases the general agreement is good. The combination of E/R = 9000 (°K) and A = 25.42 (g/cm^2 sec atm) results in the best agreement considering both sets of experimental data.

Because the extinction velocity is important in the determination of the constants A and E/R, some analysis was performed to determine the effect of the uncertainty in this value on the results. Varying the extinction velocity above and below 5.5 m/sec by 1.5 m/sec for a value of E/R equal to 9000, changed the value of A to 24.19 and 27.31 respectively. In terms of an overall first order reaction occurring on the surface, the form of the expression for the effective chemical kinetic rate of reaction applicable to wood charcoal oxidized in air is:

$$-\dot{m}''_C = (25.4)p_{O_2,w}\,e^{-(9000/T)}\ (\text{g cm}^{-2}\,\text{s}^{-1}) \quad (12)$$

The value of E/R of 9000 found applicable to wood charcoal compares favorably with a value of 8160 found useful for Austrian brown coal char in a work by Hamor, Smith and Tyler [3]. Both of these values do not agree well with the 15,100 value of E/R found applicable to the oxidization of pyro graphite in the work of Nagle and Strickland-Constable [1]. A possible explanation for the difference between the results for graphite and those for coal char and charcoal could be the influence of a substantial amount of burning occurring in pores opening onto the surface. Under certain conditions, combustion in pores as opposed to that on an exposed surface can lower the observed activation energy by a factor of two from the actual value associated with the reaction occurring at the burning surface. A detailed discussion of this effect is given by Wheeler [4].

THE TEMPERATURE DISTRIBUTION WITHIN THE UNBURNED SOLID

To model the temperature distribution in the charcoal below the burning surface, a steady state solution to the one-dimensional heat conduction equation in a semi-infinite solid was sought. The burning surface was assumed to have constant temperature T_w and to travel at a constant velocity V, (with respect to a coordinate system fixed to the base of the charcoal cylinder) into the unburned solid, initially at uniform temperature T_0.

No steady state solution exists in a frame of reference in which the surface moves; but with respect to a system in which the burning surface remains fixed in space, the steady state solution is:

$$(T - T_0) = (T_w - T_0)\exp(-VX/\alpha) \qquad (13)$$

To obtain eqn. (13) all the properties of the charcoal forming the thermal diffusivity α, ($\alpha = k/\rho c$), were assumed constant, and heat flux only in the axial direction was allowed.

The exponential form of the anticipated temperature profile suggests that a useful way to plot the experimental results would be in the form of $\ln(T - T_0)$ vs. X. From eqn. (13) it would be expected that a straight-line with slope $-V/\alpha$ would result.

Figure 5 shows the experimental results for a charcoal cylinder with density 0.329 g/cm^3 and initial temperature of 19.7 °C burned in mainstream air velocity of 21 m/sec. The temperature outputs from two thermocouples located on the axis of the cylinder and initially 99.2 mm and 104.3 mm from the end of the cylinder to be burned, (1 and 2 respectively in Fig. 2), are shown as functions of the distance from the burning surface. The plot yields a rough straight-line with mark deviations at large distances from the burning surface and in the range of temperature difference equal to 100 °C. At large distances from the burning surface, the deviation is caused by termination of the insulation around the cylinder at 56 cm. The deviation in the region of a temperature difference of 100 °C is believed due to

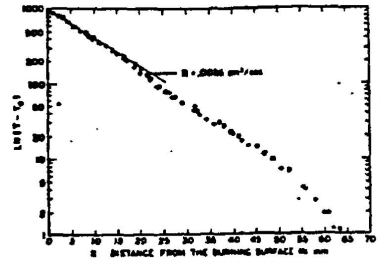

Fig. 5. Experimental data for the steady state internal temperature distribution in a charcoal cylinder with density 0.329 g/cm^3, and initial temperature (T_0) of 19.7 °C burned in a mainstream air velocity of 21 m/sec. Data shown from the thermocouples (+) and (○) initially 99.2 mm and 104.3 mm from the burning surface respectively. Line: straight line fit of data near burning surface.

desorption of adsorbed gases from the charcoal structure.

From a knowledge of the surface velocity, V, (for this test 0.138 cm/min) and the slope of the data near the burning surface, a value of the thermal diffusivity of wood charcoal appropriate to that temperature range can be found as indicated by the results of the simple conduction model. The straight-line fit of the data shown in Fig. 5, yields a value for the thermal diffusivity, α, of 0.0026 cm^2/s. Use of the slope of the data at lower temperatures to predict the thermal diffusivity using the result of the simple conduction model, eqn. (13) would be inappropriate because of the influence of the desorption region, the termination of the insulation, and consequent radial heat loss.

A modest attempt was made to calculate the thermal diffusivity from measurements of the basic properties of thermal conductivity, density and specific heat. The thermal conductivity of wood charcoal was measured and is given by

$$k = 0.0016\rho - 0.00017 \text{ (cal cm}^{-1}\text{ s}^{-1}\text{ °C}^{-1}) \qquad (14)$$

applicable at room temperature, and the specific heat was measured at room temperature and was found to be 0.24 (cal g^{-1} °C^{-1}).

The resultant thermal diffusivity was 0.0045 cm^2/sec to be compared with 0.0026 cm^2/sec found from the burning experiment.

The exact reason for the discrepancy was not sought but is probably associated with the fact that the burning test value is in a higher temperature range where the adsorbed gases have been expelled from the charcoal.

HEAT AND MASS TRANSFER COEFFICIENTS

To measure the convective heat transfer rate as a function of the mainstream air velocity, a copper cylinder the same diameter as the charcoal cylinders being used was set into the insulation so that it occupied the same position the charcoal would normally. The rate of energy lost as it cooled from 350 to 250 °C was determined. This measurement was corrected for heat lost to the insulation to find the convective heat loss rate from the exposed surface. The mass transfer characteristics of the flow field were determined from measurements of the rate of evaporation of water from a sintered disk of the same diameter and located in the same position in the air flow as a charcoal cylinder.

The non-dimensionalized results of the experiment are shown in Figure 6. The results for the heat and mass transfer rates are fit by eqns. (7) and (9) respectively. All of the properties used in the non-dimensionalization are evaluated at the film temperature, the average between the surface and ambient temperatures. The binary diffusion coefficient for water into air, D_{H_2O-air}, was calculated from an expression developed from kinetic theory by Chapman and Enskog [5]. Good agreement among the two sets of measurements in terms of the analogy between convective heat transfer and mass transfer rates is revealed.

Also shown in Fig. 6 are the results for heat transfer in a turbulent stagnation point flow taken from Garden and Cobonpue [6] and Jakob [7]. In selecting results from these sources an effort was made to preserve the ratios of the distance of the stagnation plane from the nozzle exit to the nozzle diameter (l/d) and diameter of the nozzle to the diameter of the circular heat transfer surface (d/s).

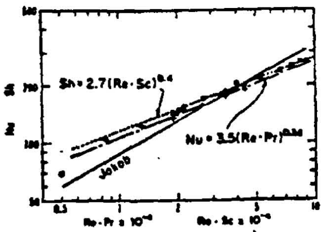

Fig. 6. Heat transfer and mass transfer data. + Present heat transfer measurement, $l/d = 2$, $d/s = 1.94$. □ Present mass transfer measurement $l/d = 2$, $d/s = 1.94$. ● Data from Gardon and Cobonpue [5] ($Pr = 0.72$) $l/d = 2$, $d/s = 2.61$. —·— $Nu = 3.5(RePr)^{0.36}$; least squares fit of +; ----- $Sh = 2.7(ReSc)^{0.4}$; least squares fit of □; ——— $Nu = 0.533(RePr)^{0.573}$; from Jakob [6] ($Pr = 72$); $l/d = 1.43$, $d/s = 1.75$.

CARBON MONOXIDE FORMATION DURING BURNING

To determine the energy released in the combustion of the charcoal, it is necessary to determine the ratio of carbon monoxide to carbon dioxide formed in the reaction. Samples of gas extracted from a region just above the level of the surface and at the circumference of the burning surface, were analyzed for the CO/CO_2 ratio with a mass spectrometer. Figure 7 shows the results plotted as a function of the surface temperature. Originally the data were collected as a function of the mainstream air velocity of the flow indicated at the top of Fig. 7. Characteristic surface temperatures as a function of the air velocity shown in Fig. 4 from the infrared pyrometer were used to convert the data from an air velocity dependence to surface temperature dependence.

Also indicated in Fig. 7 is the result of Arthur [8] for the CO/CO_2 ratio produced in the combustion of graphite and coal char granules in a quartz reacting vessel. The relation $X_{CO}/X_{CO_2} = 10^{3.4}\exp(-12{,}400/T)$ he determined from analysis of the products of the carbon reaction with a flow of oxygen nitrogen, and a small amount of phosphoryl chloride ($POCl_3$) vapor. The $POCl_3$ was added to inhibit the gas phase reaction of carbon monoxide to carbon dioxide. In a previous study [9], the effect of this inhibitor on the ratio of carbon monoxide to carbon dioxide formed during the oxidation of graphite was examined. It was found that a concentration of $POCl_3$ of less than 1% in the air flow raised the CO/CO_2 ratio in the products of combustion to 8.4 from a value of 0.05 (shown in

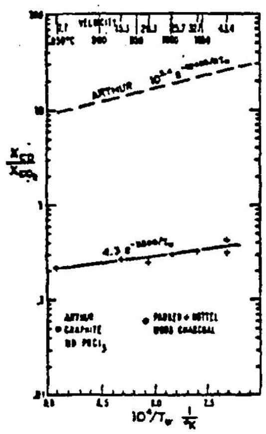

Fig. 7. Molar ratio of CO/CO_2 vs. inverse surface temperature.

Fig. 7 with no inhibitor present). Also shown in Fig. 7 is one value for the CO/CO_2 ratio measured in the combustion of charcoal by Parker and Hottel [10]. Comparing the results of the measurements reported here to those of Arthur would suggest that some gas phase reaction is involved in our combustion of wood charcoal. Because of the high air velocities used in this experiment, if a gas phase reaction does exist it must be confined to a region very close to the burning surface.

CONCLUSIONS

The simple surface combustion model presented in this work can be used to predict the burning rate and surface temperature of wood charcoal burned in a stagnation point flow of air.

An expression for the effective chemical rate of reaction of wood charcoal oxidized in air has been developed. Since this result is empirical and not based upon detailed chemical mechanisms, further work is required to determine the extent of its applicability.

Predictions of the internal temperature distribution in the burning sample can be made based on a simple one-dimensional conduction model in a semi-infinite solid, if a value for the thermal diffusivity appropriate to wood charcoal at elevated temperatures can be obtained and adequate insulation is used around the burning sample.

Results of this study imply that both a gas phase reaction and substantial combustion in pores may be involved in the oxidation of wood charcoal in air. These detailed mechanisms still need elucidation.

ACKNOWLEDGEMENTS

This work is a result of the thesis study of Evans and was supported in part by the National Science Foundation under Grant NSF GI34734, and by the Division of Engineering and Applied Physics, Harvard University.

LIST OF SYMBOLS

a	Moles of CO produced per mole C burned
A	pre-exponential factor, g/cm² sec atm
b	moles of CO_2 produced per mole C burned
c	specific heat, cal/g °C
d	diameter of the air nozzle
D	binary diffusion coefficient, specie i into air, assumed all equal to oxygen in calculation, cm²/sec
E	activation energy, cal/g-mole
h	heat transfer coefficient, cal/cm² sec K
ΔH_i	negative of the heat of combustion of charcoal to product i, cal/g carbon
h_m	mass transfer coefficient, g/cm² sec
k	thermal conductivity, cal/cm sec °C
K	$A \exp(-E/RT)$
l	distance from nozzle exit to impingement plane, cm
$\dot{m}''$	rate of increase of mass per unit time per unit area, g/cm² sec
M	molecular weight
Nu	Nusselt number, hd/k
p	pressure, atm
p_i	partial pressure of specie i, atm
R	ideal gas constant, cal/g-mole °K
RePr	product of Reynolds and Prandtl numbers, vd/α
ReSc	product of Reynolds and Schmidt numbers, vd/D

- s diameter of heat flux sensor, cm
- Sh Sherwood number, $h_m d/\rho_{air}D$
- v mainstream air velocity, cm/sec
- V surface velocity, cm/sec
- x $(a/2) + b$ [see eqns. (1), (2), (3)]
- X distance from the burning surface into the solid, cm
- X_i mole fraction of species i
- Y_i mass fraction of species i

Greek

- α thermal diffusivity, $k/\rho c$, cm^2/sec
- ϵ surface emissivity
- ρ density, g/cm^3
- σ Stefan-Boltzmann constant, cal/cm^2 $sec\ K^4$

Subscripts

- a ambient
- air air
- C carbon
- CO carbon monoxide
- CO_2 carbon dioxide
- m property of the mixture
- N_2 nitrogen
- O_2 oxygen
- w burning surface
- 0 initial value

Superscript

- ° at the reference temperature for the heats of formation—18 °C

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Attachment II to
Hazards Analyses of
Seabrook Station
Charcoal Filter Units,
YAEC 1571

Iodine Adsorber Fire Test

performed for

Yankee Atomic Electric Co.
New Hampshire Yankee

under PO No. 46114

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Introduction

The impregnated carbon used in the various air cleaning systems is typically protected from fire by water deluge systems. The initiation of the water deluge normally takes place by temperature rise signal. This type of fire control has several inherent problems:

a) temperature rise will indicate only major, fully developed fire

b) water distribution in pleated carbon beds is non uniform

c) very large amounts of potentially contaminated water are generated.

To avoid these problems a system test was performed to evaluate the detection of carbon oxidation by CO monitoring and to throttle carbon fires by stopping forced airflow through the carbon bed. Tests were perfromed in both the ASTM ignition test rig and in the Fire Wind Tunnel (FWT) to evaluate CO penetration and temperature generation.

Description of the Equipment & Procedures

1) The ASTM D3466 Test Rig which consists of heated air flow through a carbon bed with inlet air, inlet carbon bed and outlet carbon bed temperature measurement. The test is normally performed at 100 FPM velocity, however, for these tests the airflow was reduced to 40 FPM which is the design velocity of the Seabrook air cleaning systems. The bed depth normally is 1.0 inch deep for these tests. Two inch deep beds of 50 ml (~25g) of carbon was used.

2) The NUCON fire wind tunnel (FWT) consists of an adjustable flow blower followed by an indirect fired natural gas furnace to heat the air, and an adjustable plenum to hold a 24 inch X 24 inch face area adsorber specimen, and the commensurate reduction for outlet ducting.

For these tests a 4.0 inch deep carbon bed was used filled with 2% KI and 2% TEDA impregnated carbon. The inlet temperature to the carbon bed was monitored at a single point in the center area four inches from inlet face of the adsorber. The outlet face of the adsorber was instrumented at 4.0 inches away from the adsorber with five thermocouples. The CO monitor (an infrared sensor type) was taking samples 2 feet down stream from the filter outlet face in the 10 inch reduced duct section.

The adsorber full weight before fire was	65.8 lbs
empty weight	18.4 lbs
as is carbon weight	47.4 lbs
dry carbon weight (less H_2O)	43.6 lbs

When the test was performed, the gas heater was turned on maximum heat to accomplish as fast heat-up as possible. Air flow was maintained for five minutes after fire was detected, then airflow was stopped and the carbon bed inlet and outlet temperatures monitored for 1 hour. The carbon bed was removed from the FWT and weighed.

Test Results

The test (result of the carbon burning test) in the ASTM rig was conducted until all of the carbon was consumed at 40 FPM velocity. The temperatures of the inlet and outlet carbon bed are shown on Table 1.

The results of the fire wind tunnel (FWT) test are shown on Table 2 and on Figure No. 1.

The pertinent values are as follows:

CO of 50 ppm at 11 minutes
CO off scale (200+ ppm) at 19 minutes
Fire in carbon bed at 19:15 - 19:45 minutes
Airflow stopped at 24 minutes

Maximum Temperature 4.0 inches from outlet face	375°C
Temperature at 1.0 hour after ignition with no air flow 4.0 inches from outlet face	200°C
Carbon loss, total test duration (excluding moisture and 2% TEDA which would evaporate in test)	4.53 lbs
Carbon monoxide signal sharply increasing at inlet temperature of	175°C
Filter frame (304 SS) bright red at	24 minutes

Evaluation of the Test Results

The configuration of air cleaning systems is such that the iodine adsorbers are preceded by HEPA filters. The HEPA filter mounting frame is a steel structure with 22 inch X 22 inch openings, therefore, no larger burning material than one HEPA filter size could enter from the carbon bed, anything larger would be stopped by the HEPA mounting frame structure even if it would penetrate the preceding components. This was the reason for the selection of a 24 inch X 24 inch carbon section for the FWT test.

The Seabrook procedure is based on shut down of the airflow 5 minutes after a CO alarm. However, to maintain conservatism in the test, the airflow was shut down NOT 5 minutes after CO alarm, but 5 minutes after actual burning of the carbon in the test section. Even under these conditions the maximum temperature at 4.0 inches from the outlet face of the adsorber was only 375°C, and the temperature started to drop as soon as the blower was shut off. It is important to note that no isolation dampers were closed in the inlet and outlet of the FWT, thus natural air convection was maintained during the test even with the blower shut off, which is another conservatism because most air cleaning systems are equipped with outlet dampers and several are isolatable on both inlet and outlet side.

The ASTM test rig data indicates (from Table 1) that even with airflow maintained, approximately one hour is needed to burn 2.0 inch depth of carbon. While the results from the FWT test indicate that if airflow is stopped five minutes after carbon burning only approximately 10% of the carbon is burned in one hour. While if the carbon monoxide signal is used for system isolation, the fire itself will probably be prevented.

The sharp increase in CO concentration at 175°C inlet air temperature was also determined in the ASTM test rig at 40 FPM and it indicated sharp rise at 175°C inlet air temperature while autoignition did not take place until in excess of 250°C inlet air temperature.

Conclusions and Recommendations

Carbon monoxide monitoring is a very good detection method of carbon oxidation PRIOR TO ACTUAL selfsustained burning of the carbon. Isolation of the system indicating fire within five minutes of CO signal will probably prevent development of selfsustaining carbon fire. Isolation of the system can, after the fire develops during air flow, result in sharp temperature drop upon isolation of the air flow. The maximum temperature 4 inches downstream of the burning carbon bed with air flow at 40 FPM was 375°C.

Based on these results it is recommended that CO monitors be installed in the housing at outlet of the housing and another preferably in the inlet area (just upstream from carbon beds at the top of housing, since CO is lighter than air)

The system should be isolated within five minutes of a CO signal of 50 ppm maximum.

Table 1

08PS942

Test Date
3 Sept 1986

Carbon ignition followed by residual heating (i.e. air flow continued but heat off).

Method: ASTM D3466 except: 40 FPM, 2 inch bed depth and fast heat up

Material: Dry air and NUSORB KITEG II Lot 45/10

Starting condition: 25°C

Ignition occurred at an upper bed (outlet) temperature of approximately 400°C, lower bed (inlet) temperature of 285°C, air inlet temp. 285°C.

Temperatures after ignition:

	Within Carbon Bed	
Time (Min.)	Outlet Side (°C)	Inlet Side (°C)
0:15	790	255
1:00	700	920
2:00	650	850
3:00	640	800
4:00	730	800
5:00	760	805
6:00	790	790
7:00	835	780
8:00	860	790
9:00	920	790
10:00	950	780
11:00	980	730
12:00	1050	800 purple smoke
15:00	780	450
20:00	375	250
30:00	210	150
60:00	100	135

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Table 2

FWT Test Data

Time (Min.)	CO Level (ppm)	Inlet Temp (°C)	Maximum of five (5) Outlet Temps. (°C)
0	2	28	28
4	5	75	35
7	10	125	35
10	20	—	40
11	28	150	—
12	38	—	40
13	44	—	40
14	60	160	—
15	78	—	45
16	102	—	45
17	146	170	—
18	172	—	50
19	Off Scale		50
	Smoke coming out of test rig exhaust		
20		175	200
23		250	375
24	Shut down fan and furnace		
	Filter frame top glowing red		
26		375	320
28		350	—
30		—	260
33		320	250
35		300	—
36		300	—
38		280	—
40		275	225
44		260	225
47		250	220
75		205	195

Both inlet and outlet temperatures at 4.0 inches from filter face in the flow direction.

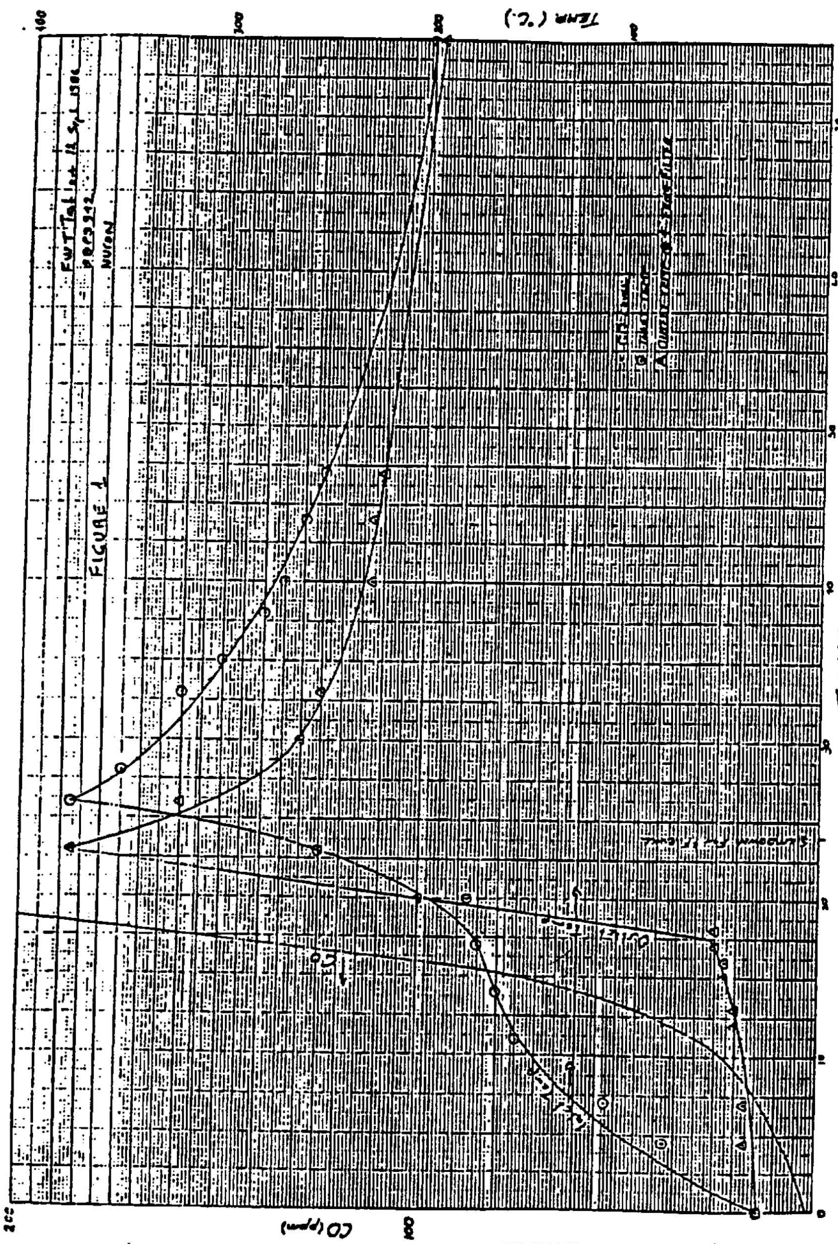
FIGURE 1
TEMP (°C)
CO (ppm)
TIME (min.)

F.3 RESPONSES TO BTP APCSB 9.5-1, APPENDIX A

This section presents a detailed comparison of the Branch Technical Position APCSB 9.5-1, Appendix A, on a position by position basis, with the approach taken in the design of Seabrook Station. Positions found in the left-hand column of each page of Appendix A are restated followed by a discussion as to how closely the plant design complies with the particular Appendix position. Each position and its corresponding response have been presented on a separate page(s).

It should be noted that Appendix A to Branch Technical Position APCSB 9.5-1 requires that plants for which applications for construction were docketed prior to July 1, 1976, but have not received a construction permit, address the positions presented in the left hand side of each page of Appendix A, whereas those plants for which construction permits were issued discuss the positions on the right hand side of the pages. Since the Licensing Board's Initial Decision awarding the Seabrook construction permits is dated June 29, 1976, whereas the permits themselves are dated July 7, 1976, it was debated whether the responses should be to the positions in the right-hand side of the pages. The decision reached was to address the left-hand side and, thereby, provide, in many cases, a more conservative response.

A. Overall Requirements of Nuclear Plant Fire Protection Program

APCSB 9.5-1, App. A

Page Paragraph

1 A.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 fire-fighting and operating crew, including personnel responsible for maintaining and inspecting the fire protection equipment.

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 fire,

(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).

The ultimate responsibility for the overall fire protection program for Seabrook Station rests with the Site Vice President.

The responsibility for various parts of the program has been delegated to other staff personnel and organizations prepared by training and experience in fire protection and in nuclear plant safety in order to provide a balanced approach in direction of the program.

The initial design, construction and basic engineering responsibility for building layout and systems design of Seabrook Station relative to fire area requirements, including consideration of potential hazards associated with postulated fires, fire detection, suppression and extinguishing systems, was assigned to the architect-engineer, United Engineers & Constructors Inc. This included responsibility for design of fire detection, suppression, and extinguishing systems. Coordination of this effort at UE&C was handled by a representative of UE&C's fire protection group which was responsible for ensuring that all applicable fire protection and prevention codes and NRC regulatory requirements were complied with. The representative directed the conduct of the fire hazards analysis to verify that the effects of postulated fires were correctly evaluated and protected against. Final review and approval at UE&C of the fire hazard analysis and the Fire Protection Reevaluation Report was performed by a staff-level fire protection engineer, an individual with an extensive background in fire protection design and evaluation. A copy of his resume has been included in this report.

During the initial design, construction and basic engineering, final review and approval of the layout and design came under the cognizance of Yankee Atomic Electric Company, Nuclear Services Division, who represented the owner. The responsibility for final review and approval of this effort with respect to fire area requirements was assigned to the Fire Protection Coordinator, who was also assigned the responsibility for the ultimate review and approval of the Seabrook fire hazard analysis and the Fire Protection Re-evaluation Report. A copy of the Yankee Atomic Electric Company Fire Protection Coordinator's resume has been included in this report. The responsibility for the fire prevention program during construction of Seabrook Station was assigned to the Resident Construction Manager. He and his staff were assisted in these activities by the YAEC Fire Protection Coordinator. Subsequent to construction completion and core load the corporate fire protection program responsibility has been assigned to the Director of Engineering. The Director of Engineering has assigned this responsibility to the Manager of Design Engineering to coordinate all fire protection activities and to perform technical reviews and evaluations of modifications and program implementation. Lead responsibility for fire protection engineering is assigned to corporate Design Engineering.

The responsibility for the maintenance of fire detection, suppression, and extinguishing systems has been assigned to the Seabrook Station Director. In addition, he has been assigned the responsibility for fire prevention activities at the plant, including training and manual fire fighting activities of plant personnel, including the fire brigade. He is assisted in these activities by his plant staff. The development of the in-plant program, plan and procedures is more fully addressed in responses to Paragraph B.1 through B.7.

APCSB 9.5-1, App. A

Page Paragraph

2 A.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.

Response

The overall fire protection systems for the Seabrook plant are based upon evaluation of potential fire hazards throughout the plant and the effect of postulated fires relative to maintaining ability to perform safe shutdown functions and minimize radioactive releases to the environment.

APCSB 9.5-1, App. A

Page Paragraph

2 A.3

Back-up

Total reliance should not be placed on a single automatic fire suppression system. Appropriate back-up fire suppression capability should be provided.

Response

Total reliance has not been placed on a single automatic fire suppression system. In all instances, there is at least one back-up system available to suppress a fire. Additional back-up capability is provided by the fire brigade as well as response by an outside fire department. Portable fire extinguishers are provided throughout the plant for use on small fires.

APCSB 9.5-1, App. A

Page Paragraph

2 A.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 supplies 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. However, in the event of the most severe earthquake, i.e. the safe shutdown earthquake (SSE), the fire suppression systems should be capable of delivering water to manual hose stations located within hose reach of areas containing equipment required for safe plant shutdown. The fire protection system should, however, retain their original design capability for:

(1) natural phenomena of less severity and greater frequency (approximately once in 10 years) such as tornadoes, hurricanes, floods, ice storms or small intensity earthquakes which are characteristic of the site geographic region and

(2) for potential man-created site related events such as oil barge collisions, aircraft crashes which have a reasonable probability of occurring at a specific plant site. The effects of lightning strikes should be included in the overall plant fire protection program.

Response

The fire suppression system includes three redundant fire water pumps; each pump designed to handle 50% of capacity. One of the fire pumps is electrically driven while the other two are individually diesel engine driven. The electric power for the motor-driven pump is provided with two independent power supplies. Each diesel engine-driven pump has its own controller. Each controller has two independent batteries. Upon loss of power from one battery, the other battery is available to supply the required power for starting the diesel engine-driven pump. Each controller is furnished with a battery charger for charging both batteries simultaneously.

The yard fire water main piping is supplied from the three independent discharge lines from the fire pumps. These lines feed the fire main piping in two directions.

The fire tanks are grounded; the fire pumps are housed within a grounded building; the fire lines are run underground and are free from the effects of lightning. Adequate grounding in plant buildings provides assurance that the effects of lightning strikes will not degrade the performance of fire detection systems.

Those portions of the fire suppression system which are underground or contained in seismic Category I buildings are protected against tornadoes and tornado driven missiles. The potential for damage of other portions of the fire suppression system by tornadoes is low because of the low incidence of tornadoes in the Seabrook area.

The entire fire suppression system including the fire pump house structure and fire protection storage tanks is designed to withstand the effects of the 100 year hurricane-110 mph. (See FSAR, Section 3.3). This wind could possibly cause the removal of some of the steel siding of the fire pump house, but would not otherwise cause the building structure to fail.

Since the elevation of the fire pump house floor slab is 21’-0”, the 100 year flood which results in a still water elevation of 20.6’ would cause no damage to the fire suppression system components here. Seabrook FSAR Section 3.4.1 describes the flood protection provided for Category I structures and their contents.

All buildings containing fire suppression systems are designed to withstand the 100 year snow and/or ice storm, which is equivalent to a roof loading of 75 psf (see FSAR Section 2.3).

In general, the fire suppression system is not designed as a seismic Category I system. However, those portions of this system within seismic Category I structures necessary to deliver water to manual hose stations located within hose reach of areas containing equipment required for safe plant shutdown are designed to withstand the effects of the SSE. Three exceptions are certain hose stations serving the Control Building, “A” Train Electrical Tunnel, and “B” Train Electrical Tunnel. These hose stations were added so that the served areas could be reached with an effective water stream using a maximum hose length of 100 feet. For physical reasons, they are connected to the non-seismic part of the fire protection system. During a fire, however, the fire brigade can add additional hose to other seismic hose stations serving these areas to provide satisfactory coverage if the non-seismic stations are unavailable. The fire pump house, as with all non-seismic Category I buildings, is designed to the requirements of the Uniform Building Code. Thus, the pump house structure will not fail as a result of an earthquake with a ground acceleration up to approximately 0.12g. In the Seabrook area, the 10 year earthquake is estimated to have a ground acceleration of approximately 0.05 g.

In the event of the most severe earthquake, the SSE, the fire suppression system is capable of delivering water to manual hose stations located within hose reach of areas containing equipment required for safe plant shutdown in the following manner:

All such areas (except as noted above) are provided with standpipes (Category I design) which are connected through an administratively controlled valve to plant service water system, also seismic Category I designed.

The potential for man-created, site related events such as oil barge collisions, aircraft crashes and explosions which could adversely affect the fire suppression system is of a very low probability. The details pertaining to these events are given in the FSAR Section 2.2 and in the NRC staff Safety Evaluation Report for the Seabrook station.

APCSB 9.5-1, App. A

Page Paragraph

3 A.5

Fire Suppression System

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 guideline specified in APCSB Branch Technical Position 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment".

Response

The failure or inadvertent operation of the fire suppression systems will not incapacitate safety related systems or components.

The fixed fire suppression system for safety-related areas consists of standpipes and hose reels and automatic water spray systems. All standpipes are pressurized except those in the containment building which are dry. The automatic pre-action sprinkler systems are pressurized with air but are not wet until actuated by the Fire Detection System. The automatic water spray deluge systems are not pressurized. The standpipes in the containment building are not pressurized until the water supply valves are opened.

Standpipes and automatic water spray deluge piping systems in safety-related areas are designed and supported as required for a Category I system to prevent pipe failure and subsequent pipe whip.

APCSB 9.5-1, App. A

Page Paragraph

3 A.6

Fuel Storage Areas

The fire protection program (plans, personnel and equipment) for buildings storing new reactor fuel and for adjacent fire zones which could affect the fuel storage zone should be fully operational before fuel is received at the site. Schedule for implementation of modifications, if any, will be established on a case-by-case basis.

Response

The fire protection system for the fuel area and the adjacent fire areas was operational prior to receiving fuel on site. The portion of the fire protection program required to protect the new fuel storage building, including implementing procedures and personnel training, was in effect prior to receiving fuel on site.

APCSB 9.5-1, App. A

Page Paragraph

4 A.7

Fuel Loading

The fire protection program for an entire reactor unit should be fully operational prior to initial fuel loading in that reactor unit. Schedule for implementation of modifications, if any, will be established on a case-by-case basis.

Response

The fire protection program was operational prior to initial fuel loading.

APCSB 9.5-1, App. A

Page Paragraph

4 A.8

Multiple-Reactor Sites

On multiple-reactor sites where there are operating 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.

Response

Seabrook 2 construction activities have been stopped. The fire protection program developed for Seabrook 1 provides for a continuing evaluation and the administrative controls necessary to protect the operating unit from fire hazards. The provision of additional fire protection capability is based upon the results of this continuing evaluation. The response to Paragraph A.1 provides the responsibilities applicable to the post-construction operational phase.

APCSB 9.5-1, App. A

Page Paragraph

4 A.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.

Response

A fire involving more than one reactor has not been postulated. Construction on Seabrook 2 has been stopped.

B. Administrative Procedures, Controls and Fire Brigade

APCSB 9.5-1, App. A

Page Paragraph

4 B.1

Fire Protection System and Personnel Administrative Procedures

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

NFPA 27 - Private Fire Brigades

Response

Administrative procedures consistent with the need for maintaining the performance of the fire protection system and personnel in nuclear power plants is provided using the guidance contained in the appropriate NFPA publications. These procedures are described in the Station Fire Protection Manual.

APCSB 9.5-1, App. A

Page Paragraph

5 B.2

Bulk Storage of Combustible Materials

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.

Response

Effective administrative measures are implemented to govern the storage of materials and the housekeeping of the plant. The plant "Station Maintenance Manual" shall be the governing administrative document for housekeeping. The "Station Fire Protection Manual" is the administrative manual to control combustible materials.

APCSB 9.5-1, App. A

Page Paragraph

5 B.3

Normal/Abnormal Conditions Or Other Anticipated Operations

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:

(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 non-combustible 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.

Response

Any plant modifications, engineering design change requests, and plant design change requests are reviewed for fire protection concerns. Plant procedures are reviewed by plant management. Maintenance procedures, except for routine jobs in non-controlled areas, are reviewed by plant management.

(a) Work involving welding, cutting and brazing is controlled and covered in the Station Fire Protection Manual.

(b) Open flames or combustion generated smoke will not be used for leak testing or air flow determinations.

(c) Storage of combustible supplies are controlled in plant areas. Use of wood is controlled by the Station Fire Protection Manual. In-situ combustibles are considered in the fire hazards analysis. Transient combustibles used during maintenance or refueling are controlled by the Station Fire Protection Manual.

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Page Paragraph

6 B.4

Public Fire Department Support

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.

Response

The plant fire protection systems plus the fire brigade allow the plant to be self-sufficient with respect to fire fighting. Reliance on the local fire department is for backup capability.

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7 B.5

Plant Fire Brigade Guidance

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.

(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 pre planned and post-critiques 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 offsite command post.

Response

(a) Effective measures for training and equipping fire brigades, testing and maintaining fire protection equipment, emergency lighting and communication have been implemented to cover the above subjects.

Testing and inspections of fire detection and protection systems have been covered by established procedures.

(b) Fire brigade training is accomplished in a manner to include all of the above concerns.

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8 B.6

Coordination With Local Fire Department

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 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.

Response

Selected shift crew personnel are trained in fire protection. Shift crew fire protection training is by job classification which is directed towards those individuals who are at liberty to leave the control room during various phases of plant operation.

The plant fire protection training program is offered annually to local fire departments where practicable. Local fire department training curriculum includes the pertinent aspects of:

a. Station layout

b. Operational precautions

c. Radiological and other hazards

d. Types and locations of probable fires

e. Responsibilities and limitations of authority

f. Other topics, as necessary

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Page Paragraph

9 B.7

NFPA Standards

NFPA 27, "Private Fire Brigade" should be followed in organization, training, and fire drills. This standard also is applicable for the inspection and maintenance of fire fighting 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 prevention and fire suppression which are recognized and/or sponsored by the fire protection industry should be utilized.

Response

Fire brigade training is formulated around the recommendations in NFPA 27. Other NFPA manuals are used as they apply to the plant fire protection program.

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 Oversight organization. The QA program criteria that apply to the fire protection program should include the following:

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Page Paragraph

10 C.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 therefrom are controlled.

Response

During initial design and construction UE&C engineering organization prepared fire protection design engineering and procurement documents which met the guidelines of the Branch Technical Positions. The Yankee Atomic Electric Company (YAEC) reviewed design and procurement documents to ensure compliance. The above functions are currently the responsibility of Engineering.

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Page Paragraph

10 C.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.

Response

Detailed, written operational test, inspection, fire drill, training and administrative control procedures for the fire protection program have been prepared by the plant staff. These activities are audited by the Oversight Organization.

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Page Paragraph

10 C.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.

Response

The Operational Quality Assurance Program (OQAP) defines and establishes the application of the OQAP to Fire Protection Program.

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Page Paragraph

11 C.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.

Response

The Oversight organization performs audits to verify implementation of the fire protection program.

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Page Paragraph

11 C.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.

Response

A fire protection test program has been established and implemented to assure that the fire protection systems are in conformance with the design requirements. Current station procedures provide for tests and inspections to assure readiness of the systems and its components. The fire protection surveillance program is audited by the Oversight organization.

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Page Paragraph

11 C.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.

Response

Procedure documentation is provided for the identification of items that have satisfactorily passed required tests and inspections. The Oversight organization performs audits to verify documentation.

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Page Paragraph

11 C.7

Non- Conforming Items

Measures should be established to control items that do not conform to specified requirements to prevent inadvertent use or installation.

Response

The OQAP provides measures to control the use of items and to prevent inadvertent use or installation of non-conforming items.

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Page Paragraph

11 C.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 non-conformances are promptly identified, reported and corrected.

Response

Measures have been established and implemented via the Fire Protection Program per the responsibilities discussed in the response to Paragraph A.1.

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Page Paragraph

12 C.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.

Response

Records for fire protection activities are prepared and maintained per Administrative Procedures.

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Page Paragraph

12 C.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.

Response

The Oversight organization provides audits to verify the above activities.

D. General Guidelines for Plant Protection

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Page Paragraph

12 D.1 (a)

Building Design - Plant Layouts

Plant layouts should be arranged to:

(1) Isolate safety-related systems from unacceptable hazards, and

(2) Separate redundant safety-related systems from each other so that both are not subject to damage from a single fire hazard.

Response

The above stated design requirements of "isolation and separation" have been adhered to in the layout of the plant, to the maximum extent practical. Where safety-related systems cannot be isolated from potential fire hazards, additional detection, barriers and/or automatic fire suppression methods with appropriate backup are provided.

Those safety-related systems which are required to safely shut down the plant consist of separate and independent flow trains. No portions of these systems are located near or in any area which could potentially become a significant fire hazard. In those cases where redundant safety-related equipment (e.g. the primary component cooling water heat exchangers) are not separated from each other by a physical barrier, no combustible materials of any significant quantity are present within the immediate vicinity of the equipment, precluding the possibility of damage to redundant equipment due to a potential fire. Where necessary, an adequate barrier is provided to prevent the propagation of a postulated fire caused by combustible material contained in one safety-related component (e.g. component cooling pump) from jeopardizing the operation of a redundant component.

Electrical and instrument layouts are arranged to isolate safety-related systems from unacceptable fire hazards by eliminating the use of combustible materials to the greatest extent possible. Redundant safety-related electrical equipment are separated from each other by physical barriers or distance to prevent both systems from damage due to a single fire hazard. Each diesel generator has been structurally segregated from its redundant adjacent unit. The wall which separates the units on the main level and below is constructed of two-foot thick reinforced concrete with a fire rating in excess of three hours. Upper floor walls, which are one-foot thick reinforced concrete, have a three hour fire rating.

The circulating and service water areas are separated by a two-foot thick reinforced concrete wall whose fire rating is in excess of one and one-half hours. (Reference Deviation #3, SBN-904).

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3 D.1 (b)

Building Design - Detailed Fire Hazard Analysis

In order to accomplish l.(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.

Response

A detailed fire hazards analysis of all areas which include safe shutdown systems has been provided in this report. The need for additional hazard analyses will be determined based on the type and extent of proposed plant modifications.

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Page Paragraph

13 D.1 (c)

Building Design - Cable Spreading Room

For multiple reactor sites, cable spreading rooms should not be shared between reactors. Each cable spreading room should be separated from other areas of the plant by barriers (walls and floors) having a minimum fire resistance of three hours. Cabling for redundant safety divisions should be separated by walls having three hour fire barriers.

Response

The cable spreading room is designated a “fire area” and is separated from other areas of the plant by fire barriers having a fire resistance of three hours. Three hour fire barrier walls are not provided between redundant safety-related cable trays in the cable spreading room because the space allocation of the station design makes it physically impossible. However, the redundant safety-related cables are located in the cable trays which are separated by distance, and this distance meets or exceeds that required by “Attachment C, Physical Independence of Electric Systems” of AEC letter dated 12/14/73, which is generally in agreement with Regulatory Guide 1.75.

In addition, the cable spreading room does not contain high energy equipment such as switchgear, transformers or potential sources of missile or pipe whip, and is not used for storage of flammable materials. Circuits in trays are limited to control and instrument functions. Those power supply circuits serving the control room are routed in embedded conduits. All cables are self-extinguishing and non-propagating and, as a minimum, pass the IEEE-383 1974 flame test. See response to D.3(c) for justification of design.

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13 D.1 (d)

Building Design - Non-Combustibility Requirements for Interior Construction

Interior wall and structural components, thermal insulation materials and radiation shielding materials and sound-proofing should be non-combustible. Interior finishes should be non-combustible 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 configuration (ASTM E-84 Test, "Surface Burning Characteristics of Building Materials").

Response

Thermal insulating materials meet the non-combustible definition in Branch Technical Position CMEB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants." They have flame spread/smoke developed/fuel contributed rating of 25/50/50, as tested by Underwriters' Laboratories Inc. in its use configuration, ASTM E-84 test "Surface Burning Characteristics of Building Materials."

Interior walls and structural components, radiation shielding materials and sound-proofing and interior finishes are non-combustible 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 Building Materials"

Prior to 1978 the ASTM E-84 Test reported flame spread, smoke developed and fuel contribution. However, fuel contribution is no longer reported. Therefore, materials tested prior to 1978 must report flame spread, smoke developed and fuel contribution. Materials tested in 1978 and after must only report flame spread and smoke developed.

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Page Paragraph

13 D.1 (e)

Building Design - Metal Deck Roof Construction

Metal deck roof construction should be non-combustible (see the building materials directory of the Underwriters' Laboratory, Inc.) or listed as Class I by Factory Mutual System Guide.

Response

Metal deck roof construction is non-combustible or listed as Class I by Factory Mutual System Approval Guide.

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Page Paragraph

14 D.1 (f)

Building Design - Suspended Ceilings

Suspended ceilings and their supports should be of non-combustible construction. Concealed spaces should be devoid of combustibles.

Response

Suspended ceilings and their supports are non-combustible construction.

Concealed spaces in safety-related areas are devoid of combustibles. Such spaces, however, may contain metal-sheathed lighting cable type "ALS", which is not considered combustible.

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14 D.1 (g)

Building Design - High Voltage. High Ampere Transformers

High voltage - high ampere transformers installed inside buildings containing safety related systems should be of the dry type or insulated and cooled with non-combustible liquid.

Response

The only high voltage - high ampere transformers installed inside buildings containing safety related systems are 480 volt unit substations which utilize dry type transformers.

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14 D.1 (h)

Building Design - Oil Filled Transformers

Buildings containing safety related systems should be protected from exposure or spill fires involving oil filled transformers by:

locating such transformers at least 50 feet distant; or

ensuring that such building walls within 50 feet of oil filled transformers are without openings and have a fire resistance rating of at least three hours.

Response

The generator step-up transformers, unit auxiliary transformers and reserve auxiliary transformers are the only oil-filled transformers, and are located outside along the north wall of the turbine building. The north wall has a three hour fire resistance rating. Refer to Tab 15. All oil-filled transformers are protected by automatic water spray systems, and are located at least 50 feet from any safety related systems.

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15 D.1 (i)

Building Design - Floor Drains

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 Drainage of Floors"). Drains in areas containing combustible liquids should have provisions for preventing the spread of the fire throughout the drain system. Water drainage from areas which may contain radioactivity should be sampled and analyzed before discharge to the environment.

Response

Floor drains are located in those areas where automatic sprinkler and spray systems are installed. These drains are sized to pass the expected flows resulting from automatic system actuation, as well as that produced by manual hose application if employed.

In areas where hand hose lines are the only water sources utilized to combat a fire, drains are provided if accumulation of fire fighting water could result in unacceptable damage to safety-related equipment in the area. In such areas, the operator can use the hose to control the quantity of drain water to avoid unacceptable damage to equipment.

Water drainage from buildings with potential for radioactive contamination will be routed to the waste processing building, where it is sampled and analyzed for radioactivity.

Drainage within the diesel generator building is designed to prevent the spread of fire from one area to another. Other areas with combustible liquids have normally closed shut-off valves in the drain lines or drain directly to the oil/water separation vault.

A fire in the primary auxiliary building, should it occur, may require large amounts of fire fighting water, which could result in the PAB floor drain sump overflowing and spilling over into the pipe tunnel between the vault area and the containment building. The combined pipe tunnel area and the PAB sump can hold up to 14,000 gallons of fire fighting water. Water in excess of this would overflow into the vault No. 2 floor drain sump. This contained water would not jeopardize the operability of safety-related equipment and equipment required for a safe plant shutdown. Contaminated drainage is processed through the liquid waste system. Sump pumps located in the affected areas pump water at a nominal rate of 25 gpm per pump to the floor drain tanks in the waste processing building. Provisions for sample analysis are available at the waste test tank prior to discharge to the environment.

In the event of a fire in either the waste processing building or the fuel storage building, the fire fighting water could drain to the lowest elevation of the building, where it would be contained. Any resulting flooding in either building would thus not jeopardize the operability of safety-related equipment or equipment required for the safe shutdown of the plant. Sump pumps located in the affected areas pump water at a nominal rate of 25 gpm per pump to the floor drain tanks in the waste processing building.

If a fire requiring large amounts of water should occur in the containment building, there exists a possibility of flooding the reactor instrument cavity. However, the cavity can hold more than 47,000 gallons of water without jeopardizing the operability of safety-related equipment or equipment required for safe shutdown of the plant. Sump pumps located in the affected areas pump water at a nominal rate of 25 gpm per pump to the floor drain tanks in the waste processing building.

All safety-related equipment, except draw-out switchgear and local control panels are mounted on pedestals to avoid water damage, or provided with curbs or other barriers, as required, to contain the water and direct it to floor drains. The draw-out switchgear and local control panels are capable of withstanding a minimal degree of floor flooding without damage.

The electrical tunnels contain no sources of flood water other than the fire protection system piping. The fire protection system piping are zoned pre-action dry pipe systems with the zone valves located external to the tunnel areas. The individual fire protection system zones will be actuated by ionization fire detectors. Fire detectors are provided in the areas zoned to provide for local indication and for an audible and visual alarm in the control room and the guardhouse. Water from the fire protection system will be drained from the tunnel zones to a sump external to the electrical tunnel areas.

Redundant pumps have been installed in the sump to pump the water collected from the tunnel fire water drains to the storm drain system.

The electrical tunnel areas are zoned for fire protection. It is highly improbable that a fire will occur in more than one zone at any time; therefore the capacity of each pump is based on the flow of the largest tunnel zone. Each pump is connected to a redundant emergency bus. The installed pump capacity is capable of handling the flow requirements from two zones at all times except in the event of loss of power on one emergency bus.

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15 D.1 (j)

Building Design – Floors, Walls and Ceilings

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 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 required. (Refer to NFPA 80, "Fire Doors and Windows".)

Response

Except for exterior walls and ceilings, floors, walls and ceilings enclosing separate fire areas have a minimum 1½ hour or three hour fire rating. Stairwells have three hour rated walls and 1½ hour rated doors.

Penetrations in fire barriers having a fire resistance of three hours, including conduits, piping and sleeves, are sealed or closed with materials providing a fire resistance rating at least equal to that designated for the fire barrier itself, with the exception of bus duct penetrations in the east wall of the non essential switchgear room and bus duct penetration in the north wall of turbine building. Refer to Deviation 14, SBN 970, dated March 18, 1986.

Door openings, except where noted above, are protected with equivalent rated doors, frames and hardware that have been tested and approved by a nationally recognized laboratory. Only doors providing access to the buildings from outside or doors providing access to vital areas are locked and alarmed.

Penetrations for ventilation ducts are protected by a standard "fire door damper", where required, with a fire rating equal to fire barrier itself.

For compliance of 3-hour rated double leaf pressure doors in fire zones GB-FI 2B-A, CB-F-2B-A, CB-F-2C-A and PAB-F-2B-Z, refer to Deviation No. 11, SBN 932, dated March 18, 1986. Refer to the following letters for additional deviations: Deviation 5, SBN-904; Deviation 6, SBN-904; Deviation 7, SBN-904; Deviation 8, SBN-904.

The sub units of multi-section type rated fire dampers, CBA-DP-l3l (CB-F-4A-A); DAH-DP-163 & 164 (DG-F-3A-Z & 3B-Z) have been independently tested and UL certified. Refer to Deviation No. 12, SBN 932, dated January 24, 1986; and Deviation 8, SBN-970.

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16 D.2 (a)

Control of Combustibles

Protection of Safety-Related Systems

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

Response

All safety related systems are isolated or separated from combustible material wherever feasible. Where isolation is not feasible, as noted below, the fire protection system supplies suppression, based on the fire hazard analysis, to insure that a fire does not defeat the safety system function.

(1) The redundant emergency diesel generator fuel oil day tank and associated piping are separated from each other by three hour fire rated barriers. No combustible materials other than the fuel oil in the day tank and piping is stored in the area. Each system is protected by an automatic deluge water spray system which is actuated by a detection system.

(2) The turbine-generator lube oil tank and reservoir, even though a non safety-related system, is separated and protected as described above.

(3) The reactor coolant pump oil systems are provided with an oil collection system and are isolated by virtue of spatial separation and would, should a fire occur, only involve one reactor coolant pump area. The fire hazard analysis presented in Appendix B of this report demonstrates that during a design basis fire, except for the vertical shaft of fire influence, the operation of the containment fan coolers and the heat sink of the steel and concrete would limit the temperature of the general containment area to 253°F. The associated pressure at this time in the containment would be 4.0 psig. This temperature and pressure throughout the containment would not prevent the safe shutdown of the reactor. The vertical shaft of fire influence, while being much hotter than the general area (flame temperature of 4000°F), does not impinge on, nor would it damage, any system or components required for safe shutdown of the reactor.

Based on the results of the fire hazard analysis, no fire suppression system is provided in these areas.

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16 D.2 (b)

Bulk Gas Storage

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".)

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".)

Response

There are no large bulk containers (non-DOT cylinders) of flammable gas inside structures near safety-related equipment. Bulk Hydrogen storage is located outdoors and remote from any safety related equipment. The bulk gas storage located within the Turbine Building is the non-flammable, low pressure 2-¾ ton, carbon dioxide storage tank for the generator purge system. Also stored in the Administration Building are DOT approved cyrogenic containers of Argon and Nitrogen. The containers are equipped with DOT required and approved pressure relief valves. The containers are installed per Station requirements. The gases are non-flammable and are used by Chemistry and Health Physics.

Many of the different gases being utilized within the administration and service building are stored outdoors located within a roofed over storage area south of the administration and service building (See Table 1 for the gases being used).

Seabrook Station requires the installation of several DOT approved compressed gas cylinders inside structure housing safety-related equipment. These DOT cylinders are seismically mounted and/or restrained in seismic buildings and restrained in bottle racks in non-seismic buildings. The DOT cylinders are fitted with an approved safety device to allow gas to escape, preventing an explosion, of the normally charged cylinders if they are exposed to a fire.

The following is a description of the general location and purpose of the DOT cylinder installations:

(A) West Feedwater Pipe Chase – nitrogen cylinder(s) are installed at elevation 3'-0", to provide a backup safety-grade supply of control "air" for the atmospheric steam dump valves (MS-PV-3001 and MS-PV-3004).

(B) Personnel Hatch Area – nitrogen cylinder(s) are installed at elevation 21'-0", to provide a refill supply of control "air" for the West Chase Feedwater and Main Steam Isolation valves.

(C) East Feedwater Pipe Chase – nitrogen cylinder(s) are installed at elevation 3'-0", to provide a backup safety-grade supply of control "air" for the atmospheric steam dump valves (MS-PV-3002 and MS-PV-3003).

(D) Primary Auxiliary Building – nitrogen cylinder(s) are installed at elevation 25'-0", to provide a safety-grade backup "air" supply for each Train of primary component cooling water temperature control valves (CC-TV-2171-1,2 and CC-TV-2271-1).

(E) Diesel Generator Building – nitrogen cylinder(s) are installed in each stairwell, elevation 21'-6", to provide an "air" supply for the preaction sprinkler system, installed over the diesel generators.

(F) Primary Auxiliary Building Sample Room – Argon cylinder(s) are installed in the Sample Room for an inert gas supply for the Flush Tank (SS-TK-197). Nitrogen Cylinders are installed for purging the hydrogen sensor.

(G) Hydrogen Analyzer Room – Oxygen cylinder(s) are installed in the room to provide reagent gas for the analyzers.

(H) Turbine Building – Carbon dioxide and hydrogen cylinders are installed at the generator pedestal, elevation 21'-6", to provide a backup supply of gases for the generator hydrogen and purge systems.

(I) Turbine Building – Air cylinder(s) are installed in the vicinity of the generator pedestal, elevation 21'-6", to provide a backup supply of air, during maintenance to the generator breaker air receivers.

(J) Turbine Building – Nitrogen cylinder(s) are located on the northwest side of the Generator Stator (GSC) Coolant Tank, elevation 21'-0" to provide a supply of purge gas for calibration of the coolant tank vent hydrogen monitor.

(K) Turbine Building – Oxygen cylinder(s) are located on the northeast side of the Generator Stator (GSC) Coolant Tank, elevation 21'-0" to provide a supply of oxygen for maintaining an oxygen saturated environment within the GSC cooling water.

(L) Fuel Storage Building - Nitrogen cylinder(s) are located on the south side of the spent fuel pool near the spent fuel pool heat exchangers, to provide a supply of Nitrogen for tools and accessories used on the Spent Fuel Bridge Crane.

(M) 345kV Switchyard Equipment Enclosure and Overhead Crane Structure – SF_6 Gas Cylinders are located in the southwest corner of the enclosure at elevation 55' – 1 1/4" to provide a supply of gas for the Gas Insulated Substation equipment located in the 345kV Switchyard.

Table 1

Gas	Cylinder Volume (Ft^3)*	Storage Condition (psi)	Number of Cylinders
Acetylene	300	250	2
Argon	331	2400	9
Argon/Methane	240	2200	10
Helium	291	2400	6
Nitrogen	301	2400	12
Propane	172**	516	3

* At 70 ºF, 14.7 psi

** 20-pound cylinders

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Page Paragraph

17 D.2 (c)

Use of Plastic Materials

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 plastic materials, 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.

Response

Usage of plastic materials (except that employed as insulating materials on electric cabling, see Section D.3.(g)) is as follows:

The use of plastic materials, especially PVC and neoprene, has been minimized. In electrical specifications, all materials are required to be self-extinguishing and non-propagating when exposed to fire and flames, to the extent practical.

Fiberglass-reinforced plastic (FRP) floating covers are used in the boric acid, recovery test and reactor makeup water tanks. The FRP skin on the polyurethane foam core has a flame spread rating of 100 which is equivalent to that of redwood. In normal operation the tanks will be at least partially filled with water and the covers will be in full contact with water. The probability of initiating combustion in the cover under this condition and having the combustion spread is extremely low.

Fiberglass-reinforced plastic is used for the chemical drain, chemical drain treatment, and seal water supply tanks. Each tank is located in a separate cubicle. In the highly unlikely event of combustion igniting the tank, the flame would be extinguished at the tank water level.

Plastic spent fuel pool and reactor cavity skimmers are partially immersed in water and, therefore, not a fire hazard.

Batteries in the four battery rooms of the Control Building, one battery room in the Turbine Building and two battery rooms in the Relay Room are fabricated with plastic. The containers will contain the electrolyte solution.

Fibercast Factory Manual (FM) approved pipe and fittings are being used in the fire protection underground piping system. This use of Fiberglass-reinforced pipe does not create an unacceptable fire hazard.

PVC piping and polyethylene containers are used in the Fire Pump House as part of the chlorine addition system for the Fire Protection Water Storage Tanks. These materials are used because the Sodium Hypochlorite is not compatible with carbon steel equipment. This material is being installed in a sprinkler area. Therefore, it does not create an unacceptable fire hazard.

Fiberglass-reinforced plastic (FRP) piping is used in the Air Removal System from the Waterbox Priming Drop Out Tank to the Priming pumps to eliminate the corrosion experienced with carbon steel equipment. This piping is only installed in sprinkler areas of the Turbine Building. Therefore, it does not create a unacceptable fire hazard.

Polyethylene (plastic) high integrity containers (HIC) in steel overpacks are used to hold spent resins in the drum storage area of the Waster Processing building. Because the HICs are contained in the steel overpacks, the HICs are not a fire hazard and will not add to the combustible loading of the building.

Vendor-supplied Leased Makeup Water Treatment System piping and conduit is plastic. The room has sprinklers and is cut off from the Administration Building by CMU block walls. The installation is therefore acceptable.

The Waste Processing Building air filters 1-WAH-F-11 and 1-WAH-F-170 contain filter cores that are three-inch, schedule 40, PVC. The PVC cores may be installed on the filter supply and take-up reels if metal filter cores are not available. A filter fire would not adversely affect the ability to achieve and maintain shutdown in the event of a fire. It is preferable to install non-PVC roll filter cores in these filters.

<u>APCSB 9.5-1, App. A</u>

Page	Paragraph
17	D.2 (d)

<u>Storage of Flammable Liquids</u>

Storage of flammable liquids should as a minimum, comply with the requirements of NFPA 30, “Flammable and Combustible Liquids Code”.

<u>Response</u>

Storage of flammable liquids complies with the requirements of NFPA 30, “Flammable and Combustible Liquids Code” in the design and venting of tanks.

APCSB 9.5-1, App. A

Page Paragraph

18 D.3 (a)

Electric Cable Construction, Cable Trays and Cable Penetrations

Cable Tray Construction

Only non-combustible materials should be used for cable tray construction.

Response

All cable trays are of unpainted galvanized steel construction except for cable trays used in the 345 kV switchyard enclosure area which are of unpainted aluminum construction.

APCSB 9.5-1, App. A

Page Paragraph

18 D.3(b)

Cable Spreading Rooms

See Section F.3 for fire protection guidelines for cable spreading rooms.

Response

See response to APCSB 9.5-1, Appendix A, Section F.3 on cable spreading room.

APCSB 9.5-1; App. A

Page   Paragraph

18   D.3 (c)

Cable Trays Outside Cable Spreading Rooms

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.

Response

Water based fire protection systems are provided for cable trays except for trays containing only instrumentation cables, in the cable spreading room, cable chases, electrical tunnels, penetration areas outside of containment and elevation 25’-0” of the primary auxiliary building. Manual hose stations and portable extinguishers are provided as backup in these areas and all other areas. However, automatic water sprinkler systems are not provided in other areas for the reasons stated below.

The cables to be used will be self extinguishing, non-propagating and, as a minimum, will pass the IEEE-383-1974 flame test. Control and instrumentation cables cannot ignite from overloading or grounds since the maximum fault is insufficient to heat the insulation to the flash point. Power cables can carry sufficient fault current to reach the flash point of the cable insulation; however, protective relaying on the switchgear circuits will respond to fault currents and open the circuit before enough heating has occurred to damage the cable insulation and start a fire. For additional protection, interlocked armored cable will be used for all 15 kV cables and those 5 kV cables which are routed in trays except cables for the Supplemental Emergency Power System (SEPS). Cables for the SEPS are triplex cables routed in solid bottom trays with solid covers. The redundant safety divisions are separated in accordance with Attachment “C” of AEC letter dated 12/14/73 “Physical Independence of Electric Systems and the fire hazard analysis has assured that both divisions can not be incapacitated by a single fire.

Cables are designed for wet and dry locations without electrical faulting.

APCSB 9.5-1, App. A

Page Paragraph

18 D.3 (d)

Cable and Cable Tray Penetration of Fire Barriers

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, minimum meet the requirements of ASTM E-119, "Fire Test of Building Construction and Materials", including the hose stream test.

Response

Penetrations of fire barriers by cable and cable trays are sealed with materials providing a fire resistance rating at least equal to that designated for the fire barrier. The fire seals, as a minimum, meet the requirements of ASTM E-119, "Fire Test of Building Construction and Materials".

APCSB 9.5-1, App. A

Page Paragraph

18 D.3 (e)

Fire Breaks

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.)

Response

Fire breaks are not provided in horizontal tray runs between the fire barriers, based on fire hazard analysis.

Fire stop locations in vertical cable tray runs were selected on the bases of limiting materially 1) the spread of fire via a vertical cable tray and 2) the resultant damage due to a fire in a vertical cable tray run.

The following guidelines were employed:

a) Horizontal offsets >1 foot were considered to end vertical cable tray runs.

b) Fire stops were not installed where cable tray fire suppression was present regardless of length of vertical run.

c) In vertical cable tray runs >25 feet, fire stops were placed to limit the spread of fire to not more than 35 feet. In fact more than two thirds of the vertical runs between fire stops are approximately 25 feet or less. The remaining vertical runs between fire stops vary from about 28 feet to about 35 feet. Where practical in vertical cable tray runs greater than 25 feet, fire stop locations were adjusted to floor elevations.

APCSB 9.5-1, App. A

Page Paragraph

19 D.3 (f)

Flame Test of Electric Cables

Electric cable constructions should as a minimum pass the current IEEE No. 383 flame test. (This does not imply that cables passing this test will not require additional fire protection.)

Response

The majority of the control cable construction used is at a minimum qualified to the IEEE-383 (1974) flame test. Non-IEEE 383 control cable and wiring is used in some locations and is considered to be insignificant. Examples of non-IEEE 383 cable and wiring uses include vendor supplied wiring under the computer room floor; detector cable for Lubricating Oil and Turbine Bearing running above elevation 75’ of the Turbine Building; Excore Neutron Monitoring Cable Assemblies; various telephone wiring; and wiring within some pre-wired cabinets, such as the Main Plant Computer System Cabinets in the Computer Room.

Power cable is qualified to the IEEE-383 (1974) flame test.

APCSB 9.5-1, App. A

Page Paragraph

19 D.3 (g)

Corrosive Gases from Cables

To the extent practical, cable construction that does not give off corrosive gases while burning should be used.

Response

There is no objective standard corrosion test available. From the presently available tests, results are subject to individual judgement and are not repeatable. Available copper mirror test date was reviewed prior to award of the cable order.

APCSB 9.5-1, App. A

Page Paragraph

19 D.3 (h)

Content of Cable Trays, Raceways, Conduit, Trenches and Culverts

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.

Response

Electrical cable trays, raceways, conduit, or trenches are normally used exclusively for cables. No piping for flammable or combustible liquids or gases are installed in these areas. The introduction of combustible materials into these areas are reviewed by Engineering and administratively controlled to ensure that safety related systems will not be impacted. The use of combustible materials has been minimized to the extent practical. The use of combustible materials in these areas is as follows:

Nylon 11 tubing (Imperial Eastman Nylo-Seal) has been installed in conduits and junction boxes with cables which service non-safety related plant equipment. This tubing supports the Chemical Analysis System Hydrogen detection sensors which monitor the Excess Letdown Hx and Letdown Hx compartments, and the Valve Room in containment for Hydrogen concentrations below 50% of the lowest explosive limit. Since the tubing is routed in conduit which does not service equipment required for accident mitigation or post accident monitoring, the probability of initiating combustion and having the combustion impact a safety system is extremely low.

APCSB 9.5-1, App. A

Page Paragraph

19 D.3 (i)

Smoke Venting of Cable Tunnels, Culverts and Spreading Rooms

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.

Response

Manual smoke venting is provided in the cable spreading rooms and cable tunnels, but not for the containment electrical penetration area. The present ventilation system in this penetration area consists of recirculation air cooling units which have no exhaust capability. Portable fans will be used by the fire brigade for smoke removal if necessary.

The design of cable tunnels and spreading room provides for manual smoke venting, as required to facilitate manual fire fighting capability.

APCSB 9.5-1, App. A

Page Paragraph

19 D.3 (j)

Control Room Cables

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. Cable should not be installed in floor trenches or culverts in the control room.

Response

The control room is not used as a raceway for cables between other rooms or buildings. Cables entering the control room are terminated there. Cables routed to the control room are the minimum necessary for operation of the units.

A floor trench, less than one square foot in cross section, connects the computer room to the control room and leads to a trench under the main control board. It accommodates low voltage signal cables.

A second floor trench, less than one square foot in cross section, connects the computer room to the control room and leads to auxiliary control consoles in the control room. It accommodates low voltage signal cables. Both of the above trenches between the computer room and the control room total less than one square foot in cross sectional area.

APCSB 9.5-1, App. A

Page Paragraph

20 D.4 (a)

Ventilation

Discharge of Products of Combustion

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.

Response

The products of combustion that need to be removed from a specific fire area have been evaluated as part of our fire hazard analysis.

All fire areas are exhausted through the normal plant ventilation system, if available and practical, in the event of a fire. Portable exhausters are available to remove smoke and corrosive gases from fire areas in case of closure of ventilation fire dampers. The exhausts from the radioactive areas are monitored by permanently installed radiation instrumentation. High radiation is alarmed in the control room. Additionally, portable radiation instrumentation can be used if necessary. Should the products of combustion contain radioactivity above the permissible limits of the plant technical specifications, the exhaust of the products of combustion will be terminated until adequate cleanup can be conducted.

APCSB 9.5-1, App. A

Page Paragraph

20 D.4 (b)

Evaluation of Inadvertent Operation or Single Failures

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 of operations personnel.

Response

There is no ventilation system designed specifically to exhaust smoke or corrosive gases; normal ventilation is designed so there is no possibility for an inadvertent operation or single failure to violate the plant controlled areas.

The plant ventilation system is designed to ensure containment capability during a single failure or inadvertent operation without violating the controlled areas or endangering the public or operating personnel.

APCSB 9.5-1, App. A

Page Paragraph

20 D.4 (c)

Power Supply and Controls

The power supply and controls for mechanical ventilation systems should be run outside the fire area served by the system.

Response

All mechanical ventilation equipment is located in mechanical equipment rooms. The power supply and controls for the mechanical ventilation systems are generally run outside the fire area served by the system, with the following exceptions:

The power supply and controls of the ventilation system for the A Train switchgear room is supplied from a motor control center in that room. A similar system fed from a B Train motor control center ventilates the B Train switchgear room. The control cables are routed in separated paths through the cable spreading room.

Ventilation of the cable spreading room is controlled by cables passing through the cable spreading room, but its power feed is routed outside the spreading room. The control cables for the cable spreading room ventilation fans are run through the cable spreading room since it is not feasible to bring the control cables into the main control room except via the cable spreading room.

It is necessary to locate the power supply to each 4 kV switchgear room ventilation fan in its switchgear area because it is not feasible to do otherwise. In addition, fire detection and manual fire protection are provided in the areas.

APCSB 9.5-1, App. A

Page Paragraph

20 D.4 (d)

Protection of Charcoal Filters

Fire suppression systems should be installed to protect charcoal filters in accordance with Regulatory Guide 1.52, "Design Testing and Maintenance Criteria for Atmospheric Clean-Up Air Filtration".

Response

Charcoal filters provided for this project are not equipped with fire suppression systems. Ref.: SBN-1208, dated October 9, 1986 and SBN-97O, dated March 18, 1986.

Revision Regulatory Guide 1.52, dated July 1976, states that a single failure-proof low flow air bleed system or other cooling mechanisms is acceptable to prevent excessive temperature rise in the charcoal filter bed.

A low flow air bleed system, which meets the requirements of R.G. 1.52, is provided for the following safety-related charcoal filters:

Filter No.	System	Low Flow Air Source
EAH-F-9 & EAH-E-69	Containment Enclosure Emergency Exhaust (Redundant Filter and Fans)	By-Pass Air from Redundant Fan
FAH-F-41 & FAH-F-74	Fuel Storage Building Exhaust Unit (Redundant Filter and Fans)	By-Pass Air from Redundant Fan
CBA-F-38 & CBA-F-8038	Control Room Emergency Clean Up Unit (Redundant Filter and Fans)	By-Pass Air from Redundant Fan

The following non-safety-related charcoal filters do not meet the guidelines of R.G. 1.52. However, per Reference SBN-970, Deviation No. 13 and SBN-l208, no fire would result from loss of air flow across these charcoal filters.

Filter No.	System
CAH-F-8	Containment Recirculation Unit
PAH-F-16	PAB Nominal Exhaust Unit
CAP-F-40	Containment On-Line Purge Unit

All the charcoal filters, both safety and non-safety, are provided with temperature alarms and carbon monoxide alarms in the Control Room.

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Page Paragraph

20 D.4 (e)

Fresh Air Supply Intakes

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.

Response

All buildings satisfy the above requirements. In addition, the fresh air intakes for the control room which provide air for ventilation and pressurization are obtained from two locations remote from exhaust air outlets and smoke vents of other fire areas. These are the only sources of supply air to the control room.

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Page Paragraph

21 D.4 (f)

Stairwells

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.

Response

Stairwells are designed to minimize smoke infiltration during a fire, and to serve as escape and access routes in the event of a fire. Fire exits are clearly marked and established by pre-fire plan. Stairways, designated as fire access or egress routes, except in the primary containment structure, are enclosed with fire barriers having a designated fire resistance rating of at least three hours (2 hours for the Administration Building), and have approved automatic fire door assemblies rated at a minimum of one and one-half hours.

APCSB 9.5-1, App. A

Page Paragraph

21 D.4(g)

Smoke and Heat Vents

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 square foot of venting area per 200 square feet of floor area should be provided. If forced-convection ventilation is used, 300 CFM should be provided for every 200 square feet of floor area. See NFPA No. 204 for additional guidance on smoke control.

Response

Smoke and heat vents have generally not been used since the normal ventilation system for potentially affected area can be manually controlled and can be used for smoke and heat venting, unless the fire damper in the fire wall closes due to excessive heat. Portable exhausters are available to remove smoke and heat upon closure of the ventilation fire dampers.

The normal ventilation exhaust system for the cable spreading room and switchgear rooms can be utilized for smoke and heat relief. The cable spreading room and each switchgear room is supplied air from its own supply fan, and air is exhausted from each area by its own exhaust fan. Ventilation air can be drawn into the cable spreading room or switchgear rooms by opening doors. Air would be exhausted through the affected room exhaust system.

The supply air system will be manually shut down if smoke or radiation is detected in the supply plenum of the PAB.

APCSB 9.5-1, App. A

Page Paragraph

21 D.4 (h)

Self-Contained Breathing Apparatus

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 on-site for each self-contained breathing unit. In addition, an on-site six 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 containments.

Response

Self-contained breathing apparatus using full face positive pressure masks and approved by NIOSH have been provided for fire fighting, damage control and control room personnel. These units have a minimum operating life of one-half hour and have been distributed in the control room and the fire brigade lockers. At least two extra air bottles for these units, each with a minimum operating life of one-half hour, are located on-site. The plant also has a respiratory air compressor for recharging the air bottles on-site. The air compressor is located in an area free of dust and contaminants.

APCSB 9.5-1, App. A

Page Paragraph

22 D.4(i)

Total Flooding Gas Extinguishing Systems

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 System" and 12A, Halon 1301 Systems).

Response

Areas having Halon 1301 gas extinguishing systems are provided with automatic damper closures in the supply and exhaust ducts, initiated from the Halon control panel upon actuation of the system in conformance to NFPA-12A.

APCSB 9.5-1, App. A

Page Paragraph

22 D.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.

(b) Suitable sealed beam battery powered portable hand lights should be provided for emergency use.

(c) Fixed emergency communication should use voice powered head sets at pre-selected stations.

(d) Fixed repeaters installed to permit use of portable radio communication units should be protected from exposure fire damage.

Response

(a) The following tabulation identifies lighting systems available at each area required to be manned for safe shutdown of the reactor.

Area	Normal Lighting	Essential Lighting	Emergency Lighting
1. Control Room	Yes	Train A & B	Diesel Generator powered fluorescent fixtures (Train A & B) per deviation request transmittal by letter SBN-932 Battery Packs (8 hour)
2. Train A Switchgear Room	Yes	Train A & B	Diesel Generator powered fluorescent fixtures (Train B) per deviation request transmitted by letter SBN-932 Battery Packs (8 hour)
3. Train B Switchgear Room	Yes	Train A & B	Diesel Generator powered fluorescent fixtures (Train B) per deviation request transmitted by letter SBN-932 Battery Packs (8 hour)
4. Diesel Generator Room A	Yes	Train A & B	Battery Packs (8 hours)
5. Diesel Generator Room B	Yes	Train A & B	Battery Packs (8 hours)
6. PAB Boric Acid Tank Room	Yes	Train B	Battery Packs (8 hours)
7. PAB Charging Pump Rm. CS-P-2A	Yes	Train B	Battery Packs (8 hours)
8. PAB Charging Pump Rm. CS-P-2B	Yes	Train B	Battery Packs (8 hours)
9. PAB DG Heat Exchanger Area - Valve SW-V-l7	Yes	Train B	Battery Packs (8 hours)
10. Mechanical	Yes	Train B	Battery Packs (8 hours)
11. Turbine Bldg. Main Fl. Valves SCC-V138 and SCC-Vl39	Yes	Train A	Battery Packs (8 hours)
12. Condensate Storage Tank NW Valve Room	Yes	None	Battery Packs (8 hours)
13. Non-Essential	Yes	Train A	Battery Packs (8 hours)
14. Control Rm. HVAC Equip. Rm.	Yes	None	Battery Packs (8 hours)

In compliance with 10CFR Part 50, Appendix R, Section III-J, all the above areas are also provided with eight-hour-rated self-contained battery packs with sealed beam units for access and egress lighting. All other plant areas are provided with 1½ hour rated self-contained battery packs with sealed beam units for egress lighting.

The extent of the compliance to above requirements refer to Deviation No. 10, SBN-932, dated March 18, 1986.

(b) Fire brigade and operation personnel required to achieve safe plant shutdown have been provided with suitable battery-powered, portable hand lights.

(c) For those events which require Control Room evacuation, we have identified the following areas as requiring manning to achieve and maintain cold shutdown.

Switchgear Rooms A and B

Diesel Generator Control Panels A and B

In addition, there are other areas (e.g., Boric Acid Tank Room) where one time actions (e.g., valve operation) may be necessary.

The remote shutdown locations identified above share a dedicated sound powered telephone channel (headphones are provided as necessary to assure effective communications). Each location also has access to a dedicated paging station. There is also an extension from the station telephone system near each location.

(d) The station trunked radio system is designed to provide communications between all areas of the station via hand-held portable radios. The radio system would provide communication to those areas noted in (c) as requiring one time actions.

The trunked radio system equipment (trunking controller, repeaters, and RF mixing rack) is powered from Unit 1 non-safety power system. Back-up power is provided by the Train A emergency diesel generator and a dedicated battery rated for 2-hour use.

Portable units are powered by rechargeable batteries.

The trunked radio system equipment (trunking controller, repeaters, and RF mixing rack) is protected from exposure to possible fire damage.

E. Fire Detection and Suppression

APCSB 9.5-1, App. A

Page Paragraph

23 E.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."

(b) Fire detection systems should give audible and visual alarm and annunciation in the control room. Local audible alarms should also sound at the location of the fire.

(c) Fire alarms should be distinctive and unique. They should not be capable of being confused with any other plant system alarms.

(d) Fire detection and actuation systems should be connected to the plant emergency power supply.

Response

(a) The fire detection system will comply with NFPA 72D as follows:

The fire detection system provides in the main control room distinctive displays of either fire or trouble for each fire control panel. Each change in status is recorded on hard copy for record purposes. The record identifies time, date, and occurrence.

Inspection and tests of automatic fire detectors is conducted in accordance with Chapter 8 of NFPA 72E (1987). Due to the lack of combustibles, detectors have not been provided above the suspended ceiling in the control room. Reference Deviation 16, SBN-970, dated March 18, 1986.

The electronic fire detection and alarm system employs a multiplexed reporting system using a multi-conductor data bus to interconnect different fire zones. Circuits have been arranged such that a single break or a single ground fault in the wiring will not result in a false alarm signal.

An open circuit will not prevent transmission on either side of the fault. The system is checked against open circuit by means of periodic maintenance tests.

A ground or a short circuit will be alarmed automatically as a system trouble alarm.

Fire detecting equipment is installed in accordance with Paragraph 2-6 of NFPA 72E, Automatic Fire Detectors.

The circuit arrangement, system equipment and trunk capacities of the multiplexed fire detection system complies with the requirements of Table A of Article 430.

(b) The fire detection system gives an alarm locally at its control panel and an audible and a visual alarm in the main control room. Furthermore, the plant PA system will be utilized to warn personnel for a fire in an area. The trouble signals are similarly annunciated at the same locations.

(c) Fire alarms are distinctive and unique. They are not capable of being confused with any other plant system alarms.

(d) The fire detection alarm panels on Main Control Board are fed by the 120V A-C uninterruptible power bus. Alarm data loop is powered by the emergency diesel. Power to local detectors and local panels is provided by the 120V A-C emergency diesel bus where available. Each local panel has built-in battery backup.

<u>APCSB 9.5-1, App. A</u>

<u>Page</u> <u>Paragraph</u>

23 E.2 (a)

<u>Fire Protection Water Supply Systems</u>

<u>Yard Fire Main Loop</u>

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 (AWA). 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 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.

The fire main system piping should be separate from service or sanitary water system piping.

<u>Response</u>

The underground fire main loop was designed to furnish the anticipated fire water requirements using published codes and standards for guidance as enumerated above.

The pipe material is cement-lined welded steel pipe, (except the feed to the General Office Building outside the Protected Area which is plastic pipe and the underground feed to the Mechanical Maintenance Storage Facility, and the RCA Storage Facility which is Fibercast, Factory Mutual (FM) approved, Class 1614, pipe.) to reduce internal tuberculation, coated and wrapped on the outside with bituminous coal tar paint and paper wrapping.

Water from the town of Seabrook water system is used to fill the fire water tanks. A metering pump automatically injects sodium hypochlorite into the fire water tank fill line as required. Flushing of the entire system will be accomplished by discharging water through selected hydrants.

Sections of the main can be isolated, during periods of maintenance and repair, by closing, approved visually-indicating, sectional post indicator valves. The fire main system piping serves the fire protection system exclusively.

APCSB 9.5-1, App. A

Page Paragraph

24 E.2 (b)

Multiple Units Fire Protection Water Supply Systems

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 so), separate yard fire main loops should be used.

Response

The yard fire main system consists of a single loop with cross-connection between units. Unit 2 construction has been stopped, however some Unit 2 buildings have active water suppression systems installed for property loss conservation. Post indicating valves are provided to allow maintenance of a portion of the loop, if required. The water supply is sized for the largest single expected flow including 500 gpm for manual hose streams. The fire water piping main is supplied from three independent discharge lines, one from each fire pump. These lines feed in two directions to supply water to each half of the looped plant fire main piping.

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25 E.2 (c)

Fire Pump Installation

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 or 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. Pump 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.

Details of the fire pump installation should as a minimum conform to NFPA 20 "Standard for the Installation of Centrifugal Fire Pumps".

Response

The fire protection system has three 50% pumps. During a fire, water is supplied by operation of one (1) motor driven pump and one (1) diesel engine-driven pump with the second diesel engine-driven pump functioning as a spare. At all times 100% capacity is available with one 50% pump inactive.

Fire pump discharge connections to the yard fire main loop are not located on opposite sides of the plant. Each fire pump discharges to an outside manifold with independent sectional valves. The yard fire main loop is supplied in two directions from the outside manifold arranged to discharge to either half of the loop.

Each pump has its own driver with independent power supplies and control. There are 3 hour rated fire barrier walls between each of the three fire pumps. Each of the fire pumps with its controller is in a separate fire area.

Remote indication and alarm is provided in the control room for engine failure to start, low lube oil pressure, high engine jacket water temperature, engine overspeed, A-C power failure and battery failure.

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25 E.2 (d)

Fire Water Supplies

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. 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 sources.

Response

The water supply for the fire protection system is stored in two 500,000 gallon tanks. 300,000 gallons in each tank is reserved exclusively for fire protection by means of vertical standpipes for other water sources. This standpipe extends up to the 300,000 gallon level in each tank and provides a source of water for non-fire protection service. The Technical Requirement minimum volume of water in each tank is 215,000 gallons.

The suction piping to the three fire pumps is arranged to permit suction from either or both of the two fire water storage tanks.

The manual valves in the suction piping to the fire pumps and in the relief valve header permit isolation of either storage tank.

The plant's fire water supply system is capable of refilling either tank in eight hours to the 300,000 gallon level.

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26 E.2 (e)

Fire Water Supply Design Bases

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.

Response

The two (2) 500,000 gallon tanks, with 300,000 gallons per tank dedicated for fire protection supply capacity meet the above requirements for hose streams plus the largest demand on a safety related area. Reference Deviation No. 9, SBN 932, dated January 24, 1986. Deviation No. 9 of SBN-932 indicated that the largest demand safety related area was the Diesel Generator Room. Per EC274103, it has since been determined that the largest demand safety related area is the PAB. This does not alter the conclusion of this paragraph or the commitment of this response.

The flow from two fire pumps, each sized to deliver 1,500 GPM at a discharge head of 130 PSI, exceeds the above requirements.

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26 E.2 (f)

Lakes or Ponds as Sources

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.

(1) the additional fire protection water requirements are designed into the total storage capacity; and

(2) failure of the fire protection system should not degrade the function of the ultimate heat sink.

Response

Lakes or fresh water ponds are not utilized as a source of fire protection.

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27 E.2(g)

Outside Hose Installations

Outside manual hose installation should be sufficient to reach any location with an effective hose stream. To accomplish this 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 1000 feet.

Threads compatible with those used by local fire departments should be provided on all hydrants, hose couplings and standpipe risers.

Response

Factory mutual approved, or UL listed fire hydrants equipped with 6” inlet and two (2) 2½” hose connections are located throughout the plant site. These hydrants are supplied from the main fire loop through a 6” branch line with shut-off valve and valve box to grade. The hydrants are so located that no structure is jeopardized by hydrant spacing, due to plant layout, in excess of 250 feet, since they are within 50 feet of any structure. Hose houses are provided at designated hydrant locations.

Each hose house is equipped with 250 feet of 2½” woven jacket lined fire hose and other auxiliary equipment recommended in NFPA No. 24, “Outside Protection.”

All 2½” and larger threads used on standpipe risers, hose couplings and hydrants are American Standard (National) threads and all 1½” threads are Iron Pipe Thread (IPT). The threads are compatible with equipment used by the local fire department.

There is a wall hydrant with two 2½” hose connections located on the west side of the Mechanical Maintenance Storage Facility.

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27 E.3 (a)

Water Sprinklers and Hose Standpipe Systems

Sprinkler and Standpipe Layout

Each automatic sprinkler system and manual hose station standpipe should have 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.

Each sprinkler and standpipe system should be equipped with OS&Y (outside screw and yoke) gate valve, or other approved shutoff 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.

Response

All automatic sprinkler systems and manual hose station standpipes located throughout the plant are connected to the plant underground water main. Sufficient isolation valves are provided in the distribution piping to insure flow to both the primary and backup systems. Each of the above systems is equipped with an OS&Y gate valve.

The sprinkler and hose reels in the Mechanical Maintenance Storage Facility are controlled by a common OS&Y gate valve. The wall hydrant could provide a supply for backup protection.

The Administration building has a combined sprinkler manual hose station system.

Automatic sprinkler systems and automatic water spray deluge systems alarm and annunciate in the main control room where location of a fire is readily identified. Water flow alarms are not provided in standpipe systems since hose stations must be manned by fire fighting personnel before water flow could signal an alarm. Since fire fighting personnel are already at the site of the fire, an alarm serves no useful purpose.

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28 E.3 (b)

Supervision of Valves

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").

Response

Valves for automatic sprinkler systems and hose standpipe systems are either electrically or administratively supervised.

Post indicator valves in the yard loop show "open" or "shut" and are supervised by the administrative control.

With valves supervised as described above, and with the administrative control supervised by the plant operators, adequate control is provided for fire protection.

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28 E.3 (c)

Automatic Sprinkler Systems

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".

Response

The automatic sprinkler systems conform to the requirements of NFPA 13, "Standard for the Installation of Sprinkler System" and NFPA 15, "Standard for Water Spray Fixed System".

An exception is face bushings that were installed in the piping. A limited number of face bushings were permitted on condition that they were installed without screwed automatic sprinkler heads. See also Deviations 1 and 6, SBN- 970.

An additional exception is the Administration Building which has a combined sprinkler/manual hose station system.

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28 E.3 (d)

Fire Protection Water Supply System

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 100 feet of 1½ 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 of at least 4 inch diameter for multiple hose connections and 2¼ inch diameter for single hose connections. These systems should follow the requirements of NFPA 14, "Standpipe and Hose Systems" for sizing, spacing and pipe support requirements.

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 shut off valves and pressure reducing devices (if applicable) outside the area.

Provisions should be made to supply water at least to standpipes and hose connections for manual fire fighting in areas within hose reach of equipment required for safe plant shutdown in the event of a safe shutdown earthquake (SSE). The standpipe system serving such hose stations should be analyzed for SSE loading and should be provided with supports to assure system pressure integrity. The piping and valves for the portion of hose standpipe system affected by this functional requirements should at least satisfy ANSI Standard B31.l, "Power Piping". The water supply for this condition may be obtained by manual operator actuation of valve(s) in a connection to the hose standpipe header from a normal Seismic Category I water system such as essential service water system. The cross connection should be:

(a) capable of providing flow to at least two hose stations (approximately 75 GPM/hose station) and,

(b) designed to the same standards as the Seismic Category I water system. It should not degrade the performance of the Seismic Category I water system.

Response

Interior manual hose stations are spaced at approximately 100 foot intervals, and will reach any location with an effective hose stream.

Each hose station consists of a 2½” hose connection with 2½” valve, 2½” × 1½” reducer, 100 feet of 1½” (minimum) woven jacket lined fire hose and nozzle. In some cases 1¾” fire hose with 1½” couplings may be used in lieu of 1½” hose.

The hose stations are supplied by standpipes with a minimum diameter of 4” (except for those hose stations, in non-safety related buildings, connected to sprinkler systems). Also, a 2.5" bypass line with a restricting orifice is included in the 6" Fire Protection header supplying the Control Building and Diesel Generator Building hose stations to limit flooding in the event of a pipe rupture. The bypass line pipes flow around a normally closed 6" butterfly valve. The restricting orifice and bypass line have an inner diameter of less than 4", but have been sized to allow the required flow and pressure to the downstream hose stations. If additional flow or pressure is desired, the 6" valve may be opened.

With the ability to open the 6" valve and provide a large diameter flow path, the system complies with NFPA 14, "Standpipe and Hose Systems."

Hose stations for normally unoccupied areas are located at the outside entrances and for normally occupied areas at the inside of the entrance, except containment and control room. Hose stations in the containment are located to provide complete coverage of the areas.

The basic fire protection system is designated as an NNS system, and is designed so that failure of the system will not induce failure of any safety-related system or equipment.

Standpipes located in buildings containing safety-related equipment though not safety related are supported in the same manner as a Seismic Category I system, except as noted in the response to paragraph A.4 of Appendix “A” to BTP 9.5-1. These standpipes are connected through an administratively controlled valve to a safety-related service water system having the capacity to supply 150 gpm flow, which will be available for use following an SSE. The required amount of water flow and pressure in the Seismic Category I standpipe system is assured by a seismically qualified booster pump which is powered from a diesel backed seismically qualified motor control center. If this backup fire protection water supply is placed in service, the 6" butterfly valve described above is opened to ensure full flow capability to the downstream hose stations.

The safety-related equipment, structure and/or components in the Cooling Tower East Main Steam and Feedwater Pipe Chases, Service Water Pumphouse, Intake and Discharge Structures are protected by hose houses provided at yard fire hydrants located near these structures. Reference Deviation No. 15, SBN 970, dated March 18, 1986.

Hose reels in the Mechanical Maintenance Storage Facility are supplied by the building's sprinkler system. Each hose station consists of a 1 ½" hose connection and a one hundred foot length of 1 ½" hose.

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30 E.3 (e)

Hose Nozzles

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.

Response

Standpipe hose racks or reels are equipped with adjustable spray (fog) nozzles that are Factory Mutual approved and/or Underwriters Laboratory, Inc. listed. Only spray type nozzles have been provided for use on energized electrical equipment and on energized cabling. Solid stream nozzles are not provided for use on energized electrical equipment or cabling.

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30 E.3 (f)

Foam Suppression

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 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).

Response

The design of the fire protection system does not include the use of foam suppression. Tanks and transformers containing flammable liquids that are within or near buildings are protected by automatic deluge systems actuated by thermal detection. Detectors alarm in the main control room.

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31 E.4

Halon Suppression Systems

The use of Halon fire extinguishing agents should as a minimum comply with the requirements of NFPA l2A and l2B, “Halogenated Fire Extinguishing Agent Systems”, Halon 1301 and Halon 1211. Only UL or FM approved agents should be used.

In addition to the guidelines of NFPA l2A and l2B, 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:

(a) minimum required Halon concentration and soak time

(b) toxicity of Halon

(c) toxicity and corrosive characteristics of thermal decomposition products of Halon.

Response

Halon 1301 fixed gas extinguishing systems used in the plant facilities meet the requirements of NFPA l2A and are UL listed or FM approved.

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31 E.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".

Particular consideration should also be given to:

(1) minimum required CO_2 concentration and soak time;

(2) toxicity of CO_2

(3) possibility of secondary thermal shock (cooling) damage;

(4) offsetting requirements for venting during CO_2 injection to prevent over pressurization versus sealing to prevent loss of agent;

(5) design requirements from over pressurization; and

(6) 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.

Response

No carbon dioxide suppression systems, except for portable extinguishers, are used in the plant fire protection system.

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32 E.6

Portable Extinguishers

Fire extinguishers should be provided in accordance with guidelines of NFPA 10 and 10A, "Portable Fire Extinguishers, Maintenance and Use". Dry chemical extinguishers should be installed with due consideration given to clean-up problems after use and possible adverse effects on equipment installed in the area.

Response

Portable fire extinguishers are provided in accordance with guidelines of NFPA 10 and 10A, "Portable Fire Extinguishers, Maintenance and Use".

Extinguishers (Halon, CO_2, dry chemical or pressurized water) are selected and installed with consideration given to 1) combustibles in the area, such as paper and wood, liquid fuel and electrical equipment and 2) the avoidance of detrimental effects on equipment installed in the area of possible usage.

F. Guidelines for Specific Plant Areas

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32 F.1 (a)

Primary and Secondary Containment - Normal Operation

Fire protection requirements for the primary and secondary containment areas should be provided on the basis of specific identified hazards. For example:

- Lubricating oil or hydraulic fluid system for the primary coolant pumps.
- Cable tray arrangements and cable penetrations.
- Charcoal filters.

Because of the general inaccessibility of these areas during normal plant operations, protection should be provided by automatic fixed systems. Automatic sprinklers should be installed for those hazards identified as requiring fixed suppression.

Operation of the fire protection systems should not compromise integrity of the containment or the other safety-related systems. Fire protection activities in the containment areas should function in conjunction with total containment requirements such as control of contaminated liquid and gaseous release and ventilation.

Fire detection systems should alarm and annunciate in the control room. The type of detection used and the location of the detectors should be most suitable to the particular type of fire that could be expected from the identified hazard. A primary containment general area fire detection capability should be provided as backup for the above described hazard detection. To accomplish this, suitable smoke detection (e.g., visual obscuration, light scattering and particle counting) should be installed in the air recirculation system ahead of any filters.

Automatic fire suppression capability need not be provided in the primary containment atmospheres that are inserted during normal operation. However, special fire protection requirements during refueling and maintenance operations should be satisfied as provided below.

Response

An automatic water spray deluge system is not provided for the reactor coolant pumps lube oil systems located in the primary containment, since the fire hazard analysis presented in Appendix B of this report demonstrates that a suppression system is not necessary to prevent damage to safety-related systems or components. An automatic pre-action system is provided for the electrical penetration areas of the secondary containment.

The cable tray arrangement inside the primary containment is not provided with fixed suppression or detection systems, since there are no combustibles stored in this area. The cable used is a fire retardant, non-propagating type, meeting the fire test requirements of IEEE-383. Cabling for redundant safety divisions is separated by distance or barrier, as described in response D.1. (c). Fire hose stations and portable fire extinguishers are readily available for use in the unlikely event of a fire.

Each of the reactor coolant pump areas in the containment is provided with high voltage ionization fire detectors.

The primary containment is accessible for manual fire fighting during normal operation.

Control of contaminated liquid and gaseous release is ensured by the primary containment ventilation purge system.

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34 F.1 (b)

Primary and Secondary Containment - 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.

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.

Response

The permanent fire detection and suppression systems in the containment are discussed in the response to Section F.1 (a).

It is realized that refueling and maintenance operations in the containment could introduce additional transient loads, such as decontamination control materials, decontamination supplies and temporary wood staging, as well as introducing additional hazards such as welding and cutting and temporary wiring. Procedures and controls necessary to assure adequate fire protection during this time period have been developed. These are more fully discussed in the response to Section B.3.

Standpipes with hose stations have been permanently installed in the containment for use as required in any fire fighting operations during a refueling or maintenance outage. In addition, portable fire extinguishers are available at strategic locations in the containment.

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35 F.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.

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.

Manual fire fighting capability should be provided for both hazards. Hose stations and portable water and Halon extinguishers should be located in the control room to eliminate the need for operators to leave the control room. An additional hose piping shutoff valve and pressure reducing device should be installed outside the control room. Hose stations adjacent to the control room with portable extinguishers in the control room are acceptable.

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.

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.

Breathing apparatus for control room operators should be readily available. Control room floors, ceiling, 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.

The control room ventilation intake should be provided with smoke detection capability to automatically alarm locally and isolate the control room ventilation system to protect operation by preventing smoke from entering the control room. Manually operated venting of the control room should be available so that operators have the option of venting for visibility. Cables should not be located in concealed floor and ceiling spaces. 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.

Safety related equipment should be mounted on pedestals or the control room should have curbs and drains to direct water away from such equipment. Such drains should be provided with means for closing to maintain integrity of the control room in the event of other accidents requiring control room isolation.

Response

The control room complex is separated from other areas of the plant by floors and walls having a minimum fire resistance rating of three hours. All penetration seals have a minimum fire resistance rating equal to that designated for the wall and floor they penetrate.

Manual hose stations are located outside the control room. Nozzles were chosen for the hose stations to satisfy actual fire fighting needs, satisfy electrical safety and minimize physical damage to the electrical equipment from hose stream impingement. Portable fire extinguishers are located in the control room. Breathing apparatus is provided for the control room operators.

Fire detection in the control room complex is provided by ionization detectors. Alarm and annunciation is provided in the main control room. Fire detection from other parts of the plant is also alarmed and annunciated at the same location.

The control room ventilation intake is provided with smoke detection capability to automatically alarm and permit isolation of the control room ventilation so as to protect operators by preventing smoke from entering the control room. A recirculation system with charcoal filters has been provided. This system can be started manually by the control room operator from the Main Control Board to remove smoke. Additional venting of the control room could be accomplished by opening the doors.

All cables that enter the control room terminate in the control room. There is no cabling routed through the control room from one area to another.

Metal jacketed lighting cable (Type ALS) is used in the control room ceiling spaces. This cable has an aluminum sheath which is not a combustible material. No other cables are located in ceiling spaces.

Control room electrical equipment is not provided with pedestals, and floor drains are not provided. These features are not required, as hose stations and standpipes are located outside the room and up to 4 inches of flooding can be tolerated without damage to any safety-related equipment. Drainage can be maintained through the open door to the turbine building or the stairwell to the outdoors.

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37 F.3

Cable Spreading Room

The primary fire suppression in the cable spreading room should be an automatic water system such as closed head sprinklers, open head deluge, or open directional spray nozzles. Deluge and open spray systems should have provisions for manual operation at a remote station; however, there should 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. Cables 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).

An automatic water suppression system with manual hoses and portable extinguisher backup is acceptable, provided:

(a) At least two remote and separate entrances are provided to the room for access by fire brigade personnel; and

(b) Aisle separation provided between tray stacks should be at least three feet wide and eight feet high.

Alternately, gas systems (Halon or $C0_2$) may be used for primary fire suppression if they are backed up by an installed water spray system and hose stations and portable extinguishers immediately outside the room and if the access requirements stated above are met.

Electric cable construction should, as a minimum, pass the flame test in IEEE Std 383, "IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations."

Drains to remove fire fighting water should be provided with adequate seals when gas extinguishing systems are also installed.

Redundant safety related cable division should be separated by walls with a three-hour fire rating.

For multiple-reactor unit sites, cable spreading rooms should not be shared between reactors. Each cable spreading room of each unit should have divisional cable separation as stated above and be separated from the other and the rest of the plant by a wall with a minimum fire rating of three hours. (See NFPA 251, "Fire Tests, Building Construction and Materials", or ASTM E-119, "Fire Test of Building Construction and Materials", for fire test resistance rating.)

The ventilation system to the cable spreading room should be designed to isolate the area upon actuation of any gas extinguishing system in the area. In addition, smoke venting of the cable spreading room may be desirable. Such smoke venting systems should be controlled automatically by the fire detection or suppression system as appropriate. Capability for remote manual control should also be provided.

Response

The primary fire suppression in the cable spreading room consists of several automatic fixed spray dry pipe deluge systems. Automatic water sprinkler systems are provided for cable trays except for trays containing only instrumentation cables. Instrumentation cables would not ignite from over loading since the maximum fault current is insufficient to heat the insulation to the flash point. Provisions are made to preclude inadvertent operation by having two or more fire detection heads actuate the automatic spray systems. Location of spray nozzles considers cable tray sizing and arrangement to assure adequate water coverage. Cables are specified to allow wetting down with deluge water without electrical faulting.

Spray systems are zoned so that a single failure will not deprive the entire area of automatic fire suppression capability. Manual hoses and portable extinguishers are provided in adjacent areas for back-up use in the cable spreading room. Access to the cable spreading room is provided through two remote and separated entrances. Aisle separation between stacked cable trays meets the three feet wide by eight feet high, except in limited cross-over locations which do not limit personnel access. Electric cable construction, as a minimum, pass the flame test in IEEE Standard 383.

Cabling for redundant safety divisions is separated by distance or barrier as described in Attachment "C" Physical Independence of Electric Systems of AEC letter dated 12/14/73, which is generally in agreement with Regulatory Guide 1.75.

Cable spreading rooms are not shared between reactors. Construction on Unit 2 has been stopped. Unit 1 cable spreading room is designated a "fire area" and is separated from other areas of the plant by a fire barrier having a fire resistance of three hours.

The cable spreading room does not contain high energy equipment such as switchgear, transformer or potential sources of missiles or pipe whip, and is not used for storing flammable materials. Circuits in trays are limited to control and instrument functions. Those power supply circuits serving the control room are routed in embedded conduits. There are no combustible materials other than cable in the cable spreading room and all cables are self-extinguishing and non-propagating; therefore, the fire hazard evaluation shows that a postulated fire will not occur in the cable spreading room.

Smoke venting of the cable spreading room is available by use of the normal Ventilation system. This system is not controlled automatically by the fire detection or suppression system but by remote manual control. Portable fans can be used for smoke removal upon closure of ventilation fire dampers. Automatic fire detectors provide an alarm at its local control panel and a visual and an audible alarm in the main control room.

Drains are provided to remove fire water from actuation of the deluge system.

See D.3(c) for justification of adequacy of separation without the use of three hour fire rated walls.

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39 F.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.

Response

The plant computer does not perform any safety function, and the total failure of the computer will not prevent the safe and orderly shutdown of the plant. The plant computer room is a portion of the control room complex but is separated from the main control room by three hour fire rated walls. Automatic fire detectors with fixed Halon 1301 system are provided in the computer room to provide an alarm at its local control panel and a visual and an audible alarm in the main control room. Manual hose stations are located outside the control room. Halon hand-held extinguishers are located in the computer room. Portable water extinguishers are not provided.

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40 F.5

Switchgear Rooms

Switchgear rooms should be separated from the remainder of the plant by minimum three-hour rated fire barriers, if 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.

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.

Response

Switchgear rooms are separated from the remainder of the plant by minimum three-hour rated fire barriers. Automatic fire detection is alarmed and annunciated in the main control room. Even though switchgear rooms are unoccupied, alarms are provided. Alarm and indication in the main control room readily identify the fire control panel in alarm. Portable extinguishers are provided in the area with hose stations located outside in an adjacent area and yard fire hydrants readily available for use if and when required.

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Page Paragraph

40 F.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.

Response

The remote safety-related shutdown panels are housed in the control building at floor elevation 21'-6" and in the diesel generator building at floor elevation 2l'-6". (See drawings F-3l0431 and F-202069.)

Automatic fire detectors are provided in the control building at floor elevation 21'-6" and in the diesel generator building at floor elevation 21'-6". These automatic fire detectors provide local indication plus alarm and indication in the main control room. In addition, the diesel generator building at elevation 21'-6" is protected by a manual preaction sprinkler system.

Combustible materials are minimized in all of the above areas. Portable extinguishers are provided inside these areas, and manual hose stations are provided outside these areas.

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Page Paragraph

41 F.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.

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 1½ hours.

(c) Provide a remote manual actuated sprinkler system in each room and provide the 1½ hour fire barrier separation.

Response

Battery rooms are separated from each other and other areas of the plant by barriers having a fire rating of 3 hours. The exhaust ventilation system for the battery rooms is capable of maintaining a hydrogen concentration well below 2% by volume. The exhaust system is redundant, and powered from independent safety related electrical trains. Each exhaust fan is provided with a flow switch which indicates loss of flow in the control room.

Portable fire extinguishers are located nearby, and a hose station is available within hose reach of the battery rooms.

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Page Paragraph

41 F.8

Turbine Lubrication and Control Oil Storage and Use Areas

A blank fire wall having a minimum resistance rating of three hours should separate all areas containing safety related systems and equipment from the turbine oil system.

Response

The turbine lube oil tank is located adjacent to the exterior wall of the turbine building inside a one (1) foot thick concrete wall enclosure whose fire rating is in excess of three (3) hours. This enclosure is capable of containing the contents of the tank. Although there are no safety related systems located in the vicinity, the fire protection system in this area consists of an automatic deluge suppression system and back-up protection with local hose stations.

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Page Paragraph

42 F.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.

Automatic fire suppression such as AFFF foam, or sprinklers should be installed to combat any diesel generator or lubricating oil fires. Automatic fire detection should be provided to alarm and annunciate in the control room and alarm locally. Drainage for fire fighting water and means for local manual venting of smoke should be provided. Day tanks with total capacity up to 1,100 gallons are permitted in the diesel generator area under the following conditions:

a. The day tank is located in a separate enclosure, with a minimum fire resistance rating of three hours, including doors or penetrations. These enclosures should be capable of containing the entire contents of the day tanks. The enclosure should be ventilated to avoid accumulation of oil fumes.

b. The enclosure should-be protected by automatic fire suppression systems such as AFFF or sprinklers.

Response

Each diesel generator, along with its associated auxiliary equipment, is separated from the adjacent redundant unit by a wall having a fire rating in excess of the designated rating of three hours. Doors in these walls are Class A with a three hour fire rating.

Each fuel oil day tank (1500 gallons) is installed in a separate enclosure which is located on the floor above the diesel generator served. This enclosure is designed with walls, floor and ceiling having a fire rating in excess of the designated rating of three hours, and sized to contain the contents of the tank. Doors servicing these enclosures are Class A.

Redundant automatic preaction water systems are provided in each of the two Fuel Oil Storage Tanks areas. Automatic deluge water systems are provided in each of the two fuel oil day tank areas. Automatic preaction water system in fuel oil piping trenches is provided in each of the two engine rooms. Manual preaction water system for area wide coverage is provided in each of the two engine rooms. Drainage is provided to remove fire protection water.

Automatic fire detection has been provided in the fuel oil storage areas and trenches and in the diesel generator area, with an alarm at its local control panel and a visual and an audible alarm in the main control room. Sufficient detection devices are available to detect that a fire exists in the area and alarm. Local fire hydrants are available to extinguish a fire outside the range of the fixed water spray system.

The normal ventilation systems have the capacity to exhaust the area during and after a fire, unless heat from the fire closes the fire damper in the system. A gravity vent system is provided for the diesel fuel oil vapor, but will not provide sufficient air for sustaining combustion should a fire start. This restriction of combustion air is more important than smoke and heat removal from this area.

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Page Paragraph

42 F.10

Diesel Fuel Oil Storage Areas

Diesel fuel oil tanks with a capacity greater than 1,100 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-hours fire resistance requirements. See NFPA 30, Flammable and Combustible Liquids Code, for additional guidance.

When located in a separate building the tank should be protected by an automatic fire suppression system such as AFFF or sprinklers.

Tanks, unless buried, should not be located directly above or below safety related systems or equipment regardless of the fire rating of separating floors or ceilings.

Response

Although the design of the fuel oil storage areas differs from the design Specified above, the results of the fire hazard analysis presented in Appendix A of this report demonstrates the adequacy of the provided construction, even under the most extreme condition of failure of the water spray system. The design provides fire protection comparable to that recommended in the above guidelines.

Each of the SEPS diesel fuel tanks is in excess of 6,000 gallons. The SEPS diesel generators with their fuel tanks are located less than 50 feet from the Cooling Tower that contains safety related equipment. The generator enclosures are not fire rated. However, the south wall of the Cooling Tower, adjacent to the SEPS installation is three-hour fire rated. The construction of this wall would prevent a fire in the non-safety related SEPS diesel generators from adversely affecting the operation of the safety related equipment in the Cooling Tower. This design meets the intent of these guidelines.

APCSB 9.5-1, App. A

Page Paragraph

44 F.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.

Equipment pedestals or curbs and drains should be provided to remove and direct water away from safety-related equipment.

Provisions should be made for manual control of the ventilation system to facilitate smoke removal if required for manual fire fighting operation.

Response

The equipment vault areas and the charging pump areas which house safety related pumps and heat exchangers are each divided into fire areas separated by fire barriers having at least 1½ or 3 hour ratings. Each fire area contains only one of two redundant components in a safety related system. The fire hazard analysis demonstrates that any postulated fire in one fire area will not affect safety related equipment in an adjacent fire area. These areas are equipped with portable fire extinguishers and have standpipe hose stations available.

Both of the redundant primary component cooling water pumps are located in one fire area. A metal barrier partition has been placed between the two pumps and a preaction sprinkler system has been provided above the pumps.

Both the motor driven and turbine driven emergency feedwater pumps are located in one fire area. Our fire hazard analysis indicates there are minimal combustibles, other than pump lubricating oil and fiberglass ladders, located in this area. The pumps are separated by 15 feet. Ionization detectors have been provided for early warning of a fire and portable extinguishers and hose station for manual firefighting.

The service water pump and the circulating water pump areas are separated by a 1½ hour fire wall. Our fire hazard analysis indicates that combustibles located in these areas consist of pump lubricating oil and fiberglass ladders. Ionization detectors have been provided in the service water pump area and portable extinguishers supplemental by yard hydrants for manual firefighting.

Normal ventilation equipment can be used to facilitate smoke removal, as it can be manually controlled from the main control room until the fire dampers close.

All safety-related pumps and equipment are supported on curbs or pedestals. Floor drains in these areas will direct all water to either the radioactive liquid waste or non-radioactive liquid waste system, as required.

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Page Paragraph

44 F.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 water density that might occur during fire water application.

Response

Portable extinguishers are located in the fuel storage building. A local hose station is located outside the area but within hose reach.

There are minimal combustibles in the fuel storage building. A fire detection system has been provided.

Sumps and sump pumps are provided to prevent accumulation of water. New fuel is stored to preclude criticality should unborated water accumulate in this area.

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Page Paragraph

45 F.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.

Response

Portable fire extinguishers are provided, and a local hose station is within hose reach of the spent fuel storage area.

There are minimal combustibles in the spent fuel area. A fire detection system has been provided.

APCSB 9.5-1, App. A

Page Paragraph

45 F.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 alternate 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.

Response

The radwaste building is separated from other areas of the plant by fire barrier having 3 hour rating. Automatic deluge systems are provided in the extruder/evaporator area, asphalt meter pump room and turn table/drum conveyor area. Ionization type fire detectors are provided in the waste compactor area, decontamination area, extruder/evaporator area (thermal detection also), asphalt meter pump room (thermal detection also), turntable/drum conveyor area (thermal detection also) and waste solidification control room to indicate locally at the control panel and to initiate visual and audible alarm in the main control room. Manual hose stations and portable fire extinguishers are available for use. The ventilation system is capable of being isolated during a fire. All water from the fire suppression systems will drain to the waste processing building sumps.

APCSB 9.5-1, App. A

Page Paragraph

46 F.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 back-up to the sprinkler system.

Response

No flammable liquids are stored in the decontamination area nor are other combustibles stored in the decontamination area, therefore no automatic sprinklers are provided. However, smoke detectors have been installed and portable fire extinguishers and hose stations are available. With the aid of early detection, the operator has the capability for shutting down the ventilation system and manually fight an unlikely fire.

APCSB 9.5-1, App. A

Page Paragraph

46 F.l6

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 tank and combustible materials where feasible.

Response

Combustible materials should not be stored near safe shutdown water storage tanks in such a manner that the operability of the tanks could be compromised by the effects of a fire. Hose reels and/or hydrants and portable extinguishers are provided as fire protection.

APCSB 9.5-1, App. A

Page Paragraph

46 F.17

Cooling Towers

Cooling towers should be of non-combustible construction or so located that a fire wall 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.

Response

The service water cooling tower is constructed of non-combustible material. Concrete is used for the superstructure. The fill material is a hard burned clay which is chemically inert, and the mist eliminators are fiberglass.

APCSB 9.5-1, App. A

Page Paragraph

47 F.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.

Response

The record storage, shops, storage room, and auxiliary boiler room within the Administration and Service Building are separated from other buildings by barriers having a three (3) hour fire rating. Due to their remote location relative to safety related systems and equipment, a fire in these areas could not adversely affect any safety related systems or equipment. The fuel oil tank for the auxiliary boilers is provided with a dike to contain its entire contents.

G. Special Protection Guidelines

APCSB 9.5-1, App. A

Page Paragraph

47 G.1

Welding and Cutting Acetylene - Oxygen Fuel Gas Systems

This equipment is used in various areas throughout the plant. Storage areas 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).

Response

Flammable welding gas equipment is generally stored in the Administrative Building - Machine Shops, Chlorination - Machine Shop, Circulating Water Pumphouse. Portable extinguishers, hose stations, and/or hydrants with hose houses are provided in these areas. Administrative procedures have been generated for the use of this equipment; hot work permits are required for utilization of this equipment.

APCSB 9.5-1, App. A

Page Paragraph

47 G.2

Storage Areas for Dry Ion Exchange Resins

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.")

Response

Dry ion exchange resin is not stored near essential safety related systems. Long term storage of dry ion exchange resin will be in the service building and/or warehouses. The storeroom in the service building and warehouses are protected by sprinkler systems. Local hose stations and hydrants are provided as backup fire protection. Fire protection flow alarms would indicate fire conditions in the warehouses. Curbs are not provided for these storage areas. Drains are provided.

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Page Paragraph

48 G.3

Hazardous Chemicals

Hazardous chemicals should be stored and protected in accordance with the recommendations of NFPA 49 "Hazardous Chemicals Data". Chemical storage areas should be well ventilated and protected against flooding conditions since some chemicals may react with water to produce ignition.

Response

Chemicals are stored in the chemical storage room and storeroom of the service building and in the warehouses. These areas are well ventilated and protected against flooding conditions. Small quantities of chemicals are also stored for use in the chemical laboratories which are well ventilated and protected against flooding.

APCSB 9.5-1, App. A

Page Paragraph

48 G.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 material.

Response

Materials that have collected and contain radioactivity are stored in metal tanks or containers which are located in the waste processing building. The storage area is free from ignition sources and combustibles and is separated from fires in adjacent buildings by a three hour rated fire wall. Decay heat emanating from the containers is removed by the building ventilation system.

H. Deviations from National Fire Protection Association (NFPA) Code/Underwriter's Laboratory (UL) Listing

Ref.: -SBN- 970, dated 3/18/86

Section 9.5.1.1 from Seabrook's FSAR states:

The Fire Protection Systems have been designed using the general guidelines of the following codes and standards:

(a) American Nuclear Insurers (ANI) - Specifications for Fire Protection of New Plants.

(b) National Fire Protection Association (NFPA) and ABS Codes as Listed in Table 9S-I.

(c) Uniform Building Code (UBC).

The following are deviations from NFPA:

1. Low Point Drain Valves in Sprinkler Systems:

Most of the low point drain valves, used throughout the sprinkler systems, do not meet NFPA 13, Section 3-14 since they are not UL listed. These drain valves, United Brass Series 125 S Globe Valves, have all the same characteristics as United Brass UL listed valves, except for the flow characteristics. Since these valves are only used as low point drains, the flow characteristics are not of a concern. The use of non-UL listed valves in this application is acceptable.

2. The test flow meter for Fire Pumps 1-FP-P-20A, 20B, and 20C does not meet NFPA 20:

NFPA 20 states that the test flow meter must be capable of up to 175% of rated pump capacity. The pumps have a rated capacity of 1,500 gpm. One hundred seventy-five percent (175%) of this is 2,625 gpm, but the flow meter is only capable up to 2,600 gpm.

These pumps will only be tested to a maximum 150% of their rated capacity which is well within the range of the flow meter. The capacity of the flow meter is also only 1% lower than what is required by code.

Because of the above stated reasons, the test flow meter is acceptable.

3. Audible evacuation alarms do not meet NFPA 72A:

NFPA 72A, Section 2-5.4, "Distribution of Evacuation Signals," states that fire alarm systems provided for evacuation of occupants shall have one or more audible alarms on each floor divided by a fire wall. Areas of the plant which are protected by preaction sprinkler systems do not have audible alarms throughout the area for the evacuation of occupants. However, if there is a fire problem, the Control Room will receive an alarm from the area detection and/or the water flow alarm valves on the sprinkler systems. Plant operating personnel and the fire brigade will be immediately dispatched to the area in question.

Because of this reason, lack of the audible alarms within the fire area is acceptable.

The areas which do not have audible alarms throughout the area include the Fuel Oil Day Tank Rooms, the Mechanical Room on El. 5l'-6", the Diesel Generator Rooms, and the Fuel Oil Storage Rooms in the Diesel Generator Building, the Turbine Building. El. 25' in the PAB, the electrical tunnels Trains A and B, the cable spreading area in the Control Building, and the extruder/evaporator area, the metering pump area, and the turntable/conveyor belt area in the Waste Process Building.

4. Fire tanks were not built to AWWA Standards as required by NFPA 22, but instead, to API 650:

The requirements for a tank built to American Petroleum Institute Standard 650, for storage of petroleum, are more stringent than the requirements in AWWA Standards for water tanks. The tanks are, therefore, acceptable.

5. HVAC fans do not shut down upon detection of smoke as required by NFPA 90A:

For safety-related ventilation systems, there is a conflict between the nuclear safety-related HVAC System and NFPA 90A. It is necessary to keep the ventilation system operational (depending on area heat loads). This is especially true for a ventilation system serving multiple areas. If a damper in a branch duct for one fire area closes due to fire in its respective fire area, it is necessary to continue operating fans to provide cooling air to other areas served. This design philosophy is also applied to nonsafety-related HVAC Systems at Seabrook.

Seabrook Station relies on area detection for early warning of fire problems. These detectors alarm in the Control Room. Plant operating personnel will take immediate action to determine the magnitude of the fire problem and will, at that time, decide if it is necessary to shut down fans.

For these reasons, not shutting down the fans is an acceptable deviation.

6. Sprinklers for area coverage over the PCCW pumps in the PAB El. 25’, do not strictly meet NFPA 13:

   Due to severe congestion at the ceiling and the thickness of the beams at the ceiling, several sprinklers over the PCCW pumps could not be located in strict accordance with NFPA 13, Section 4.3.

   The ceiling beams, extending down to 42 inches from the ceiling, do not physically allow sprinkler location to meet Table 4-2.4.b in NFPA 13. The sprinklers are, however, placed in the beam pockets to compensate for the obstruction of the spray patterns due to the beams. There are also areas in the PAB in which the ceiling is heavily congested with supplementary steel, supports, and conduits not allowing the sprinklers to meet the maximum distance from the ceiling criteria in NFPA 13. In these cases, the sprinklers were placed in the best location possible to allow for complete coverage of the floor. For the above reasons, the locations of the sprinklers are an acceptable deviation.

7. Fire protection booster pump does not meet NFPA 20:

   Per Branch Technical Position APCSB 9.5-1, Appendix A, Position C3(d) - A backup to the normal Fire Protection System was provided for the standpipes servicing safety equipment in the event of a Safe Shutdown Earthquake (SSE). A permanent connection between one train of service water and the Fire Protection System (safety-related area standpipe) is provided with a booster pump to supply the required pressure.

   The fire protection booster pump is an Aurora Series 350, stainless steel pump that is not UL listed, nor FM approved. The pump controller is a non-automatic (manual) controller which includes a local on-off push button with status lights. There is a gate valve and a pressure gauge in both the suction and discharge lines to the pump. A relief valve is located at the pump discharge. An orifice plate is located in a test line connecting the suction and discharge of the pump so that pump flow may be tested. A permanent flow meter is not being provided, but there are connections for a portable flow meter.

   One requirement in NFPA 20 is that fire pumps shall be listed for fire protection. Even though the FP booster pump is not UL/FM, it has similar characteristics to a UL/FM pump. UL/FM pumps, however, are made from cast iron which cannot be seismically qualified. The FP booster pump is made from stainless steel and, therefore, can be seismically qualified.

NFPA 20 also requires that fire pumps shall have an automatic controller which would start the pump upon a low pressure reading. The pump is also required by NFPA 20 to have remote reading. The pump is also required by NFPA 20 to have remote alarm and signal devices at a point of constant, attendance to indicate such items as that the controller has operated into a motor running condition and loss of line power on the line side of the motor starter. NFPA 20 also requires to galvanize or paint the suction pipe to prevent tuberculation.

The FP booster pump is not, however, the main fire pump. It is a small (150 gpm) backup fire pump which only supplies the standpipe (hose reel) systems in certain areas of the plant in the unlikely event that SSE damages the normal fire protection supply. The plant operating personnel will be immediately dispatched to the FP booster pump to open the isolation valve between the Service Water System and the Fire Protection System, and to start the pump. Due to these circumstances, an automatic controller is not necessary. The alarms required by NFPA 20 are also not needed since plant operating personnel will be at the pump if there is a problem with it. Since tuberculation is also not seen as being a problem due to the limited use of the pump, lining of the suction piping is not required.

For these reasons, the deviations stated above are acceptable.

Equipment in the Fire Protection Systems, except as noted in the FSAR, conforms to the standards of the NFPA, and is Underwriter's Laboratory (UL) listed and/or Factory Mutual (FM) approved. The following is a deviation from UL listed:

1. <u>Teflon used to enhance closure of UL listed fire damper</u>:

   A Teflon coating has been applied to the blade guide flange of the fire dampers to improve their closure characteristics under flow. Although the dampers are not tested with the Teflon coating, this coating will not prevent the dampers from meeting the test requirements of UL 555. In the damper closure part of the test, the dampers were tested under no flow conditions. The untested, per UL, Teflon modification allows the damper to close under a flow condition.

   UL 555 under "Corrosion Protection," allows after a damper is tested the use of epoxy or alkyd-resin type or other outdoor paint in the surface of the damper. Since the Teflon coating is, in essence, the same as a paint coating, it will not affect the rating of the damper. The use of Teflon on fire dampers is acceptable.

The following is a deviation from the FM approval requirements:

1. Fibercast fittings used in the underground sprinkler supply line to the Alternate RP Checkpoint:

   During installation of the underground sprinkler supply line to the Alternate RP Checkpoint, it was discovered that FM approved Fibercast pipe and fittings were no longer available from the manufacturer. There was sufficient inventory of FM approved Fibercast pipe in stock to complete the installation. However, fittings (tee, flanges and elbows) were not in stock. Fibercast fittings made from the same material, with the same dimensions and the same engagement as the FM approved Fibercast fittings were available without the FM stamp. Engineering reviewed the form, fit and function of the substitute Fibercast fittings and allowed their installation in this application only.

I. Fire Proofing for Structural Steel

(Ref.: Letter to NRC SBN-lOl7, dated April 24, 1986)

Professional Loss Control, Inc. (PLC) conducted a Seabrook Structural Steel Survivability Analysis for those areas noted in Table 1. Wherever PLC indicated structural steel needed to be fire proofed, a structural integrity review was conducted on the fire areas as indicated by PLC temperatures. In most cases, the structure can withstand the potential loss of structural steel. No fireproofing will be done on these beams and/or columns. A few limited cases, some steel was fireproofed in a fire area but only steel indicated by PLC and needed to maintain the fire areas structure.

TABLE 1
STRUCTURAL STEEL FIRE PROOFING ANALYSIS CHART

Fire Area/Zone	PLC Analysis of Area Shows no Structural Steel Fireproof Required	PLC Analysis of Area Shows Only Limited Fireproofing of Structural Steel is Needed	PLC Analysis of Area Shows Only Limited Fireproofing of Structural Steel is Needed UE&C Has Determined Structure Can Accept Steel Losses	Miscellaneous Notes
EFP-F-l-A	X			
MS-F-1A-Z	X			
MS-F-1B-Z	X			
MS-F-2A-Z MS-F-2B-Z				Does not contain exposed combustibles. Low Loading.
MS-F-3A-Z			X	
MS-F-3B-Z				Does not contain exposed combustibles. Low Loading.
MS-F-4A-Z	X			
MS-F-5A-Z				Exposed steel used for cable tray supports. Concrete slab is self-supporting.
RHR-F-1A-Z	X			
RHR-F-1B-Z	X			
RHR-F-1C-Z			X	
RHR-F-1D-Z			X	
RHR-F-2A-Z	X			
RHR-F-2B-Z			X	

TABLE 1
STRUCTURAL STEEL FIRE PROOFING ANALYSIS CHART

Fire Area/Zone	PLC Analysis of Area Shows no Structural Steel Fireproof Required	PLC Analysis of Area Shows Only Limited Fireproofing of Structural Steel is Needed	PLC Analysis of Area Shows Only Limited Fireproofing of Structural Steel is Needed UE&C Has Determined Structure Can Accept Steel Losses	Miscellaneous Notes
RHR-F-3A-Z	X			
RHR-F-3B-Z	X			
CB-F-3B-A	X			
CB-F-S1-0 CB-F-S2-0				Does not contain exposed combustibles. Low Loading.
ET-F-1A-A ET-F-1B-A ET-F-1C-A ET-F-1D-A ET-F-S1-0				Slab is self-supporting. Do not need structure steel.
DG-F-3A-Z	X			
DG-F-3B-Z	X			
DG-F-3E-A	X			
DG-F-3F-A	X			
PAB-F-1A-Z			X	
PAB-F-1B-Z	X			
PAB-F-1F-Z	X			
PAB-F-1G-A	X			

TABLE 1
STRUCTURAL STEEL FIRE PROOFING ANALYSIS CHART

Fire Area/Zone	PLC Analysis of Area Shows no Structural Steel Fireproof Required	PLC Analysis of Area Shows Only Limited Fireproofing of Structural Steel is Needed	PLC Analysis of Area Shows Only Limited Fireproofing of Structural Steel is Needed UE&C Has Determined Structure Can Accept Steel Losses	Miscellaneous Notes
PAB-F-S1-0 PAB-F-S2-0				Does not contain exposed PAB combustibles. Low loading.
PAB-F-2A-Z	X			
PAB-F-2B-Z			X	
PAB-F-2C-Z		X		
PAB-F-3A-Z	X			
PAB-F-3B-Z	X			
PAB-F-4-Z	X			
PAB-F-1J-Z	X			
PAB-F-1K-Z				Does not contain exposed combustibles. Low loading.
FSB-F-1A	X			
SW-F-1A-Z				Structure is separated from fire area used for safe shutdown by seismic gap. Can accept loss of structure.

TABLE 1
STRUCTURAL STEEL FIRE PROOFING ANALYSIS CHART

Fire Area/Zone	PLC Analysis of Area Shows no Structural Steel Fireproof Required	PLC Analysis of Area Shows Only Limited Fireproofing of Structural Steel is Needed	PLC Analysis of Area Shows Only Limited Fireproofing of Structural Steel is Needed UE&C Has Determined Structure Can Accept Steel Losses	Miscellaneous Notes
SW-F-1B-A SW-F-1C-A SW-F-1D-A SW-F-1E-Z SW-F-2-0				Loss of this structure does not affect safe shutdown. Structure is isolated from remaining fire areas.
CT-F-1C-A CT-F-1D-A CT-F-2B-A CT-F-3-0				Loss of this structure does not affect safe shutdown. Structure is isolated from remaining fire areas.
CE-F-1-A		X		
FPH-F-1A-A FPH-F-1B-A FPH-F-1C-A				Loss of this structure does not affect safe shutdown. Structure is isolated from remaining fire areas
TB-F-1B-A TB-F-1A-Z TB-F-1C-Z TB-F-2-Z TB-F-3-Z				Loss of this structure does not affect safe shutdown. Structure is isolated from fire areas used during safe shutdown by seismic gap.
NES-F-1A-A				Loss of this structure does not affect safe shutdown. Structure is isolated from fire areas used during safe shutdown by seismic gap.