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NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION REPORT

BY THE

OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 35 TO FACILITY

OPERATING LICENSE NO. DPR-35

BOSTON EDISON COMPANY

PILGRIM NUCLEAR POWER STATION, UNIT NO. 1

DOCKET NO. 50-293

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1.0 INTRODUCTION

Following a fire at the Brown's Ferry Nuclear Station in March 1975, the Nuclear Regulatory Commission initiated an evaluation of the need for improving the fire protection programs at all licensed nuclear power plants. As part of this continuing evaluation, the NRC, in February 1976, published the report by a special review group entitled, "Recommendations Related to Browns Ferry Fire," NUREG-0050. This report recommended that improvements in the areas of fire prevention and fire control be made in most existing facilities and that consideration be given to design features that would increase the ability of nuclear facilities to withstand fires without the loss of important functions. To implement the report's recommendations, the NRC initiated a program for reevaluation of the fire protection programs at all licensed nuclear power stations and a comprehensive review of all new licensee applications.

The NRC issued new guidelines for fire protection programs in nuclear power plants which reflect the recommendations in NUREG-0050. These guidelines are contained in the following documents:

- "Standard Review Plan for the Review of Safety Analysis Report for Nuclear Power Plants," NUREG-75/087, Section 9.5.1, "Fire Protection," May 1976, which includes "Guidelines for Fire Protection for Nuclear Power Plants" (BTP APCSB 9.5-1), May 1, 1976.

- "Guidelines for Fire Protection for Nuclear Power Plants" (Appendix A to BTP APCSB 9.5-1), August 23, 1976.

- "Supplementary Guidance on Information Needed for Fire Protection Program Evaluation," September 30, 1976.

- "Sample Technical Specifications," May 12, 1977.

- "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance," June 14, 1977.

- "Manpower Requirement for Operating Reactors", May 11, 1978

All licensees were requested to: (1) compare their fire protection programs with the new guidelines; and (2) analyze the consequences of a postulated fire in each plant area.

We have reviewed the licensee's analyses and have visited the plant to examine the relationship of safety-related components, systems and structures with both combustibles and the associated fire detection and suppression systems. Our review has been limited to the aspects of fire protection with the NRC's jurisdiction, i.e., those aspects related to the protection of public health and safety. We have not considered aspects of fire protection associated with life safety of onsite personnel and with

property protection, unless they impact the health and safety of the public due to the release of radioactive material.

This report summarizes the results of our evaluation of the fire protection program at Boston Edison Company's Pilgrim Nuclear Power Station, Unit 1. The chronology of our evaluation is summarized in Appendix A of this report.

2.0 FIRE PROTECTION GUIDELINES

2.1 General Design Criterion 3 - "Fire Protection"

The Commission's basic criterion for fire protection is set forth in General Design Criterion 3, Appendix A to 10 CFR Part 50, which states:

> "Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.
>
> "Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and the control room.
>
> "Fire detection and protection systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety.
>
> "Fire fighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components."

2.2 Supplementary Guidance

Guidance on the implementation of GDC-3 for existing nuclear power plants has been provided by the NRC staff in "Appendix A" of Branch Technical Position 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants."

Appendix A provides guidance on the preferred and, where applicable, acceptable alternatives to fire protection design for those nuclear power plants for which applications for construction permits were docketed prior to July 1, 1976.

Although this appendix provides specific guidance, alternatives may be proposed by licensees. These alternatives are evaluated by the NRC staff on a case-by-case basis.

Additional guidance which provides clarification of Fire Protection matters has been provided by the NRC staff in the following documents:

> "Supplementary Guidance on Information Needed for Fire Protection Program Evaluation," October 21, 1976.
>
> "Sample Technical Specifications," May 12, 1977.
>
> "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance," June 14, 1977.

"Manpower Requirements for Operating Reactors," May 11, 1978.

When the actual configuration of combustibles, safety related structures, systems or components, and the fire protection features are not as assumed in the development of Appendix A or when the licensee has proposed alternatives to the specific recommendations of Appendix A, we have evaluated such unique configurations and alternatives using the defense-in-depth objectives outlined below:

(1) reduce the likelihood of occurrence of fires;

(2) promptly detect and extinguish fires if they occur;

(3) maintain the capability to safely shut down the plant if fires occur; and

(4) prevent the release of a significant amount of radioactive materials if fires occur.

In our evaluation, we assure that these objectives are met for the actual relationship of combustibles, safety-related equipment and fire protection features of the facility.

Our goal is a suitable balance of the many methods to achieve these individual objectives; increased strength, redundancy, performance, or reliability of one of these methods can compensate in some measures for deficiencies in the others.

3.0 SUMMARY OF MODIFICATIONS AND INCOMPLETE ITEMS

3.1 Modifications

The licensee plans to make certain plant modifications to improve the fire protection program as a result of the licensee's and the staff's evaluation. The proposed modifications are summarized below. Further detail is provided in the licensee's submittals. The section of this report which discusses the modifications are noted in parentheses. The schedule for completion of all modifications is listed in Table 3.1.

Certain items listed below are marked with an asterisk (*) to indicate that the NRC staff requires additional information, in the form of design details to assure that the design is acceptable, prior to actual implementation of these modifications. The other modifications have been described in an acceptable level of detail. We will address the acceptability of these design details in a letter to the licensee or a supplement to this report.

3.1.1 Fire Detection Systems (4.2, 5.1.6, 5.2.6, 5.5.6, 5.6.6, 5.7.6, 5.15.6, 5.17.6)

Smoke detection and signaling systems will be added to the following areas: safety-related cabinets in the control room used for safe shutdown operation (5.15); the vital motor generator set room in the radwaste and control building (5.17); in the proximity of safety-related cable trays in the CRD Module areas above the 23.0-foot elevation of the reactor building (5.2); radwaste truck loading area; the reactor building closed cooling water pump rooms "A" and "B" (5.10); and the residual heat removal and core spray pump rooms "A" and "B" (5.1).

Fire detection and signaling systems will be installed in the reactor building on elevations 74'3", 91'3" and 177' to provide early warning indication of an exposure fire in the storage areas or in the vicinity of safety-related cables and equipment.

3.1.2 Water Suppression Systems and Equipment (4.3.3, 4.3.4, 4.3.5, 5.1.6, 5.3.6, 5.4.6, 5.11.6, 5.12.6, 5.15.6, 5.16.6, 5.19.6, 5.20.6)

Additional fixed water suppression system coverage will be provided for the recirculating pump motor generator set room (5.4); clean/dirty lube oil storage area; hydrogen seal oil unit; and turbine lube oil reservoir. The wet pipe sprinkler system protecting the diesel generator day tank rooms will be converted to a preaction sprinkler system and expanded to protect the diesel generators (5.19). A new sprinkler system will be provided to protect the radwaste truck loading area and the access control area of the radwaste and control building. A guard pipe will be provided to protect motor control center B-18 (23-foot level of the reactor building) from a fire water pipe failure.

To extend the manual fire suppression capabilities, new hose stations will be installed outside the offices, cable spreading room and the control room in the radwaste and control building (5.15 and 5.16); and in the intake structure (5.20). Additional lengths of hose will be added to nine interior hose stations.

Modifications will be made to preclude a single passive failure in the fire water piping system from affecting both the hose stations providing backup suppression capability and the fixed water suppression systems for areas so equipped. These modifications will include: three additional hose stations, extra lengths of hose at five existing hose stations, and the relocation of the feed main for the sprinkler system in the boiler room.

Modifications will be made to convert all hose couplings, nozzles, fittings, and fire protection water system threaded connections to provide compatibility with the Plymouth Fire Department.

Equipment will be provided at each exterior hose house in accordance with the guidance contained in NFPA 24. In addition, 2½" x 1½" x 1½" gated wye connectors will be provided in each hose house; and not less than one-half of the exterior hose houses will be equipped with 2½" adjustable fire hose nozzles.

Spray adjustable nozzles will be provided for interior hose stations located to protect areas containing high voltage equipment.

All shutoff, isolation and sectionalizing valves in the flow path supplying hose stations and water suppression systems will be locked or fixed in their correct position with tamper proof seals. These valves will be periodically checked to ensure that they are in the correct position.

3.1.3 Gas Fire Suppression Systems (4.4)

An automatic total flooding Halon 1301 system will be installed in the computer and storage/office rooms.

3.1.4 Ventilation Systems (4.7, 5.12.6)

Ventilation system modifications, to provide limited smoke venting, will be made in a few plant areas. Portable air handling units and flexible ducting will be provided for smoke removal.

3.1.5 Lighting Systems (4.9)

Lighting circuits will be modified or fixed battery-operated emergency lights with at least an eight-hour rating will be installed where a fire in one area could interrupt lighting in other areas of the plant. Battery-operated hand-held lights will be provided for fire brigade use.

3.1.6 Fire Retardant Cable Coating and Fire Stops (4.11)

PVC jacketed special control and instrumentation cables will be covered with a flame retardant coating, except where these cables are installed in enclosed trays.

Fire stops will be installed in accordance with BECo Construction Standard E347, Sheets S48, 51, 52, 54 and 57.

Fire stops will be installed every 20 feet in vertical trays. In addition, fire breaks will be installed in various trays as required by the fire hazard analysis. Computer instrument cabling in totally enclosed trays will be provided with fire stops (over a 3-foot length) every 20 feet.

3.1.7 Fire Doors (4.12, 5.8.6, 5.10.6, 5.12.6, 5.15.6, 5.20.6)

In several areas of the plant, doors through fire barriers are being upgraded to a rating equivalent to that required of the fire barrier. Fire doors between individual fire areas, and/or rooms containing equipment necessary for safe shutdown, will be locked closed, or electrically supervised.

3.1.8 Fire Dampers (4.12, 5.4.6)

In several areas of the plant, installed fire dampers will be replaced with three-hour rated dampers to be consistent with the fire rating needed for the enclosure served.

3.1.9 Fire Barriers (5.15.6)

A new wall containing a rated fire door assembly will be constructed at the 23-foot elevation of the radwaste and control building separating the cable spreading room and the adjacent corridor from the personnel decontamination area.

3.1.10 Control Room Kitchen (5.15.6)

The electric stove in the control room kitchen will be totally disabled by removing the wire and plug. It will be replaced with a microwave oven. A type ABC fire extinguisher will be provided for the kitchen area.

3.1.11 Control of Combustibles (5.19.6)

The curbs and drain scuppers in the diesel oil day tank rooms will be modified so that the entire contents of the diesel storage tank can be contained.

A noncombustible shield will be provided between the feedwater pumps to prevent an oil release from one pump from impinging on the other pumps.

The fan room plenum sound proofing material will be replaced with a fiber glass board.

Spare gas cylinders, used as part of the containment sampling system, will be removed from the 51-foot level of the auxiliary building. A permanent gas cylinder storage rack will be fabricated and installed in the yard adjacent to the northeast section of the radwaste truck lock.

The duplicating machine and associated supplies including boxes of paper will be removed from the control room and relocated outside the control room environment.

The lube oil storage shed will be relocated a safe distance from the fire water storage tanks.

3.1.12 Portable Extinguishers (4.6, 5.13.6, 5.19.6, 5.20.6)

Hand-held portable dry chemical fire extinguishers will be installed at a strategic location inside each diesel generator room. The distribution as well as the type selection of portable fire extinguishers will be in conformance with the recommendations contained in NFPA 10.

3.1.13 Administrative Controls and Quality Assurance (6.C)

The existing fire protection administrative programs will be amended. Plans and procedures stipulating the management and staff organization and its qualifications; the fire brigade training program; controls over combustibles and ignition sources; and prefire plans for fighting fires will be developed and implemented. The program and its implementing procedures will meet the guidelines presented in the NRC document, "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance".

Quality assurance provisions will be established for the design, procurement, installation, testing and administrative controls for fire protection utilizing the programmatic guidance and procedures contained in the licensee's 10 CFR Part 50, Appendix B, operational quality assurance program. Existing quality assurance implementing procedures will be modified to include and apply the quality assurance criteria, addressed in BTP 9.5-1, to a level commensurate with the objectives and requirements for fire protection.

3.1.14 Exposed Steel Protection* (4.13)

Exposed steel, the failure of which might affect safe plant shutdown, will be protected by coating to provide three-hour protection.

3.1.15 Supervision of Detection and Actuation Circuits for Automatic Suppression Systems (4.2)

The detection and actuation circuits for all automatic suppression systems will be supervised to detect and annunciate circuit breaks, ground faults, and power failures.

3.1.16 Self Contained Breathing Apparatus* (4.7)

Additional air bottles, a cascade filling system, and a compressor will be provided sufficient to provide emergency breathing air capability to sustain 10 men for 6 hours.

3.1.17 Communication Systems* (4.10)

Repeaters or antennas will be installed as necessary to ensure effective portable radio communications to facilitate fire fighting in the plant.

3.1.18 Alternate Shutdown Capability* (5.16.6)

An alternate shutdown system will be provided, independent of cabling and equipment in the cable spreading room. In addition, the licensee will:

(1) Separate redundant cable trays/conduits by asbestos board (or equivalent) barriers. Flame retardant coating or asbestos board barriers will be installed to provide protection against exposure fires.

(2) Residual heat removal power cables routed through the cable spreading room will be separated from the remainder of the room by a barrier enclosure. Additional protection in the form of flame retardant coating or asbestos board barriers will be provided against the hazards of other power cables in the room.

3.1.19 Penetration Seals* (4.12.3, 4.12.4)

Pipe and electrical cable penetration seals will be tested to determine fire resistance ratings. Lower rated seals will be upgraded to three hours or acceptability of the lower rating provided.

3.2 Incomplete Items

In addition to the licensee's proposed modifications, several incomplete items remain, as discussed below. The licensee will complete the evaluations necessary to resolve these incomplete items. The sections of this report which discuss these incomplete items are noted in parentheses. We will address the resolution of incomplete items in a supplement to this report. The schedule for the completion of the licensee action on these incomplete items is given in Table 3.2. This schedule will permit any additional modifications, such as may be required, to be implemented on a schedule which is consistent with that noted in Section 3.1 of this report.

3.2.1 Safe Shutdown Analysis (4.1, 4.1.4, 5.2.6, 5.3.6, 5.10.6, 5.12.6, 5.14.6, 5.17.6, 5.18.6)

An analysis of safety-related shutdown systems will be conducted to demonstrate that fire-related damage in any fire area will not inhibit the capability to safely shut down. This analysis will demonstrate the adequacy of the separation provided, and the effectiveness of fire breaks and fire stops. Consideration will be given to the effects of heat buildup; tray stacking; fixed and transient combustibles; damage or undesired effects resulting from the (manual hose) application of water spray; fire, smoke and/or heat propagation between safety-related fire zones not separated by rated fire barriers; and fire, smoke and/or heat propagation between fire areas via maintenance hatches and open stairways. Additional protection will be proposed if the analysis shows that the safe shutdown capability of the plant could be jeopardized by an unsuppressed fire.

3.2.2 Testing Fire Detectors (4.2)

The adequacy of new and existing fire detector systems will be confirmed by testing in plant areas where:

(1) ceiling heights are greater than 12 feet,

(2) ceiling obstructions, such as joists and beams, are greater than 8" deep (4" in the case of heat detectors), or

(3) ventilation rates are greater than 8.6 air change per hour.

3.2.3 Battery Room Ventilation Air Flow Monitor (5.13.6)

Each battery room will be equipped with a ventilation air flow monitor which alarms and annunciates in the control room on the loss of the air flow to either battery room, or the licensee will provide justification that such monitors are not necessary.

3.2.4 Cable Combustibility

Documentary evidence will be submitted for those cables which will not be covered with a flame retardant coating to demonstrate that they are capable of passing IEEE Std 383 flame test.

3.2.5 Prevention of Spread of Combustible Liquid Fire via Drain Systems (4.8)

A study will be performed to determine the extent to which backflow valves need to be installed in the drain systems in any plant areas containing a large quantity of combustible liquid to prevent spread of a possible combustible liquid fire via the drain system.

3.2.6 Suppression of Charcoal Fire in Augmented Off-Gas System (4.7.2)

A suppression capability will be provided for a charcoal fire inside the augmented off-gas system charcoal vessels unless the licensee can demonstrate that, in the event of such fire, the two-hour whole body dose at the nearest exclusion area boundary is less than 5 rem using conservative calculation assumptions.

3.2.7 DC Power System Hazard Analysis

The licensee will analyze the effects of postulated fire damage and provide modifications as necessary to the 125/250 volt DC systems to preserve the plant's safe shutdown capability. The analysis will include the considerations outlined in Section 3.2.1 of this report.

3.2.8 CO_2 System Discharge Test (4.4, 5.15.6)

The licensee will provide calculations and reference prototype testing of the CO_2 system in the cable spreading room to verify that a design concentration of 50% is achieved in all parts of the room, and a concentration of 30% is achieved within 1 minute, 30 seconds, of actuation. If calculations and prototype testing is inconclusive, an in situ discharge test will be performed.

TABLE 3.1

IMPLEMENTATION DATE FOR LICENSEE PROPOSED MODIFICATIONS

ITEM		DATE
3.1.1	Fire Detection Systems	next refueling outage
3.1.2	Water Suppression Systems and Equipment.	11-1-79
3.1.3	Gas Fire Suppression Systems	5-1-79
3.1.4	Ventilation Systems.	4-1-79
3.1.5	Lighting Systems	3-1-80
3.1.6	Fire Retardant Cable Coating and Fire Stops.	3-1-80
3.1.7	Fire Doors	8-1-79
3.1.8	Fire Dampers	3-1-80
3.1.9	Fire Barriers.	4-1-79
3.1.10	Control Room Kitchen	8-1-79
3.1.11	Control of Combustibles.	9-1-79
3.1.12	Portable Extinguishers	1-1-79
3.1.13	Administrative Controls and Quality Assurance. . . .	9-1-79
3.1.14	Exposed Steel Protection*.	3-1-80
3.1.15	Supervision of Detection and Actuation Circuits. . .	2-1-79
3.1.16	Self Contained Breathing Apparatus*.	12-1-78
3.1.17	Communication Systems *.	3-1-80
3.1.18	Alternate Shutdown Capability*	10-1-79
3.1.19	Penetration Seals*	7-1-79

*NOTE: The design details for these modifications will be subject to further staff review prior to implementation, and will be submitted as soon as possible to allow sufficient time for the review. Six months lead time is considered appropriate, where possible.

TABLE 3.2

COMPLETION DATES FOR INCOMPLETE ITEMS

ITEM		DATE
3.2.1	Safe Shutdown Analysis	10-1-79
3.2.2	Testing Fire Detectors	3-1-80
3.2.3	Battery Room Ventilation Air Flow Monitor.	11-1-78
3.2.4	Cable Combustibility	3-1-80
3.2.5	Prevention of Spread of Combustible Liquid Fire via Drain Systems.	3-1-79
3.2.6	Suppression of Charcoal Fire in Augmented Off-Gas System	12-1-78
3.2.7	DC Power System Hazard Analysis.	2-1-79
3.2.8	CO_2 System Discharge Test.	3-1-80

NOTE: If analysis results indicate modifications are required, the design details will be due within 6 months of the analysis submittal date and design implementation within 12 months of the analysis submittal date, with implementation no later than October 1980.

4.0 EVALUATION OF PLANT FEATURES

4.1 Safe Shutdown Systems

There are several arrangements of safety-related systems which can be used to shut down the reactor and cool the core during and subsequent to a fire. The exact arrangement available in a fire situation will depend upon the effects of the fire on such systems, their power supplies, and control stations. The general functional requirements for safe shutdown and systems/components required to fulfill these requirements are as follows:

(1) Reactivity Control

Shutdown of the reactor is normally accomplished by inserting control rods. The reactor protection system will scram the reactor automatically on abnormal operating conditions or by the action of the operator in the control room. The scram pilot valve solenoid in the reactor trip system is normally energized to control the air supply to scram valves. On receiving a trip signal, the pilot valve solenoid deenergizes, venting the air pressure from both scram valves and directing pressurized water in the accumulators to act on the control rod drive piston to insert control rods into the reactor core.

The reactor trip system is of fail-safe design. Control rod drive water in the accumulators, which provides motive power for the scram, is normally pressurized by nitrogen gas and needs no additional electric or pneumatic power for the emergency operation. Faulting in the control circuits of the trip system or the loss of instrument air scrams the reactor.

In the event that one or more control rods failed to insert, the standby liquid treatment system provides backup means of reactivity control. The system is manually initiated from the control room to pump a boron solution into the reactor. The system consists of two sets of components arranged in parallel redundancy. It is designed to bring the reactor from rated power to cold shutdown, with all control rods remaining withdrawn, at any time in the core life.

(2) Reactor Coolant Inventory Control and Decay Heat Removal

Following a normal plant shutdown, main steam is bypassed to the main condenser to dissipate the decay heat generated in the reactor. Reactor coolant inventory is maintained by the feedwater system.

If the main condenser and the feedwater system were to be unavailable, cooling of the reactor could be provided by discharging steam generated

by decay heat into the pressure suppression pool via the reactor pressure relief valves, or exhaust(s) from the reactor core isolation cooling turbine and/or the high pressure coolant injection turbine. The decay heat transferred to the pressure suppression pool is then dissipated into the Atlantic Ocean through the residual heat removal system, the reactor building closed cooling water system, and the salt water service system. Coolant makeup to the reactor under high pressure could be provided by the reactor core isolation cooling system, the high pressure coolant injection system, or the control rod drive water inleakage.

In the event that all high pressure cooling systems were lost or unable to maintain the reactor water level, the reactor could be depressurized automatically by the automatic depressurization system, or by manually opening the reactor pressure relief valve(s) so that flow from the low pressure coolant injection, which is one mode of operation of the residual heat removal system, and/or the core spray system can enter the reactor to provide core cooling and maintain the coolant inventory. The residual heat removal system and the core spray system are independent of each other. Both systems are designed with two independent and redundant trains with appropriate interconnections.

When the reactor pressure is reduced to about 50 psig, the residual heat removal system can be aligned in the shutdown cooling mode of operation which cools the reactor by recirculating the coolant through the residual heat exchanger transferring the decay heat directly to the reactor building closed cooling water system.

(3) Instrumentation

In addition to those instruments associated with the systems discussed above, the following instrumentation is needed for the safe plant shutdown:

- Source range neutron monitoring
- Reactor level and pressure indication
- Suppression pool level and temperature indication
- Control rods position indication

(4) Power

Separation of the plant auxiliaries power sources is maintained in the 4160-volt, 480-volt and lower voltage systems.

There are six separate and independent 4160-volt buses which can be supplied by unit generated or offsite power. Of the six, two emergency service buses, which supply power to essential loads required during abnormal transients or accidents, can also be supplied from the onsite standby a-c power source which consists of two independent and redundant diesel generators, each one supplying only one emergency bus, either of which supplies power to sufficient equipment for safe shutdown.

The 480-volt system is also divided into normal service and emergency service buses. There are three emergency 480-volt buses; each 4160-volt emergency bus supplies one 480-volt emergency bus. The third can receive power from either of the two other 480-volt emergency buses.

D-C power systems are provided to supply an uninterruptible source of power for normal operation and for safe shutdown. There are two 125-volt systems, one 250-volt system, and two 24-volt systems. Each system has its own batteries, but is normally supplied by battery chargers which are powered by 480-volt a-c buses (120-volt a-c buses for 24-volt systems).

The major safety-related components required for safe shutdown are separated to prevent damage to redundant equipment due to a fire. However, there are areas of the plant where the physical separation for essential supporting systems or electrical cables may not provide assurance that redundant components of systems required for safe shutdown would not be damaged by a fire. Although modifications have been proposed to improve the fire protection in these areas, the licensee will conduct additional analysis for those areas containing redundant divisions of cable or supporting systems required for safe shutdown to determine the modifications required to preserve a safe shutdown capability following a fire. The licensee has concluded his analysis for the cable spreading room and has committed to provide an alternate shutdown capability independant of the area. We will address the acceptability of the licensee's proposed modifications for other such areas in a supplement to this report.

4.2 Fire Detection and Signaling Systems

Fire detectors used in the plant include ionization type smoke detectors, air duct ionization type smoke detectors and heat detectors. Fire detectors are located in the safety-related areas of the reactor building, the turbine building, the off-gas retention building and the radwaste and control building.

There are a total of 16 ionization type smoke detection systems installed in the plant. In each zone where these detectors are installed the number and placement of detectors was based on the general guidelines contained in NFPA 72E.

The installed fire and smoke detection and signaling systems are supervised to indicate loss of power, undervoltage, short circuits, open circuits, or ground faults. Alarm and supervisory signals are transmitted to the fire protection panel in the control room, with audible signals unique and distinct from other plant alarms. In addition, the detection and actuation circuits for all automatic suppression systems will be supervised to detect and annunciate circuit breaks, ground faults and power failures.

Water flow alarm transmitters on the feed mains to individual sprinkler systems transmit a signal to the control room when actuated. This alarm indicates the sprinkler system in which water is flowing.

The plant presently does not have a complete fire detection coverage and some areas containing or exposing safety-related systems do not have fire detection systems. To protect these areas the licensee will provide additional detector and detection systems as summarized in Section 3.1.1 of this report.

Reliance on specific detector spacing guidance in NFPA 72E has resulted in generally reasonable detector response times in rooms with smooth ceilings not over 12 feet high with low to moderate air change rates. In rooms in which these conditions do not exist, closer spacing or other arrangements of detectors are usually required to achieve reasonable detector response times. Failure to apply sound engineering judgment in determining detector placement in such rooms could result in unacceptable fire damage. Therefore, the licensee will evaluate the feasibility of in situ tests using an appropriate smoke generating device to verify the adequacy of the smoke detector systems. Bench tests will be used to verify the adequacy of other types of detectors which are to be installed. Procedures for appropriate tests will be prepared by the licensee.

We will address the adequacy of Fire Protection provided by the fire detection and signaling systems in a supplement to this report.

4.3 Water Suppression Systems

4.3.1 Water Supply

Fire water is obtained from two 250,000-gallon heated water tanks devoted exclusively to fire protection. A service connection from the city water main permits makeup of water to the water tanks.

A separate suction is provided for each fire water storage tank and various cross-ties are provided for interchangeability.

One of the two 250,000-gallon water tanks would provide a water supply which would be less than required for a two-hour operation of the largest sprinkler system with an additional 1000 gpm capability reserved for manual hose application. However, the required quantity of water can be made available by refilling the water tank from the city main connection as water is being supplied for fire fighting. In addition, water from the redundant water tank provides an onsite storage in excess of the required capacity.

We find that the water supply satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.3.2 Fire Pumps

The water supply is delivered by either an electric motor-driven fire pump or a diesel engine driven pump which is used for standby and emergency use

on loss of a-c power. Each pump has a rated output of 2000 gallons per minute at a discharge head of 125 pounds per square inch gauge and can take suction from either of the station's two fire water storage tanks.

A small jockey pump (rated at 50 gpm) is provided to maintain a constant pressure for the water system. If the system pressure drops substantially, the motor-driven fire pump will start automatically, and if pressure continues to drop the diesel-driven pump will also start automatically.

Fire pump availability, running and trouble alarms are annunciated in the control room.

Both fire pumps are located on the operating level of the intake structure. The electric motor-driven fire pump and the controls are in a room common with the circulating water pumps, separated by a barrier constructed of 1/2-inch marinite board. The diesel engine-driven fire pump and controls, and the diesel fuel oil tank are in two separate sprinklered enclosures.

We find that, the fire water pumps conform to the provisions of Appendix A to BTP 9.5-1 and are, therefore, acceptable.

4.3.3 Fire Water Piping Systems

Each of the two fire pumps has a separate 12-inch discharge line supplying the 12-inch underground fire loop which encircles the plant. All yard fire hydrants, automatic water suppression systems and interior hose standpipes are supplied via headers from the main loop. Post-indicator valves provide sectionalized control and isolation of portions of the fire main loop with valving arranged such that a single break in the system will not preclude water supply to both the primary and backup feed header servicing any one fire area except for the auxiliary plant heating boiler room. The licensee has proposed modifications for this room as summarized in Section 3.1.2 of this report.

Yard fire hydrants have been provided at approximately 250-foot intervals along the fire main loop. Each hydrant is provided with a key-operated gate valve to permit hydrant isolation and maintenance without removing a portion of the fire loop from service. Hose houses have been installed adjacent to each hydrant. Equipment will be provided in each exterior hose house as summarized in Section 3.1.2 of this report.

National Standard Fire Hose threads are used on all fire protection equipment. The threads used on the 1½ inch couplings for hose and appliances are not compatible with those used by the local fire departments. The licensee will make the necessary modifications to convert all hose

couplings, nozzles, fittings and fire protection water system threaded connections to provide compatibility with the Plymouth Fire Department.

All shutoff, isolation and sectionalizing valves in the flow path supplying hose stations and water suppression systems will be locked or fixed in their correct positions with tamper proof seals. These valves will be periodically checked to ensure that they are in the correct position.

We find that, subject to implementation of the above described modifications, the fire water piping systems conform to the provisions of Appendix A to BTP 9.5-1 and are, therefore, acceptable.

4.3.4 Interior Fire Hose Stations

Interior hose stations are provided throughout the turbine, the radwaste and control, the reactor auxiliary, the reactor, and the administrative buildings. With the exception of the turbine building, the interior hose stations are equipped with 75 feet of 1½-inch hose and combination spray and straight stream nozzles, stored on a hose rack or reel. The turbine building hose reels contain 50 feet of hose.

To extend the manual fire suppression capabilities, new hose stations will be installed outside the offices, the cable spreading room, and the control room in the radwaste and control building, and in the intake structure. Additional lengths of hose will be added to nine interior hose stations.

In addition, modifications will be made to preclude a single passive failure in the fire water piping system from affecting both the hose stations providing backup suppression capability and the fixed water suppression systems for areas so equipped. These modifications will include the addition of interior hose stations in the access control area, diesel generator room "A" and diesel generator room "B"; and the installation of extra lengths of hose at five existing hose stations. Pressure drops due to additional lengths of hose which result in a total length in excess of 75 feet will be reviewed and modifications provided as necessary to ensure that adequate pressure and flow will be available at these hose stations.

Approved spray nozzles will be provided for interior hose stations located to protect areas containing high voltage equipment.

We find that, subject to implementation of the above described modifications, the interior fire hose stations satisfy the objectives identified in Section 2.2 of this report and are, therefore, acceptable.

4.3.5 Automatic Water Suppression Systems

Automatic water spray systems are installed over the main power transformer, the auxiliary transformer, the shutdown transformer and the turbine lube oil reservoir. A preaction water suppression system is installed over the turbine lube oil reservoir. Each of these systems is automatically actuated by pneumatic rate of rise heat detectors, independent of electrical power signals.

At present, 16 automatic sprinkler systems are installed in the plant. Modifications will be made to expand the sprinkler coverage in four of these existing systems. In addition the existing wet pipe sprinkler system provided for the diesel day tank rooms will be modified to provide coverage for the diesel engine area and converted to a preaction system.

New sprinkler systems have been proposed for the radwaste truck loading area and the access control area of the radwaste and control building.

The only safety-related area presently served by a sprinkler system is the diesel generator room day tank area. No adverse consequences will result from the inadvertent discharge of water in this area. Following the implementation of the proposed modifications the safety-related diesel generator rooms "A" and "B" will be served by automatic water suppression systems. Actuation of these proposed systems could affect the operation of the onsite power system; however, the redundant units and their auxiliaries (including fire protection systems) are separated by barriers. This separation will prevent an inadvertent operation of the water suppression system in either area from simultaneously affecting both units.

Pressurized fire water piping is not routed in the vicinity of safety-related systems, except in the reactor building, where a fire water supply pipe is routed in the proximity of a motor control center. A guard pipe will be provided to eliminate any adverse effect resulting from a water pipe failure in this area.

We find that, subject to implementation of the above described modifications, the automatic water suppression systems satisfy the objectives identified in Section 2.2 of this report and are, therefore, acceptable.

4.4 Gas Fire Suppression Systems

Carbon dioxide for fire suppression is stored in a low pressure bulk storage tank located in the turbine building. CO_2 hose reels are located in the switchgear areas, reactor feed pump, and generator areas.

A total flooding fixed nozzle carbon dioxide system is installed in the cable spreading room. The system is automatically actuated by rate of rise heat detectors, with manual actuation capability independent of electrical power and automatic controls. Nonrated dampers in the supply and exhaust ventilation ducts automatically close when the system is actuated. The system is designed with a reserve capability for a second discharge.

To provide additional fire protection capability in the computer and storage room, a total flooding halon extinguishing system will be installed.

The system will be automatically initiated by a cross zoned detection system, with a backup manual release control.

The licensee will demonstrate the adequacy of the CO_2 extinguishing system installed in the cable spreading room. The results of this analysis or test should demonstrate that a satisfactory concentration of extinguishant can be achieved in all parts of the room.

We will address the adequacy of gas fire suppression systems in a supplement to this report.

4.5 Dry Chemical Systems

Automatic dry chemical suppression systems have been installed on the main generator turbine bearings and in the drainage trenches in the diesel generator building. These systems are automatically actuated by heat detectors or manually operated locally. A backup supply of dry chemical extinguishant is provided by wheeled dry chemical units, connected to the fixed system with quick disconnect couplings, and manually discharged as necessary.

We find that the dry chemical systems satisfy the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.6 Portable Fire Extinguishers

Both hand-held and wheeled dry chemical and carbon dioxide portable extinguishers are provided throughout the plant. The type, distribution, and arrangement of all portable fire extinguishers in the plant will be in accordance with the provisions contained in the current edition of NFPA 10.

We find that, subject to implementation of the above commitment, portable fire extinguisher installation conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.7 Ventilation Systems and Breathing Equipment

4.7.1 Smoke Removal

Ventilation systems are provided for all indoor plant areas. These systems, although not designed to remove smoke in the event of a fire, will be used for such service.

Ventilation air exhaust from the radiation controlled areas is monitored for radioactive contamination. In case a high radiation level is detected, the ventilation system will be isolated. Smoke removal operation, if in progress, will be terminated.

Modification will be made to the ventilation systems to provide additional smoke venting capability, consistent with the fire loading, for a few areas. Portable air handling units consisting of fire service smoke ejectors and flexible ducting will be provided for smoke removal.

We find that, subject to implementation of the above described modifications, the provisions for smoke removal comply with the provisions of Appendix A to BTP 9.5-1 and are, therefore, acceptable.

4.7.2 Filters

HEPA filters used throughout the plant are of noncombustible construction using metal frame and asbestos media.

Each of the redundant standby filter units serving the control room complex contains 4.5 cubic feet of charcoal media. This system is rarely in use, protected by an outside metal sheath and, except for abnormal conditions (airborne contaminants), will not adsorb heat inducing contaminants. These units are protected by nearby manual hose stations.

Automatic sprinklers are provided as an integral component of the charcoal filters in the standby gas treatment system.

An automatic sprinkler system has been provided over the augmented off-gas system charcoal vessel vault. This system has been designed to prevent the spread of any fire external to the vessels.

Due to the high combustible loading, inaccessibility, and the potential for high level of reactivity release, an automatic suppression capability will be provided for a charcoal fire inside the augmented off-gas system charcoal vessels, unless the licensee can demonstrate that, in the event of such fire, the two-hour whole body dose at the nearest exclusion area boundary is less than 5 rem using conservative calculation assumptions.

We find that, subject to implementation of the above described modification, or demonstration of acceptable dose consequences, the protection for the charcoal filters satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.7.3 Breathing Equipment

Ten self-contained breathing units with eight spare bottles have been provided at the facility, dedicated to emergency use. Additional spare bottles will be provided so that two spare bottles will be available for each unit. Recharging cylinders and a cascade unit will provide a six-hour onsite reserve air supply.

We find that, subject to implementation of the above described modifications, breathing facilities will comply with the provisions of Appendix A to BTP 9.5-1 and are, therefore, acceptable.

4.8 Floor Drains

Floor drains have been provided in all plant areas protected with fixed water fire suppression systems. In areas where the drainage capacity is such that the expected maximum discharge of the fire suppression system could cause a water buildup, the safety-related equipment is supported on pedestals. Drains are also provided in all areas where manual hoses are

likely to be used, with the exception of the control room, the cable spreading room and the HVAC machinery spaces. In these areas water will be drained out through door openings.

Drains from the turbine oil system discharge to an oil separator remote from safety-related systems. Drains from each diesel generator room are provided with back flow valves prior to connection to a sump pump receiver serving the diesel generator rooms.

The curb and scuppers for the diesel oil day tank rooms for the diesel generators are inadequate to contain the contents of the diesel oil storage tank. The licensee will raise the curbs and scuppers so that the entire contents of the oil will be contained within the room.

Adequate protection may not have been provided in every area to prevent the spread of combustible liquid via the drain system. A study will be performed to determine the extent to which backflow valves need to be installed in the drain systems for the quadrants and any other plant areas containing a large quantity of combustible liquid. Additional protection will be provided as necessary for each hazard.

We will address the adequacy of the backflow protection in a supplement to this report.

4.9 Lighting Systems

Plant lighting systems include: normal a-c powered lights; emergency a-c powered lights; emergency d-c powered lights; and installed emergency lighting units powered from self-contained batteries. A number of safety-related fire zones and fire zones required for access to safety-related fire zones have the potential for being without both normal and emergency lighting due to a fire. In each of these fire zones emergency and/or normal lighting circuits will be modified, existing circuit cables protected or fixed, 8 hour battery powered emergency lighting units will be installed to eliminate the potential for any safety-related fire zones or required access fire zone from being without lighting due to the effects of a fire in any other fire zone.

In addition, battery-operated hand lights will be procured with the fire equipment purchase. A number of these lights will be stored in the fire ready room adjacent to the control room, and an additional supply will be maintained at the gatehouse.

The installed four-hour rated fixed battery operated seal beam emergency lights will be replaced with units which have at least an eight-hour power rating for plant areas where these lights are provided to eliminate the potential for loss of lighting in the event of a fire.

We find that, subject to implementation of the above described modifications, adequate lighting will be available to support firefighting and plant operations in the event of a fire emergency.

4.10 **Communication Systems**

The in-plant communication system consists of two separate hardwired subsystems: a six-channel, five-party line (with paging, public address) system; and a separate maintenance and special operations communication system. Portable radio communication units are provided at the site capable of operation in certain areas of the plant.

Tests will be performed using UHF and VHF walkie-talkie units to measure radio coverage throughout the plant. Repeaters or antennae will be installed, if required, to ensure effective portable radio communications between the control room, guard house and various points in the plant to facilitate fire fighting activities.

We find that, subject to completion of the test programs described above and the implementation of any necessary modifications, the communication systems will be adequate to coordinate fire fighting and plant operations in the event of a fire emergency.

4.11 Electrical Cables

The cable insulation used in the plant consists mainly of ethylene-propylene (EPR) insulated conductors with a neoprene jacket. The insulating material for special application instrumentation cables is polyethylene with a polyvinyl chloride (PVC) jacketing. The total amount of PVC jacketed cable used is less than 20% of the total plant cabling.

IEEE Standard 383 was not in existence at the time that the electrical cable for Pilgrim Station was purchased. A sample of the plant's EPR insulated 5, 15, 24 kV cables, and 600-volt power and control cables were tested with the plant's penetration seals. However, no specific testing for cable combustibility has been performed by the licensee. Except where cables are installed in enclosed trays, flame retardant coatings will be applied to all the PVC jacketed cables.

The licensee will supply documentary evidence that those cables for which covering with a flame retardant coating has not been proposed are capable of passing the IEEE Std 383 flame test. We will address the acceptability of cable insulation material in a supplement to this report.

4.12 Fire Barrier Penetrations

4.12.1 Doorways

Fire barriers are penetrated by doors, ventilation ducts, electrical raceways, and mechanical piping systems. Class A, B, C and D fire doors, as well as some unrated doors, have been provided in fire barriers. Fire rating of doors will be upgraded to be consistent with the fire rating of the enclosure, based on the fire hazards analysis. Where fire doors are required, the door position will be electrically supervised with alarm

annunciation in a constantly manned location or the doors will be locked closed.

We find that, subject to implementation of the above described modifications, protection for door penetrations in fire barriers complies with the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.12.2 Ventilation Duct Penetrations

Fire dampers are installed in all ventilation duct penetrations through barriers with the exception of the standby gas treatment system and control room makeup air units. The fire dampers are Underwriters Laboratory rated for 1½ hours.

The installed fire dampers will be replaced with three-hour rated dampers in those areas where postulated fires could exceed the rating of the installed dampers.

We find that, subject to implementation of the above described modifications, protection of ventilation duct penetrations complies with the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.12.3 Electrical Cable Penetrations

Electrical cable penetrations in fire barriers are typically constructed with a fire resistant insulating material, sealed with urethane foam and a flame retardant coating. The licensee has performed a test to demonstrate a one-hour fire rating of these seals. The licensee will modify or replace these pentration seals with seals that have a demonstrated fire rating equivalent to that of the barrier, or will provide an analysis to demonstrate acceptability of lower rated seals, based upon test results and the completed fire hazards analysis.

We find that, subject to implementation of the above described commitment, protection of electrical cable penetration seals complies with the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.12.4 Piping Penetrations

Piping penetrations through the fire barriers are either connected to preformed steel sleeves and provided with welded ends or are grouted and sealed with a combination of concrete, asbestos rope, asbestos wool, glass wool or cellular concrete.

The fire resistance rating of the installed pipe penetration seals has not been established. The rating of the installed pipe penetration seals will be established, demonstrated and upgraded where necessary to the rating required for the barrier, or an analysis will be provided to demonstrate the acceptability of the current seals, based upon test results and the completed fire hazards analysis.

We find that, subject to implementation of the above described commitment, protection of pipe penetrations complies with the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.13 Fire Barriers

The radwaste and control, the reactor, the reactor auxiliary and the turbine buildings are separated from each other by three-hour fire walls. Three-hour rated walls or walls capable of qualifying as three-hour rated barriers are provided within buildings to separate and isolate areas containing redundant safety-related systems and components, or areas with significant fire hazards. Floors and ceilings are capable of qualifying for fire rating consistent with the results of the fire hazard analyses.

Exposed structural steel members were analyzed to determine the maximum allowable steel temperature under design loading. The results of this analysis demonstrated that in the event of an unmitigated fire the support members would fail. The exposed steel will be protected in those areas where postulated failure could impact adversely on the plant's safe shutdown capability.

We find that, subject to implementation of the above described modifications, the fire barriers are adequate to prevent fire propagation outside the area of fire initiation.

4.14 Separation Criteria

Design and construction of Pilgrim Station predates industry standards on physical separation. The engineered safeguards systems are separated into two principal divisions with a third division consisting of components which may be transferred between the redundant divisions. The separation criteria are based on the protection afforded by physical distance, barriers and conduit. When cables of the three divisions are routed in cable trays through one fire area, protection is provided by either a physical separation of three feet horizontal and five feet vertical or less with interposed asbestos fire board stops.

Recognizing the above described physical separation is not sufficient protection in the event of a fire, the licensee will conduct a more detailed fire hazards analysis for those areas containing redundant divisions of cables serving safe shutdown loads to determine the modifications required to preserve a safe shutdown capability following a fire. The licensee has concluded his analysis for the cable spreading room and has proposed an alternate shutdown capability independent of the area. We will address the acceptability of the licensee's proposed modifications for other such areas in a supplement to this report.

We will address the adequacy of cable separation and proposed modifications in a supplement to this report.

4.15 Access and Egress

Most safety-related areas are reasonably accessible for manual fire fighting through separated stairwells. Areas with limited access and egress are addressed in Section 5.0 of this report.

4.16 Nonsafety-Related Areas

We have evaluated the distance and fire barriers which separate nonsafety-related areas from safety-related areas. Following implementations of modifications prescribed in Section 3.0 of this report, protection against a fire in the nonsafety related areas will be adequate to preserve the ability to safely shut down the plant.

4.17 Toxic and Corrosive Combustion Products

The products of combustion of many polymers are toxic to humans and corrosive to metals. A fire involvement of the cable jacketing material used at Pilgrim Station will give off hydrogen chloride and sulfer dioxide gases. Prompt fire detection and extinguishment are relied on to reduce the quantity of these gases. Additionally, means for smoke removal are provided or will be added as discussed in Section 4.7 of this report. The fire brigade will also be provided with and trained in the use of emergency breathing equipment for fighting fires in hazardous atmospheres.

We find that, subject to implementation of the above described modifications, products of combustion will be adequately controlled to facilitate fire fighting and emergency operations.

5.0 EVALUATION OF SPECIFIC PLANT AREAS

The licensee has performed a fire hazard analysis of the facility to determine the combustibles present in various plant areas, to identify the consequences of fires in safety-related areas and to evaluate the adequacy of fire protection systems.

The results of this analysis, other docketed information, and site visit observations were used in the staff's evaluation of specific plant areas which is discussed in the following sections. The numbering of fire areas noted in the parentheses following each plant area corresponds to those given by the licensee in his fire hazard analysis submittal.

As stated in Section 3 of this report, the licensee has committed to perform additional studies on certain issues, such as exposed steels protection, backflow protection, safe shutdown analysis, etc., to identify problematic area(s) and propose, if necessary, additional modifications. Exactly which plant area(s) will be affected by these studies are not known a priori. The conclusions made in the following sections for various plant areas are based on the assumption that additional modification(s), consistent with the objectives of Section 2.2 of this report, will be provided should any one of these plant areas be identified by such studies to have a problem not identified previously.

5.1 Reactor Building - Elevation -17'6" - Quadrants (Fire Zones 1.1, 1.2, 1.5, 1.6)

5.1.1 Safety-Related Equipment

Four separate rooms surround the reactor drywell at this elevation, each located in a corner of the reactor building. The northwest and southeast corner rooms contain components of the residual heat removal (RHR) system and core spray system. The southwest corner room contains the reactor core isolation cooling (RCIC) pump and turbine. The northeast corner room houses the control rod drive (CRD) pumps.

5.1.2 Combustibles

The combustibles in these pump rooms consist of the lube oil associated with the pumps and electrical cable insulation.

5.1.3 Consequences if No Fire Suppression

Postulated fires on this elevation of the reactor building would be limited to one of the quadrant rooms.

A complete loss by fire of the cables and equipment in any one room would not preclude a safe shutdown of the plant.

5.1.4 Fire Protection Systems

The reactor core isolation cooling pump room is provided with ionization smoke detection. Hose stations are located in both residual heat removal and core spray rooms. Hose stations are also located at the 2'-9" elevation, the reactor core isolation cooling pump mezzanine and control rod drive pump mezzanine above the reactor core isolation cooling and control rod drive pump rooms.

5.1.5 Adequacy of Fire Protection

Manual suppression would be adequate to control a fire in one safety-related pump room although lack of detection would allow the fire to continue unnecessarily.

5.1.6 Modifications

The licensee proposed to make the following improvements to these areas:

(1) An additional 25-foot length of hose will be added to the hose station in the northwest residual heat removal and core spray pump room.

(2) Smoke detection and signaling systems will be added to the northwest and southeast residual heat removal and core spray pump rooms.

We find that, subject to implementation of the above described modifications, the fire protection for these rooms complies with the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.2 Reactor Building - Elevation 23 feet - Control Rod Drive Module Areas East and West (Fire Zones 1.9 and 1.10)

5.2.1 Safety-Related Equipment

The safety-related equipment in this area includes the banks of control rod drive (CRD) modules; safety-related motor control centers; cable trays; residual heat removal, reactor core isolation cooling and high pressure coolant injection system valves.

5.2.2 Combustibles

The combustibles in this area consist of electrical cable insulation and miscellaneous transient materials.

5.2.3 Consequences if No Fire Suppression

The loss of all safety-related electrical cables in this area could have unacceptable consequences on the capability to safely shut down the reactor. The control rod drive module areas contain cable and equipment of both divisions. The safe shutdown analysis in item 3.2.1 will determine the possible impact of a fire in this area on safe shutdown operation.

5.2.4 Fire Protection Systems

Fire protection is provided by portable fire extinguishers and four hose stations located in the area.

5.2.5 Adequacy of Fire Protection

The fire protection provided for these areas may not be adequate to prevent damage to redundant divisions of safe shutdown equipment in the event of a fire.

5.2.6 Modifications

The licensee will install smoke detectors in the areas containing cable trays. In addition, the licensee has proposed a combination of flame retardant coatings, fire barriers, and additional detectors as determined necessary following the completion of the fire hazards analysis.

We will address the adequacy of the fire protection provided for the CRD module areas in a supplement to this report.

5.3 Reactor Building - Elevation 51 feet - Open Areas East and West Half

5.3.1 Safety-Related Equipment (Fire Zones 1.11 and 1.12)

The safety-related equipment in this area includes safety-related cable trays and panels, core spray and residual heat removal system valves.

5.3.2 Combustibles

The combustibles in this area consist of electrical cable insulation and miscellaneous transient materials.

5.3.3 Consequences if No Fire Suppression

The open area - west half contains both divisions of safety-related cable; however, complete loss by fire of the cables in this area will not prevent a safe shutdown and cooldown of the plant.

The open area - east half contains cable and equipment of both divisions that are required for safe shutdown. The safe shutdown analysis in item 3.2.1 will determine the possible impact of a fire in this area on safe shutdown operation.

5.3.4 Fire Protection Systems

Fire protection is provided by portable extinguishers and two hose stations located in the area.

5.3.5 Adequacy of Fire Protection

The fire protection provided for these areas may not be adequate to prevent damage to redundant divisions of safe shutdown equipment in the event of a fire.

5.3.6 Modifications

The licensee will add an additional 25-foot hose length to each of the hose stations in the area. In addition, the licensee has proposed a combination of flame retardant coatings, fire barriers, and detectors as determined necessary following the completion of the fire hazards analysis.

We will address the adequacy of the fire protection provided for Elevation 51 feet, open areas east and west half, in a supplement to this report.

5.4 Reactor Building - Elevation 51 feet - Recirculation Pump Motor Generator Set Room (Fire Zone 1.28)

5.4.1 Safety-Related Equipment

This area contains both recirculation pump motor generator sets and a reactor building closed cooling water system valve.

5.4.2 Combustibles

The combustibles in this area include the hydraulic fluid and lubricating oil contained in the motor generator sets, approximately 1462 gallons, and miscellaneous transient materials.

5.4.3 Consequences if No Fire Suppression

A fire in this area would not affect the plant's safe shutdown capability. An unsuppressed fire could, however, damage the exposed structural steel members supporting the ceiling.

5.4.4 Fire Protection System

This fire area is separated from the remainder of the reactor building by three-hour rated doors and barriers. The room is monitored by an ionization smoke detection system, and portions of the motor generator sets are protected by an automatically actuated deluge suppression system. Portable extinguishers are located in the area and a hose station is located outside the area.

5.4.5 Adequacy of Fire Protection

The ventilation system penetrations in the walls enclosing the motor generator sets are inadequate to contain a severe fire in this area. The adjacent areas contain cabling and equipment required for safe shutdown. The deluge suppression system covers only a portion of the motor generator set lube oil system, and may not be effective in suppressing motor generator set fires.

5.4.6 Modifications

The licensee proposes to make the following improvements to this area:

(1) The barrier ventilation penetrations will be replaced with three-hour rated damper assemblies.

(2) The existing automatic water suppression system will be modified to provide additional coverage within this area

(3) Extra lengths of hose will be added to an adjacent hose station (Number 7) to provide additional backup protection.

We find that, subject to implementation of the above described modifications, the fire protection for this area satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

5.5 Reactor Building - Elevation 74'3" (Fire Zones 1.13 and 1.14)

5.5.1 Safety-Related Equipment

The fuel pool cooling pumps, heat exchangers and spent fuel storage pool are located on this elevation, in addition to a small number of safety-related cable trays and panels.

5.5.2 Combustibles

The combustibles on this elevation consist of lubricants and electrical cable insulation.

5.5.3 Consequences if No Fire Suppression

A postulated fire in this area would not have an adverse effect on the safe shutdown or any safety-related equipment except for possibly the spent fuel pool cooling system. Interconnection of the RHR system to the fuel pool cooling system is possible and provides an adequate cooling capability should a fire disable the equipment in this area.

5.5.4 Fire Protection System

Fire protection is provided by manual hose stations and portable fire extinguishers.

5.5.5 Adequacy of Fire Protection

Manual fire suppression would be adequate to suppress a fire in this area although lack of detection would allow the fire to continue unnecessarily.

5.5.6 Modifications

Fire detection and signaling systems will be installed in the fire zones located on this elevation.

We find that, subject to implementation of the above described modifications, the fire protection for these fire zones satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

5.6 Reactor Building - Elevation 91'3" (Fire Zones 1.16 and 1.17)

5.6.1 Safety-Related Equipment

The standby liquid control system tanks and pumps are located on this elevation, in addition to a small number of safety-related cable trays and panels.

5.6.2 Combustibles

The combustibles at this elevation include lubricants, cable insulation and transient materials.

5.6.3 Consequences if No Fire Suppression

A fire in this area would not affect the plant's safe shutdown capability. The standby liquid control system is not required for safe shutdown.

5.6.4 Fire Protection Systems

Fire protection is provided by manual hose stations and portable fire extinguishers.

5.6.5 Adequacy of Fire Protection

Manual fire suppression would be adequate to suppress a fire in this area although lack of detection would allow the fire to continue unnecessarily.

5.6.6 Modifications

Fire detection and signaling systems will be installed in the fire zones located on this elevation.

We find that, subject to implementation of the above described modifications, the fire protection for these fire zones satisfies the objectives identified in Section 2.2 of this report and are, therefore, acceptable.

5.7 Reactor Building - Elevation 117 feet (Fire Zones 1.19, 1.20, and 1.24)

5.7.1 Safety-Related Equipment

The 117-foot elevation of the reactor building is the refueling floor. This area provides access to the new fuel vault and the spent fuel pool. This area also serves as the transfer cask washdown area, and the storage and laydown area during refueling operations.

5.7.2 Combustibles

A small amount of lubricant in the refueling crane and transient materials make up the combustibles in this area.

5.7.3 Consequences if No Suppression

An unsuppressed fire in this area could damage the refueling crane and possibly other equipment used during refueling operations. A fire in this area would not affect the plant's safe shutdown capability.

5.7.4 Fire Protection Systems

Portable extinguishers and hose stations provide manual fire fighting capability.

5.7.5 Adequacy of Fire Protection

Manual fire suppression would be adequate to suppress a fire in this area, although lack of detection would allow the fire to continue unnecessarily.

5.7.6 Modifications

Fire detection and signaling systems will be installed in the fire zones located on this elevation.

We find that, subject to implementation of the above described modifications, the fire protection for these fire zones complies with the provisions of Appendix A to BTP 9.5-1 and are, therefore, acceptable.

5.8 Reactor Building - Elevation -17'6" - HPCI Pump Room (Fire Zone 1.3)

5.8.1 Safety-Related Equipment

The high pressure coolant injection (HPCI) pump room and adjacent pump panel and valve room contain the turbine driven HPCI pump, its auxiliary equipment and associated switchgear.

5.8.2 Combustibles

The combustibles contained this area 225 gallons of lubricating oil and electrical cable insulation.

5.8.3 Consequences if No Fire Suppression

The turbine driven pump and associated equipment could be damaged by a fire; however, sufficient separation exists to ensure that safe shutdown could be accomplished using equipment located in remote fire areas.

5.8.4 Fire Protection Systems

Fire protection is provided by a 250-pound wheeled dry chemical extinguisher and a hose station in the adjacent pump room. The curbed area around the turbine will contain the total 225-gallon lube oil inventory of the HPCI turbine lube oil system. Installed ionization smoke detectors in the room provide alarm and annunciation in the control room.

5.8.5 Adequacy of Fire Protection

Due to the location and construction of the room, isolation of the room itself would provide sufficient protection to ensure safe shutdown capability. A timely response to a fire alarm with extinguishers or hose reel will be adequate to control and suppress a fire in this area.

5.8.6 Modifications

The licensee will lock or electrically supervise the door separating the high pressure coolant injection pump room from the high pressure coolant injection pump panel and valve room.

We find that, subject to implementation of the above described modification, the fire protection for this area complies with the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.9 Reactor Building - Drywell (Fire Zone 1.30)

5.9.1 Safety-Related Equipment

Safety-related equipment in the drywell includes the reactor vessel, reactor recirculation pumps, piping, valves, and electrical cabling.

5.9.2 Combustibles

Combustibles in this area consist of approximately 125 gallons of lubricating oil in the recirculation pumps, and electrical cable insulation.

5.9.3 Consequences if No Suppression

During operation, the containment is maintained in a nitrogen atmosphere; the nitrogen inerting serves as protection by preventing the initiation of fires. However, any damage caused by a postulated fire in this area would not preclude safe shutdwon.

5.9.4 Fire Protection Systems

Fire detection systems are not provided; however, drywell temperature and pressure are monitored and recorded in the control room. During refueling and maintenance operations portable extinguishers are brought into the drywell. In addition, the containment spray system will be available for fire suppression.

5.9.5 Adequacy of Fire Protection

The nitrogen inerting will be an acceptable means of protection against fires during plant operations. During maintenance operations, when the drywell is deinerted, manual fire fighting will be adequate to suppress fires.

5.9.6 Modifications

No modification in this area is required.

We find that the fire protection for this area complies with the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.10 Reactor Auxiliary Building - Elevation 3' - Reactor Building Closed Cooling Water Pump Rooms (Fire Zones 1.21 and 1.22)

5.10.1 Safety-Related Equipment

The components for the two loops of the reactor building closed cooling water (RBCCW) system are separated into two rooms by three-hour barriers

on the three-foot elevation of the reactor auxiliary building. Each room contains the pumps and heat exchangers associated with one train of the RBCCW system and the nonsafety related turbine building closed cooling water system. However, the north room, RBCCW Pump Room "B", contains a safety-related motor control center and cables of both divisions required for safe shutdown.

5.10.2 Combustibles

The combustibles in these rooms consist of the lubricants associated with the pumps and electrical cable insulation.

5.10.3 Consequences if No Fire Suppression

The RBCCW Pump Room "A" contains both divisions of safety-related cable; however, complete loss by fire of the cable and equipment in this area will not prevent a safe shutdown. The RBCCW Pump Room "B" contains cable and equipment of both divisions that are required for safe shutdown. The safe shutdown analysis in item 3.2.1 will determine the possible impact of a fire in this area on safe shutdown operation.

5.10.4 Fire Protection Systems

Fire protection is provided by portable extinguishers and hose stations located in RBCCW Pump Room "B" and the adjacent demineralized water and condensate transfer pump area.

5.10.5 Adequacy of Fire Protection

The fire protection provided may not be adequate to prevent damage to redundant divisions of safe shutdown equipment in the event of a fire.

5.10.6 Modifications

The licensee has proposed to install an automatic closing three-hour rated fire door to separate the pump rooms. In addition, the licensee has proposed a combination of flame retardant coatings, fire barriers and additional detectors as determined necessary following the completion of the fire hazards analysis.

We will address the adequacy of the fire protection provided for the RBCCW Pump Rooms in a supplement to this report.

5.11 Turbine Auxiliary Bay - Elevation 51' - Standby Gas Treatment Filter Rooms (Fire Zone 1.23)

5.11.1 Safety-Related Equipment

The standby gas treatment system (SGTS) filter rooms contain charcoal and HEPA filters of the gaseous radwaste system.

5.11.2 Combustibles

Combustibles in this area consist of carbon adsorber media, lubricants, and transient combustible materials.

5.11.3 Consequences if No Fire Suppression

Loss of the equipment in this area would have no impact on the safe shutdown of the plant. However, an unsuppressed fire could cause a radioactive release from the particulates on the HEPA filters and the iodines adsorbed onto the surface of the charcoal filters.

5.11.4 Fire Protection Systems

Fire protection for this area is provided by portable extinguishers and manual hose stations. The charcoal filters in this area are protected with an automatic water sprinkler system.

5.11.5 Adequacy of Fire Protection

The automatic water suppression system will provide adequate protection for charcoal fires. Manual hose stations in adjacent areas may not be able to effectively reach all points in this area.

5.11.6 Modifications

The licensee will add an additional 25-foot length of hose to the hose station adjacent to this area.

We find that, subject to implementation of the above described modification, the fire protection for this area satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

5.12 Turbine Building - Elevation 23' and 37' - Switchgear Rooms (Fire Zones 2.1 and 2.2)

5.12.1 Safety-Related Equipment

Switchgear room A located on the 37-foot elevation of the turbine building contains the engineered safety features and nonvital 4160 V switchgear, transformers, 480 V switchgear, 480 V motor centers, and 125 V d-c (control) chargers and buses associated with the A division. Switchgear room B located on the 23-foot elevation contains the engineered safety features and nonvital 4160 V switchgear, transformers, 480 V switchgear, 480 V motor control centers, and 125 V and 250 V d-c (control and power) chargers and buses associated with the B division. Both switchgear rooms contain redundant divisions of cables required for safe shutdown.

5.12.2 Combustibles

The combustibles in these areas are electrical cable insulation and transient materials.

5.12.3 Consequences if No Fire Suppression

Three-hour rated fire barriers are provided to separate these fire areas from the remainder of the plant. The licensee has evaluated the effects of an unsuppressed fire on the exposed structural steel members. The

results of this analysis have shown that unless suppression efforts are initiated, the support members could fail. Both switchgear rooms contain redundant divisions of cable required for safe shutdown. The safe shutdown analysis in item 3.2.1 will determine the possible impact of a fire in this area on safe shutdown operation.

5.12.4 Fire Protection Systems

Both switchgear rooms are protected with ionization smoke detection systems, CO_2 hose reels and portable extinguishers.

5.12.5 Adequacy of Fire Protection

The fire protection provided may not be adequate to prevent damage to redundant divisions of safe shutdown equipment in the event of a fire.

5.12.6 Modifications

The licensee has proposed to make the following improvements to this area:

(1) Fire doors and door assemblies separating the switchgear rooms from the adjacent plant areas will be replaced with three-hour rated assemblies.

(2) A new hose station with 75 feet of hose will be installed outside one entrance to the "B" switchgear room.

(3) Modifications will be made to the ventilation systems to provide limited smoke venting capabilities for these areas.

(4) In addition, the licensee has proposed a combination of flame retardant coatings, fire barriers, and additional detectors, as determined necessary, following the completion of the studies identified in Section 3.2 of this report.

We will address the adequacy of the fire protection provided for the switchgear rooms "A" and "B" in a supplement to this report.

5.13 Turbine Building - Elevations 23' and 37' - Battery Rooms (Fire Zones 2.3 and 2.4)

5.13.1 Safety-Related Equipment

The two safety-related battery banks are located in separate three-hour rated enclosures adjacent to the "A" and "B" switchgear rooms.

5.13.2 Combustibles

The combustibles in these areas are battery cases, electrical cable insulation and transient materials. Hydrogen buildup is precluded by a continuously operating ventilation system.

5.13.3 Consequences if No Fire Suppression

Station battery rooms are separated from each other and other plant areas by three-hour rated walls. An unsuppressed fire in one battery room could cause the loss of that division of batteries. The redundant division of batteries, located in a separate and remote fire area, would still be available.

5.13.4 Fire Protection Systems

Both battery rooms are protected with ionization smoke detector systems, CO_2 hose reels and portable extinguishers.

5.13.5 Adequacy of Fire Protection Systems

The existing fire protection would be adequate to detect and suppress a fire in these areas. The ventilation air exhaust trip alarm alone may not provide positive supervision for a continuous air flow through the rooms.

5.13.6 Modifications

Each battery room will be equipped with a ventilation air flow monitor which alarms and annunciates in the control room on the loss of air flow to either battery room, or justification will be provided that such monitors are not necessary.

The adequacy of the protection provided for the battery rooms will be addressed in a supplement to this report.

5.14 Turbine Auxiliary Bay - Elevation 6 Feet to 47 Feet (Fire Zone 2.10)

5.14.1 Safety-Related Equipment

This fire zone is located in the northeast corner of the turbine building, and contains safety-related cables and switchgear.

5.14.2 Combustibles

The combustibles in this area consist of electrical cable insulation and lubricants.

5.14.3 Consequences if No Fire Suppression

This area contains cables of both divisions of safety-related equipment. The licensee is performing additional analysis to determine the consequences of a fire in this area on the plant's shutdown capability.

5.14.4 Fire Protection Systems

An automatic sprinkler system protects this area on the 37-foot elevation. Hose stations and portable extinguishers are provided at other levels.

5.14.5 Adequacy of Fire Protection

The fire protection provided may not be adequate to prevent damage to redundant divisions of safe shutdown equipment in the event of a fire.

5.14.6 Modifications

The licensee has proposed a combination of flame retardant coatings; fire barriers; and additional detectors, as determined necessary, following the completion of the fire hazards analysis.

We will address the adequacy of the fire protection provided for the Turbine Auxiliary Bay in a supplement to this report.

5.15 Radwaste and Control Building - Elevation 37' - Control Room (Fire Zone 3.1)

5.15.1 Safety-Related Equipment

The control room contains safety-related cables and control and instrument cabinets.

5.15.2 Combustibles

The combustibles in this area consist of electrical cable insulation, electrical components in panels and consoles, and some Class A combustibles such as log books, drawings and operating procedures.

5.15.3 Consequences if No Fire Suppression

An unsuppressed fire in the control room has the potential for disabling a significant number of safety-related components in both divisions. A postulated fire in certain control room cabinets or consoles may affect redundant systems since, in some cases, redundant circuits are located in the same cabinet or console.

5.15.4 Fire Protection Systems

Three-hour rated walls separate the control room complex from the plant. Nonrated and one-hour rated doors separate the control room from the adjoining support offices. Portable extinguishers are provided inside the control room for manual fire fighting. Breathing apparatus for the control room operators is available in the fire ready room, adjacent to the control room.

5.15.5 Adequacy of Fire Protection

The manual fire fighting equipment provided should be adequate to prevent more than one cabinet from becoming involved in a fire. Further protection is needed to minimize the extent of damage within each safety-related cabinet. Additional protection is also needed to prevent the control room from being exposed to hazards from adjacent offices and the kitchen.

5.15.6 Modifications

The licensee has proposed to make the following improvements to this area:

(1) Fire detection and signaling systems will be installed in seven control room panels.

(2) Eight fire doors and door assemblies separating the control room from the adjacent offices will be replaced with three-hour rated assemblies.

(3) Two additional hose stations, each provided with 75 feet of hose, will be installed outside the entrances to the control room complex.

(4) The electric stove located in the kitchen adjacent to the control room will be disabled by removing the cord and plug and a microwave oven will be installed.

(5) A type ABC fire extinguisher will be provided for the kitchen area.

We find that, subject to implementation of the above described modifications, the fire protection for the control room complex complies with the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.16 Radwaste and Control Building - Elevation 23' - Cable Spreading Room (Fire Zone 3.2)

5.16.1 Safety-Related Equipment

The cable spreading room contains redundant divisions of safety-related cabling, 480-V switchgear and 480-V motor control center associated with the swing division.

5.16.2 Combustibles

The combustibles in this area consist of electrical cable insulation.

5.16.3 Consequences if No Fire Suppression

Three-hour rated fire barriers are provided to separate the cable spreading room from the remainder of the plant. The licensee has evaluated the effects of an unsuppressed fire on the exposed structural steel members in the ceiling. The results of this analysis indicate that unless suppression efforts are initiated, the steel support members would fail. This area contains cables of both divisions of shutdown required equipment. This equipment would be incapacitated by a major fire in this area.

5.16.4 Fire Protection Systems

The cable spreading room is monitored by an ionization smoke detection system with alarm indication in the control room. An automatically actuated

total flooding carbon dioxide system is the primary means of fire suppression. Portable extinguishers and hose stations provide manual fire suppression capabilities.

5.16.5 Adequacy of Fire Protection

The existing fire protection is inadequate to prevent a fire from involving both divisions of cables.

5.16.6 Modifications

The licensee has proposed to make the following improvements to this area:

(1) A new hose station with 75 feet of hose will be installed outside the southeast entrance to the cable spreading room.

(2) A new wall containing a rated fire door assembly will be constructed in the corridor connecting the cable spreading room and the personnel decontamination area.

(3) An alternate shutdown system, independent of the cabling and equipment in the cable spreading room, will be provided.

(4) Redundant cable trays/conduits will be separated by asbestos board (or equivalent) barriers. Flame retardant coating or asbestos board barriers will be installed to provide protection against exposure fires.

(5) Residual heat removal power cables routed through the cable spreading room will be separated from the remainder of the room by a barrier enclosure. Additional protection in the form of flame retardant coating or asbestos board barriers will be provided against the hazards of other power cables in the room.

(6) A suitable discharge test or analysis of the CO_2 extinguishing system in the cable spreading room be performed to verify that a design concentration of 50% is achieved in all parts of the room; with 30% concentration within the first 1 minute and 30 seconds following system initiation.

We find that, subject to implementation of the above described modifications, the fire protection for the cable spreading room satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

5.17 Radwaste and Control Building - Elevation 23 Feet - Vital Motor Generator Set Room (Fire Zone 3.5)

5.17.1 Safety-Related Equipment

This area houses the vital motor generator set, safety-related panels and safety-related cable trays.

5.17.2 Combustibles

The combustibles in this area consist of cable insulation and lubricants.

5.17.3 Consequences if No Fire Suppression

This area is separated from the adjacent areas of the plant by rated barriers and barrier penetrations. This area contains cables and panels of both divisions of shutdown required equipment. The safe shutdown analysis in item 3.2.1 will determine the consequences of a fire in this area on the capability to safely shut down the plant.

5.17.4 Fire Protection Systems

Portable extinguishers provide manual fire fighting capability in this area.

5.17.5 Adequacy of Fire Protection

The fire protection provided may not be adequate to prevent damage to redundant divisions of safe shutdown equipment in the event of a fire.

5.17.6 Modifications

The licensee has proposed the following modifications. The licensee will install a fire detection system which alarms and annunciates in the control room. In addition, the licensee has proposed flame retardant coatings, fire barriers and additional separation, as necessary, following the completion of the fire hazards analysis.

We will address the adequacy of the fire protection provided for the vital motor generator set room in a supplement to this report.

5.18 Radwaste and Control Building - Elevation 1' - Radwaste Corridor (Fire Zone 3.10)

5.18.1 Safety-Related Equipment

This area is located beneath the cable spreading room, and contains cables which serve both divisions of safe shutdown required systems.

5.18.2 Combustibles

The combustibles in this area consist of electrical cable insulation and lubricants.

5.18.3 Consequences if No Fire Suppression

This area contains cables of both divisions of shutdown required equipment. The safe shutdown analysis in item 3.2.1 will determine the consequences of a fire in this area on the capability to safely shut down the plant.

5.18.4 Fire Protection Systems

Portable extinguishers and hose stations provide manual fire fighting capabilities.

5.18.5 Adequacy of Fire Protection

The fire protection provided for these areas may not be adequate to prevent damage to redundant divisions of safe shutdown equipment in the event of a fire.

5.18.6 Modifications

The licensee has proposed fire detection systems, flame retardant coatings, fire barriers and additional separation as determined necessary following the completion of the fire hazards analysis.

We will address the adequacy of the fire protection provided for this area in a supplement to this report.

5.19 Diesel Generator Building Diesel Generator Rooms (Fire Zones 4.1, 4.2, 4.3 and 4.4)

5.19.1 Safety-Related Equipment

Two safety-related diesel generator sets have been provided; separated from each other and other parts of the plant by three-hour fire barriers.

5.19.2 Combustibles

The combustibles consist of lubricating oil, fuel oil, and electrical cable insulation.

5.19.3 Consequences if No Fire Suppression

An unsuppressed fire in one diesel generator room could cause the loss of one division of safety-related equipment if both normal and backup offsite power were not available.

5.19.4 Fire Protection Systems

Ionization type smoke detectors and heat detectors which alarm locally and annunciate in the control room are provided in each diesel generator room. A fixed automatically actuated dry chemical system has been installed to protect the oil line trenches, and portable extinguishers provide manual fire fighting capability. Each fuel oil day tank is separated from its associated diesel generator by a three-hour rated enclosure, and protected by an automatically actuated sprinkler system.

5.19.5 Adequacy of Fire Protection

The installed automatic systems will be adequate to suppress fires in the day tank room, or in the oil lube trenches. Portable extinguishers may not be adequate to suppress a fire involving a diesel generator lubrication oil system.

5.19.6 Modifications

The licensee has proposed to make the following improvements to this area:

(1) The installed wet pipe sprinkler system in the diesel fuel oil day tank rooms will be modified to provide coverage of the diesel engine area of the diesel generator room. The wet sprinkler system will be converted to a preaction system. Baffles will be provided to protect the generator, controls and air intakes from water discharge. Operation of the deluge valve, charging the preaction system, will be annunciated in the control room.

(2) The curbs and scupper drains in the diesel oil day tank rooms will be redesigned and relocated so that the diked area will be capable of containing the tank's entire contents.

(3) Interior hose stations will be installed in diesel generator rooms "A" and "B".

(4) Hand-held portable fire extinguishers will be installed in diesel generator rooms "A" and "B".

We find that, subject to implementation of the above described modifications, the fire protection for the diesel generator building complies with the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.20 Intake Structure (Fire Zones 5.1, 5.2, 5.3, 5.4 and 5.5)

5.20.1 Safety-Related Equipment

The safety-related equipment located in the intake structure include the five salt water service pumps. The electric-motor driven fire pump, the diesel-driven fire pump and the diesel day tank are also located in this structure.

5.20.2 Combustibles

The combustibles consist of the fuel oil in the day tank room, electrical cable insulation and lubricants associated with the pumps.

5.20.3 Consequences if No Fire Suppression

The service water pumps are contained in three separate enclosures within the intake structure. An unsuppressed fire in any one of these enclosures would be contained within that enclosure.

An unsuppressed fire in the diesel fire pump room could disable the pump; and possibly breach the surrounding barrier and spread into adjacent sections of the intake structure. Unsuppressed fire in the diesel day tank room could breach the enclosure and spread to adjacent sections of the intake structure.

5.20.4 Fire Protection Systems

Both the diesel-driven fire pump room and the diesel fuel oil day tank room are protected by automatic sprinkler systems. Portable extinguishers provide manual fire fighting capability throughout the remainder of the intake structure.

5.20.5 Adequacy of Fire Protection

The installed automatic systems will be adequate to suppress fires in the day tank room and/or diesel fire pump room. Portable extinguishers may not be adequate to suppress fires outside of the sprinkler protected enclosures. A fire in any one of the service water pump enclosures will be contained within that enclosure. Redundant pumps in the separate enclosures, will provide service water cooling for safe shutdown.

5.20.6 Modifications

The licensee has proposed to make the following improvements to this area:

(1) A new hose station within a 75-foot length of hose will be installed in the vicinity of the service water pumps.

(2) Additional portable extinguishers will be provided in the intake structure.

(3) The existing door to the diesel-driven fire water pump and day tank room will be upgraded to provide three-hour protection.

We find that, subject to implementation of the above described modifications, the fire protection for the intake structure satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

6.0 ADMINISTRATIVE CONTROLS

The administrative controls for fire protection consist of the fire protection organization, the qualifications and training for fire protection personnel, the controls to be exercised over combustibles and ignition sources, plans and procedures for fighting fires in the various plant areas, and the quality assurance provisions for fire protection.

The licensee has proposed to amend the existing fire protection administrative program to meet the guidelines presented in the NRC's guidance document, "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance". Plans and procedures stipulating the management and staff organization and its qualifications; the fire brigade training program; controls over combustibles and ignition sources; and the prefire plans for fighting fires will be developed and implemented.

The licensee has proposed a fire brigade of at least five members to be maintained onsite at all times. The fire brigade composition will not include three members of the minimum shift crew necessary for safe shutdown or any personnel required for other essential functions during a fire emergency. The composition and size of the proposed fire brigade meet the NRC staff requirement, and are acceptable.

Quality assurance provisions will be established for the design, procurement, installation, testing and administrative controls for fire protection utilizing the programmatic guidance and procedures contained in the licensee's 10 CFR Part 50, Appendix B, operational quality assurance program. Existing quality assurance implementing procedures will be modified to include and apply the quality assurance criteria, addressed in BTP 9.5-1, to a level commensurate with the objectives and requirements for fire protection.

We find that, subject to implementation of the above described programmatic changes, the fire protection program satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

7.0 TECHNICAL SPECIFICATIONS

The interim Technical Specifications for fire protection for the Pilgrim Power Station were issued as Amendment No. 29 to Facility Operating License DPM 35 on March 3, 1978. These interim Technical Specifications were found not to adequately address all of the existing fire protection systems that were relied upon in the fire protection program evaluation. Thus, the Technical Specifications were modified to include additional limiting conditions for operation and surveillance requirements for existing fire protection systems.

The licensee shall propose similar technical specifications 90 days prior to completion of the proposed modifications to fire protection systems and administrative controls resulting from this review.

8.0 CONCLUSIONS

The licensee has performed a fire hazards analysis and has proposed certain modifications to improve the fire protection program. Additional modifications have been proposed by the licensee during the course of our review, which are based upon the fire hazards analysis and our onsite evaluation of the fire protection program. These proposed modifications are summarized in Section 3.1. In addition, we have concluded that the licensee should implement certain evaluations or improvements related to the fire protection program. These are summarized in Section 3.2. Significant steps are being taken to provide additional assurance that safe shutdown can be accomplished and the plant can be maintained in a safe condition during and following potential fire situations. Additional evaluation of incomplete items, discussed in the preceding sections, will be necessary before we can conclude that the overall fire protection at the Pilgrim facility will satisfy the provisions of BTP 9.5-1 and Appendix A thereto, which the staff has established for satisfactory long-term fire protection.

We find that the licensee's proposed modifications described herein are acceptable both with respect to the improvements in the fire protection program that they provide and with respect to continued safe operation of the facility, while the remaining items are completed.

In the report of the Special Review Group on the Browns Ferry Fire (NUREG-0050) dated February 1976, consideration of the safety of operation of all operating nuclear power plants pending the completion of our detailed fire protection evaluation was presented. The following quotations from the report summarize the basis for the Special Review Group's conclusion that the operation of the facility need not be restricted for public safety:

> "A probability assessment of public safety or risk in quantitative terms is given in the Reactor Safety Study (WASH-1400). As the result of the calculation based on the Browns Ferry fire, the study concludes that the potential for a significant release of radioactivity from such a fire is about 20% of that calculated from all other causes analyzed. This indicates that predicted potential accident risks from all causes were not greatly affected by consideration of the Browns Ferry fire. This is one of the reasons that urgent action in regard to reducing risks due to potential fires is not required. The study (WASH-1400) also points out that 'rather straight forward measures, such as may already exist at other nuclear plants, can significantly reduce the likelihood of a potential core melt accident that might result from a large fire'."
>
> "Fires occur rather frequently; however, fires involving equipment unavailability comparable to the Browns Ferry fire are quite infrequent (see Section 3.3 of [NUREG-0050]). The Review Group believes that

steps already taken since March 1975 (see Section 3.3.2) have reduced this frequency significantly."

"Based on its review of the events transpiring before, during and after the Browns Ferry fire, the Review Group concludes that the probability of disruptive fires of the magnitude of the Browns Ferry event is small, and that there is no need to restrict operation of nuclear power plants for public safety. However, it is clear that much can and should be done to reduce even further the likelihood of disabling fires and to improve assurance of rapid extinguishment of fires that occur. Consideration should be given also to features that would increase further the ability of nuclear facilities to withstand large fires without loss of important functions should such fires occur."

We recognize that the "Risk Assessment Review Group Report to the U. S. Nuclear Regulatory Commission" NUREG/CR-0400 (The Lewis Committee Report), states that this Review Group is unconvinced of the correctness of the WASH-1400 conclusion that fires contribute negligibly to the overall risk of nuclear plant operation.

However, it is our conclusion that the operation of the facility, pending resolution of the incomplete items and the implementation of all facility modifications, does not present an undue risk to the health and safety of the public based on our concurrence with the Browns Ferry Special Review Group's conclusions identified above, as well as the significant improvements in fire protection already made at the facility since the Browns Ferry Fire. These include establishment of administrative controls over combustible materials and use of ignition sources, training and staffing of a fire brigade, and issuance of technical specifications to provide limiting conditions for operation and surveillance requirements for fire protection systems.

We have determined that the license amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and pursuant to 10 CFR Section 51.5(d)(4) that an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

APPENDIX A

CHRONOLOGY

In February 1976, the report by the NRC Special Review Group was issued as NUREG-0050, "Recommendations Related to the Browns Ferry Fire."

On May 1, 1976, Standard Review Plan 9.5.1, "Fire Protection," was issued, incorporating the various recommendations contained in NUREG-0050.

By letter dated May 11, 1976, Boston Edison Company was requested to compare the existing fire protection provisions at their facilities with new NRC guidelines as set forth in Standard Review Plan 9.5.1, "Fire Protection," dated May 1, 1976, and to describe (1) the implementation of the guidelines met, (2) the modifications or changes underway to meet the guidelines that will be met in the near future, and (3) the guidelines that will not be met and the basis therefor.

By letter of June ', 1976, Boston Edison Company indicated that their review of the existing fire protection provisions at the Pilgrim Station, Unit 1, against Standard Review Plan 9.5.1 will not be complete until July 2, 1976.

On September 2, 1976, Boston Edison Company committed to complete their evaluation of the Pilgrim facility against Branch Technical Position 9.5-1 by February 1, 1977, and submit the results for our review.

By letter of September 30, 1976, Boston Edison Company was requested to provide the results of a fire hazard analysis and propose technical specifications pertaining to fire protection. Boston Edison Company was also provided a copy of Appendix A which includes acceptable alternatives to the guidelines of Standard Review Plan 9.5.1.

By letter of December 1, 1976, we provided model technical specifications and requested submittal of fire protection technical specifications.

On January 11, 1977, Boston Edison Company requested a change in their planned fire hazard analysis submittal date from February 1 to March 1 of 1977.

On February 4, 1977, Boston Edison Company submitted the proposed technical specifications pertaining to fire protection for the Pilgrim station.

On March 9, 1977, Boston Edison Company provided a submittal responding to our requests of May 11 and September 30, 1976. The submittal, however, did not include the fire hazard analysis of plant areas.

On May 23-27, 1977, the Division of Operating Reactors fire protection review team visited the Pilgrim Station, Unit 1, facility. On May 27, 1977, a meeting was held at the Pilgrim facility at which the review team presented positions and requests for additional information; in particular, evaluation of fire hazards in various plant areas.

In their letter of June 7, 1977, Boston Edison Company indicated that, of the 24 plant areas analyzed for fire hazards to the electrical cable raceways, there were nine areas which require a detailed site survey due to the complexity of the raceway arrangement. Such survey was projected for completion by September 1, 1977.

By letter of June 24, 1977, we provided revised model technical specifications and requested submittal of fire protection technical specifications within 20 days of their receipt of this request.

On July 27 and 28, 1977, a meeting was held in Bethesda, Maryland, to discuss the staff's concern and requests for additional information.

On August 23, 1977, Boston Edison Company provided proposed interim technical specifications in response to our June 24, 1977 request.

On November 25, 1977, we provided revised interim technical specifications and requested a response within 20 days.

On December 15, 1977, Boston Edison Company provided comments on NRC Revised Interim Technical Specifications on Fire Protection.

On December 16, 1977, Boston Edison Company was provided a list of staff positions and requests for additional information and requested response by January 15, 1978.

On January 17, 1978, Boston Edison Company provided a preliminary response to our request of December 16, 1977.

On February 6, 1978, we requested Boston Edison Company to review their fire protection program for conformance with guidelines provided on August 12, 1977.

On February 27, 1978, Boston Edison Company provided a revised response to our request of December 16, 1977 and a summary describing the methodology of their fire hazard analysis.

On March 3, 1978, Amendment No. 29 to Facility Operating License No. DPR-35 was issued incorporating changes into the technical specifications to provide limiting conditions for operation and survellance requirements for existing fire protection equipment and administrative controls for fire protection.

On March 6, 1978, Boston Edison Company provided a response to our request of February 6, 1978.

On April 5-7, 1978, the Division of Operating Reactors fire protection review team revisited the Pilgrim Station, Unit 1, facility. On April 7, 1978, a meeting was held at the Pilgrim facility at which the team presented additional positions and its disagreements with the licensee's methodology of the analysis.

On April 13, 1978, a meeting was held in Bethesda, Maryland, to resolve those disagreements identified in the meeting of April 7, 1978. Boston Edison Company agreed to revise the method of their analysis and provide additional studies to justify certain criteria of the analysis.

On May 4, 1978, Boston Edison Company submitted a letter clarifying the intent of their previous March 6, 1978 submittal.

On May 16, 1978, a meeting was held in Bethesda, Maryland, at which Boston Edison Company presented the preliminary results of their studies for the revised method of the fire hazard analysis.

On May 26, 1978, we provided a document entitled, "Manpower Requirements for Operating Reactors," as guidance for staffing fire brigades at nuclear power plants.

On July 10, 1978, Boston Edison Company submitted supplemental information pertaining to fire protection at Pilgrim Nuclear Power Station.

On July 18, 1978, Brookhaven National Laboratory submitted Pilgrim Safety Evaluation Report review (Consultants' Report).

On September 22, 1978, Boston Edison Company submitted information to clarify verbal commitments made during the Fire Protection review.

APPENDIX B

DISCUSSION OF CONSULTANTS' REPORT

Under contract to the Nuclear Regulatory Commission, Brookhaven National Laboratory has provided the services of fire protection consultants who participated in the evaluation of the licensee's fire protection program and the preparation of the Safety Evaluation Report (SER). Their report, "Fire Protection in Operating Nuclear Power Stations - Pilgrim Safety Evaluation Report Review," discusses a recommendation which we have not adopted. The consultants' recommendation which we have not adopted, along with our basis therefor, is identified herein.

Consultants' Comment: Fire Water System Control Valve Supervision

"It is recommended that electrical supervision be required on all valves associated with the flow of water in fire protection systems protecting areas containing or exposing safety-related equipment."

Staff Response:

The NRC guidelines on valve supervision are given in Appendix "A" to Branch Technical Position (BTP) 9.5-1 of the Standard Review Plan. These guidelines permit, as an alternative to electrical supervision, an administrative program to assure that valves are maintained in the proper position. Such a program includes locking valves with strict key control or sealing valves wth tamper proof seals Periodic inspections are to be performed to verify that the method of securing the valve is intact.

These measures are consistent with the requirements imposed for supervising valves in safety-related systems, and provide adequate assurance that valves are maintained in the appropriate position. The licensee's program for valve supervision is consistent with NRC guidelines. In addition, the plant technical specifications require a monthly check of all valves in the flow path to fire suppression systems, to ensure that each valve is in the correct position.