SAFETY EVALUATION REPORT

BY THE

OFFICE OF NUCLEAR REACTOR REGULATION

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POWER AUTHORITY OF THE STATE OF NEW YORK

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

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1.0 INTRODUCTION

Following a fire at the Browns 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 Requirements 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 was based on the fire protection review team's site visit of August 14-18, 1978 and the licensee's proposed program for fire protection as described in the following docketed information:

(1) The James A. FitzPatrick Safety Analysis Report

(2) "The Fire Hazard Analysis," dated January 11, 1977 and April 29, 1977.

(3) Licensee responses to requests for additional information and Staff position, by letters dated August 3, 1978, October 23, 1978, October 27, 1978, December 21, 1978, January 4, 1979, February 8, 1979, March 7, 1979 and May 7, 1979.

(4) Licensee response to NRC's document "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance," by letter dated March 31, 1978.

Our review has been limited to the aspects of fire protection related to the protection of the public from the standpoint of radiological health and safety. We have not considered the 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 the James A. FitzPatrick Nuclear Power Plant. 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 fighting 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, REQUIREMENTS, AND INCOMPLETE ITEMS

3.1 Modifications

The licensee plans to make certain plant modifications to improve the fire protection program as a result of both his and the staff's evaluations. Such proposed modifications are summarized below. The sections of this report which discuss the modifications are noted in parentheses following each item. Further detail is contained in the licensee submittals. All modifications will be completed in accordance with the scheduled dates given in Table 3.1. Certain items listed below are marked with an asterisk to indicate that the NRC staff will require additional information in the form of design details to assure that the design is acceptable prior to actual implementation of these modifications. All other modifications delineated in Table 3.1 have been described in an acceptable level of detail.

3.1.1 Interior Hose Stations (4.3.1.4)

Additional hose stations will be provided to assure that all points in safety-related areas and other plant areas which contain major fire hazards can be effectively reached by at least one hose stream. Such hose stations will be located to limit the lengths of hose required to not greater than 100 feet.

Electrically safe fire hose nozzles will be provided for areas containing electrical hazards.

Drip valves will be installed on all interior hose standpipes downstream of the hose outlet valves.

Administrative controls will be established to prevent access to manual fire fighting equipment from being restricted by temporary storage of materials within the plant.

Three hundred psi test, single jacket, lined hose will replace unlined linen hose on those hose stations which are provided for the protection of safety-related structures and systems.

3.1.2 Valve Supervision (4.3.1.3)

Valves in the fire water system will be either locked in the correct position or electrically supervised. Further, the correct positioning of all valves in the system will be verified on a monthly basis.

TABLE 3.1

IMPLEMENTATION DATES FOR
LICENSEE PROPOSED MODIFICATIONS
AND STAFF REQUIREMENTS

	ITEM	DATE
3.1.1	Interior Hose Stations	October 1980
3.1.2	Valve Supervision	Implemented
3.1.3	Manual Fire Fighting Equipment	Implemented
3.1.4	Self-Contained Breathing Apparatus	December 1979
3.1.5	Administrative Controls	January 1980
3.1.6	Emergency Lighting	January 1980
3.1.7	Fire Doors	October 1979
3.1.8	Ventilation System-Safety Related Pump Rooms*	Spring 1980
3.1.9	Alternate Shutdown Capability-Relay Room*	October 1980
3.1.10	Exterior Hydrant Hose Houses	October 1979
3.1.11	Post-Indicator Valve Wrenches	Implemented
3.1.12	Post-Indicator Valve Labeling	Implemented
3.1.13	Fire Brigade Leader Training	Implemented
3.1.14	Control of Combustibles	December 1979
3.1.15	Alternate Shutdown Capability-Cable Spreading Room*	October 1980
3.1.16	Fire Alarm Annunciation in the Control Room	Implemented
3.1.17	Total Flooding CO_2 Suppression System-Ventilation Systems Interlocks*	Spring 1980
3.1.18	Fire Detection and Signaling Systems*	October 1980
3.1.19	Exposed Structural Steel*	October 1980
3.1.20	Electrical Cable Penetration Qualification*	October 1980
3.1.21	Ventilation Duct Penetrations	July 1980

*Note The design details for these modifications will be subject to further staff review prior to implementation.

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3.1.3 Manual Fire Fighting Equipment (3.4.1.6) (4.4.1) (4.6)

The equipment listed below will be added to the existing inventory of manual fire fighting equipment.

(1) Three fire fighting type explosion proof, smoke ejectors, each rated for 9500 CFM or equivalent.

(2) Protective clothing (coat, boots, gloves, fire fighter type helmet) for a minimum of 10 men.

(3) One additional foam pickup tube and applicator nozzle for 2-1/2-inch hose with an adapter for 1-1/2-inch hose.

(4) One hand light at each exterior hose house.

(5) One heat sensor.

(6) Dedicated ladder(s) in areas where cable trays are high and difficult to reach.

3.1.4 Self-Contained Breathing Apparatus (4.4.3)

Eighteen additional air bottles and a breathing air recharging compressor will be provided to supply the fire brigade and operating personnel for 6 hours.

3.1.5 Administrative Controls (6.0)

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 revised and implemented.

3.1.6 Emergency Lighting (4.6) (5.6) (5.7) (5.14)

Modifications will be made to the emergency lighting system serving the access and egress routes to the cable spreading room entrance, relay room entrance, east cable tunnel entrance and escape hatch, and the west cable tunnel entrance.

3.1.7 Fire Doors (4.9.1) (5.8) (5.9)

The fire door between the east and west electric bays will be replaced with a 3-hour rated door. Two stairway doors on elevations 286' and 300' will be replaced with 1-1/2-hour rated doors. The control room door on elevation 300' will be replaced with a 3-hour rated door.

3.1.8 Ventilation Systems - Safety-Related Pump Rooms SP-1 & SP-2* (5.4)

Physically separated supply ventilation systems with automatically actuated 3-hour rated dampers will be installed in safety-related pump rooms SP-1 and SP-2.

3.1.9 Alternate Shutdown Capability - Relay Room* (5.7)

An alternate shutdown capability will be provided, independent of cabling and equipment in the relay room.

3.1.10 Exterior Hydrant Hose Houses (4.3.1) (5.15)

Exterior hose houses will be mounted on concrete pedestals with doors adjusted to provide sufficient ground clearance.

Damaged doors on exterior hose houses will be repaired or replaced.

Administrative control procedures will be established to provide a semi-annual inspection of exterior hydrants.

Administrative control procedures will be established to provide a monthly inspection of the equipment stored in the exterior hose houses.

3.1.11 Post-Indicator Valve Wrenches (4.3.1)

Properly stored valve operating wrenches will be provided for the post-indicator valves in the yard loop.

3.1.12 Post-Indicator Valve Labeling (4.3.1)

Each post-indicator valve in the yard loop will be provided with labeling, clearly identifying systems or areas it protects.

3.1.13 Fire Brigade Leader Training (6.0)

The fire brigade leader and assistant brigade leader will receive special training which includes (1) critical factor analysis, (2) fire action plan, (3) tactics for fire control, (4) command decisions and (5) coordination.

3.1.14 Control of Combustibles (5.8) (5.15) (5.16)

Administrative control procedures will be established and exterior areas posted tc prohibit the storage of flammable and combustible materials in the yard areas adjacent to safety-related structures.

A rated fire barrier will be installed between the kitchen and the remainder of the control room.

Wood cabinets in the kitchen area will be replaced with cabinets of noncombustible construction.

Wood bookcases will be removed from the control room. A noncombustible file cabinet will be provided for papers, logs, operating manuals and other combustibles in the control room complex.

The turbine oil system valves and other piping system valves that could allow drainage of combustible fluids if improperly positioned will be locked in the proper position, and checked monthly.

3.1.15 Alternate Shutdown Capability -Cable Spreading Room*(5.6)

An alternate shutdown capability will be provided, independent of the cabling and equipment in the cable spreading room.

3.1.16 Fire Alarm Annunciation in the Control Room (4.2)

The fire alarm bell in the control room has been repaired such that the bell is audible from any point within the control room.

3.1.17 Total Flooding CO_2 Suppression Systems-Ventilation Systems Interlocks* (4.3.2) (5.5.6) (5.6.6) (5.6.7) (5.13.6)

Modifications will be made to the ventilation systems serving the emergency diesel generator switchgear rooms, cable spreading room, cable tunnels, and relay room to interlock these systems with the CO^2 gas suppression systems serving these areas.

3.1.18 Fire Detection and Signaling Systems* (5.2)(5.3)(5.4)(5.8)(5.11)(5.12)

Fire detection and signaling system will be installed in the following areas:

(1) Crescent areas
(2) Reactor Building elevations 312', 330', 326', 344' and 369'
(3) Battery charging rooms
(4) Battery room corridor
(5) Safety-related pump rooms SP-1 and SP-2
(6) Control Room HVAC air intake
(7) Safety related control room cabinets.

3.1.19 Exposed Structural Steel* (4.11)

Exposed structural steel will be protected against fire damage where failure of such steel could jeopardize safe shutdown.

3.1.20 Electrical Cable Penetrations Qualification* (4.3.9)

Electrical cable penetrations through fire barriers will be upgraded to provide a 3 hour fire resistant rating.

3.1.21 Ventilation Duct Penetrations (4.9.2)(5.6)(5.7)(5.8)

Rated, UL-listed, fusible link operated fire dampers will be installed in the ventilation ducts penetrating the fire barriers enclosing the control room, cable spreading room, relay room, and standby gas treatment room.

3.2 Incomplete Items

In addition to the licensee's proposed modifications which pend further staff review as footnoted in Section 3.1, several incomplete items remain for which the licensee has not provided final response to staff requests. The licensee will complete the evaluations necessary to resolve these items in accordance with the schedule contained in Table 3.2. This schedule has been established such that should these evaluations identify the need for additional modifications, they can be implemented on a schedule consistent with completion of the modifications identified in Section 3.1. We will address the resolution of these incomplete items in a supplement to this report.

3.2.1 Fire Hazard Analysis (4.1) (4.10)

An analysis will be performed for each fire area containing safety-related cable raceways (trays/conduit) or components, to verify the effectiveness of the spacial separation, tray covers, and/or fire stops in preventing simultaneous damage to redundant safety systems from a possible exposu fire involving the fixed combustibles in the area and a reasonable amount of transient combustible materials, which may be in the area for routine plant operations and maintenance. In addition to the damage resulting from elevated temperatures in the immediate vicinity of the fire, the analysis will consider the effects of:

(1) Smoke and heat propagation via open stairways, hatches, and unrated penetrations in barriers;

(2) Smoke and heat propagation via HVAC ducts not equipped with automatic closing fire dampers; and

TABLE 3.2

COMPLETION DATES FOR INCOMPLETE ITEMS

ITEM		DATE
3.2.1	Fire Hazard Analysis	November 1979
3.2.2	Pipe Penetrations	February 1980
3.2.3	Fire Water Piping System	November 1979
3.2.4	Diesel Fire Pump Room Sprinkler Head Spacing	August 1979
3.2.5	Fire Door Supervision	November 1979
3.2.6	Signaling Circuits Supervision	August 1979
3.2.7	Fire Pump Performance	August 1979
3.2.8	Fire Pump Capacity	August 1979
3.2.9	Testing of CO_2 Fire Suppression Systems	January 1980
3.2.10	Crescent Area Fire Protection	August 1979
3.2.11	Cable Flame Tests	August 1979

(3) Water spray damage from fire hose streams.

Where the analysis indicates that the present design is inadequate, corrective modifications will be proposed.

3.2.2 Pipe Penetrations (4.9.4)

A study will be performed to determine the location of critical unsealed pipe penetrations and the practical methods available to seal such penetrations.

3.2.3 Fire Water Piping System (4.3.1.)

An engineering study will be performed to determine the modifications required to preclude a single failure in the piping system from causing the loss of all fire suppression water to any safety-related fire zone.

3.2.4 Diesel Fire Pump Room Sprinkler Head Spacing (4.3.1) (5.4)

An engineering study will be performed to verify that the diesel fire pump room sprinkler head arrangement provides adequate coverage that protects the entire room.

3.2.5 Fire Door Supervision (4.9.1)

An engineering study will be performed to determine the modifications required to close and lock or electrically supervise the position of all fire doors in barriers that separate safety-related areas from each other and from nonsafety-related areas or areas containing large amounts of combustibles.

3.2.6 Signaling Circuits Supervision (4.2)

An engineering study will be performed to determine the modifications required to supervise the fire protection systems signal initiating and alarm signal sounding circuits in accordance with Article 240, NFPA 72 D.

3.2.7 Fire Pump Performance (4.3.1.2)

A test program will be conducted to verify that the fire pumps meet the performance requirements outlined in NFPA 20.

3.2.8 Fire Pump Capacity (4.3.1.2)

An engineering study will be performed to verify that a single fire pump is capable of meeting the combined demand (flow and pressure) for the operation of any fixed water fire suppression system plus 1000 gpm for hose streams.

3.2.9 Testing of Carbon Dioxide Fire Suppression Systems (4.3.2) (5.5.6) (5.6.6) (5.7.6) (5.9.6) (5.13.6)

Discharge tests of the carbon dioxide fire suppression systems installed in the safety-related areas of the plant will be performed to demonstrate that a satisfactory concentration of carbon dioxide can be achieved and maintained for the design period in all parts of the protected areas if additional documentation (to be furnished by the licensee) cannot support or establish that the systems provide adequate protection.

3.2.10 Crescent Area Fire Protection (5.2)

Engineering studies will be performed to determine: (1) the modifications required to provide a three hour rated barrier between the crescent area halves, and (2) the feasibility and desirability of converting the suppression system protecting the HPCI and RCIC turbines to automatically actuated systems.

3.2.11 Cable Flame Tests

Flame test results will be provided for the type cable(s) used in the plant's cable spreading room and relay room. In addition, the licensee will provide an evaluation justifying the acceptability of not applying a flame retardant coating to the exposed cables in these areas.

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 bring the core to cold shutdown 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 trip the reactor, automatically inserting the control rods, on receipt of signals indicating abnormal operating conditions or the reactor can be tripped manually by the operator in the control room. On receiving a trip signal the two pilot valve solenoids de-energize, venting air pressure from both scram valves and directing pressurized water in the accumulators to act on the control rod drive pistons to insert the control rods into the core.

The reactor trip system is of fail-safe design. Control rod drive water in the accumulators, which provides motive power for the rod insertion, is pressurized by nitrogen gas and needs no additional electric or pneumatic power for emergency operation.

In the event that one or more control rods fail to insert, the standby liquid control system provides backup means of reactivity control. The system is manually initiated from the control room to pump a boron (neutron absorber) solution into the reactor. The system is designed to slowly bring the reactor from rated power to cold shutdown, with the control rods remaining withdrawn in the rated power pattern, at anytime in the core life.

(2) Reactor Coolant Inventory Control and Decay Heat Removal

Following a reactor trip, steam from the reactor is bypassed to the condenser to dissipate the decay heat generated by the core. Reactor coolant inventory is maintained by the feedwater system. If the condenser and feedwater system were to be unavailable, cooldown of the reactor could be accomplished by discharging the steam generated by decay heat into the pressure suppression pool via the reactor pressure

relief valves. The decay heat transferred to the pressure suppression pool is then dissipated into Lake Ontario through the residual heat removal system, the reactor building closed loop cooling water system and the service water system. Coolant makeup to the reactor under high pressure could be provided by the high pressure coolant injection system.

In the event that the high pressure coolant injection system was not available, the reactor could be depressurized by the automatic depressurization system. The depressurization provided by the system enables the low pressure coolant injection and core spray systems to deliver cooling water to the reactor vessel.

When the reactor pressure is reduced to about 100 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 a 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 would be used during the shutdown and cooldown of the plant:

- Neutron monitoring system
- Reactor vessel instrumentation
- Suppression pool level and temperature indication

(4) Power

There are six 4160-volt buses which provide power to the plant AC auxiliaries. These buses are normally supplied by unit generated or offsite power. Of the six, two emergency service buses, which supply power to safety-related loads required during abnormal transients or accidents, can also be supplied from the onsite standby AC power source which consists of two independent and redundant diesel generator groups, each one supplying an emergency bus.

In addition to large motor loads, the 4160-volt buses supply power to the 600-volt unit substations for smaller loads. There are four normal service substations connected to two of the 4160-volt buses and four emergency service unit substations, two each connected to

the emergency service buses. Motors with ratings of 100 to 300 Hp are fed directly from the unit substations. Power for motors in the range of 1/2 to 100 Hp and other small power requirements are fed from motor control centers supplied from the normal and emergency unit substations.

Physical separation is provided between similar components of redundant electrical systems and between power and control circuitry serving or being served from these components.

The arrangement of cables and raceways is designed to preserve the independence of redundant systems required for plant shutdown. Where cable tunnels are provided, redundant protective power and control cables are routed in conduit or run in separate tunnels. Where tunnels are not provided, the redundant cables are run in separate cable trays or conduits which are physically separated. One set of cable trays, or metallic conduit, is used solely for power cables; a second set is used solely for medium level voltage (120-volt AC and 125-volt AC) cables; a third set is used solely for low voltage cables. Where cable trays are used, the three sets are physically separated from each other.

A DC power system is provided to supply 125-volt DC power to all DC loads for normal operation and for safe shutdown. Each of the two independent 125-volt DC power sources has adequate capacity to supply all DC loads required for safe shutdown. Power is normally supplied to the 125-volt DC power system from the emergency AC buses of the plant service AC power distribution system through battery chargers. Loss of AC power to a battery charger or low voltage from a battery charger causes its associated battery to supply power to the DC loads.

The majority of the safety-related components required for safe shutdown of the reactor are separated to prevent damage to redundant equipment due to a fire. However, there are areas of the plant where the physical separation for major components, essential supporting equipment or electrical cables may not be sufficient to provide assurance that redundant systems would not be damaged by a fire. Although modifications have been proposed to improve the fire protection in these areas, sufficient supporting information has not been provided for the staff to conclude that the safety-related systems will be adequately protected from fires.

The licensee will conduct additional analysis to demonstrate that the capability to safely shut down exists taking into consideration the consequences of postulated fires in each area of the plant. For

areas where it cannot be demonstrated that the capability to safely shut down exists as a consequence of postulated fires, corrective modifications will be proposed. We will address the acceptability of the licensee's analysis and proposed modifications in a supplement to this report.

4.2 Fire Detection and Signaling Systems

The plant has a protective signaling system which transmits various fire alarm and supervisory signals to the control room. In addition to signals from heat or smoke detectors located in selected areas in the plant, the system also transmits alarm and supervisory signals concerning fire pump operation or impairment, carbon dioxide system actuation or trouble, operation of the air foam system or selected water spray, deluge, or automatic sprinkler systems, and closing of selected valves in the fire protection water system.

The signaling system is provided with backup power in the event of a loss of offsite power by a connection to the emergency power supply system.

The signaling system does not comply with NFPA 72D in that circuits between many heat detectors or supervisory devices and the fire alarm annunciator panels in the control room are not supervised. An engineering study will be performed to determine the modifications required to supervise the fire protection systems; i.e., a signal initiating an alarm sounding circuit in accordance with Article 240, NFPA 72D.

Smoke or heat detectors have been provided in selected areas of the plant. To ensure that proper consideration has been given to such factors as ceiling height and configuration, ventilation air flow rate and pattern, location and arrangement of plant equipment and combustibles, etc., in determining the type, number and location of fire detectors, the licensee will perform a study to verify the adequcy of the existing and proposed detector system design. Additional modification will be implemented as necessary following the completion of the study.

Alarm, supervisory, and trouble signals are annunciated in the control room both visually and audibly. Alarm, supervisory, and trouble signals are annunciated by a common alarm bell which is distinctive from other plant system alarms. This bell was tested during the site visit and was found to be nearly inaudible. This bell has been repaired so that it can be heard clearly from any part of the control room under the noisiest conditions likely to be found there.

We will address the acceptability of the fire detection and signaling systems in a supplement to this report.

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4.3 Fire Control Systems

4.3.1 Water Systems

4.3.1.1 Water Supply

The fire protection water supply for the plant is provided by Lake Ontario, which also serves as the ultimate heat sink.

We find that the water supply conforms to the provisions of Appendix A of BTP 9.5-1 and is, therefore, acceptable.

4.3.1.2 Fire Pumps

The water supply is developed by two vertical shafts centrifugal fire pumps, each with a rated output of 2500 gpm at 125 psig. The pumps, which take suction from a common sump (but through separate suction lines), are located in adjacent rooms in the screenwell house. These rooms are separated from each other by 3-hour rated barriers with 3-hour rated doors. The diesel driven pump and its fuel tank and controller are located by themselves in a sprinklered room. The electric motor driven pump is in a separate room with several safety-related pumps.

A recent fire pump test report indicates that the diesel driven fire pump did not meet the performance requirements outlined in NFPA 20. In addition, neither pump test report included data points from shut-off to 150% of rated capacity, without which a complete evaluation is not possible. The licensee will provide the results of a test program that will be performed to verify that the fire pumps meet the performance requirements outlined in NFPA 20. If the pumps cannot meet these requirements repairs or modifications will be proposed.

A UL listed automatic fire pump controller is located in the same area with each fire pump. Each pump can be manually started from the control room or at the individual controller, but can be manually stopped only at the controller. Pump running, driver nonavailability, and pump driver trouble signals are annunciated in the control room. Additional annunciation is provided at each fire pump controller.

The electric motor driven pump will start automatically if the pressure in the loop yard main falls below 95 psig. The diesel engine driven pump will start automatically if the pressure falls below 85 psig.

Power for the electric motor driven fire pump is supplied from the normal AC system. Sufficient fuel to operate the diesel engine driven fire pump for 8 hours is stored in a fuel tank next to the engine.

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A 30 gpm automatic electric driven centrifugal jockey pump located in the same room as the electric motor driven fire pump takes suction from the intake sump to maintain about 150 psig in the fire water system yard loop. A hydropneumatic tank formerly employed in the system is now kept completely filled with water.

The fire pumps discharge into the yard main through 12-inch diameter underground lines separated from each other by about 11 feet. Depth of cover is about 6 feet and the nearest road is about 20 feet away. A 12-inch line inside the screenwell house also connects the pump discharge lines to one another and to a 12-inch line which serves the majority of systems in the plant. Appropriate valves are installed to isolate either pump discharge line.

The licensee will provide an analysis which will verify that a single fire pump is capable of meeting the combined demand (flow and pressure) for any automatic water fire suppression system plus 1000 gpm for hose streams, taking into account the pressure drop between pump discharge and the suppression system.

We will address the acceptability of the fire water pumps in a supplement to this report.

4.3.1.3 Fire Water Piping System

A separate 12-inch discharge line from each pump supplies the 12-inch underground loop main which encircles the plant. All yard fire hydrants, automatic and manual water suppression systems, and interior hose stations are supplied by this loop main. Post-indicator valves subdivide the loop into a number of sections so that a single section could be isolated without impairing the entire system. However, there are locations where the isolation of a single section could impair the availability of both automatic sprinklers and the backup hose stations in areas containing or exposing safety-related equipment. An engineering study will be performed to determine the modifications required to preclude a single failure in the piping system from causing the loss of all fire suppression water to any safety-related area.

Electrical supervision is provided for valves controlling water flow into sprinkler or deluge systems, as noted in Section 4.2. Post-indicator valves on the underground loop main, fire pump discharge valves, sectionalizing valves inside the plant, and valves controlling the flow of water to standpipes will be locked in their correct positions and checked on a monthly basis.

Yard fire hydrants have been provided at intervals of 200 to 300 feet around the exterior of the plant. The lateral to each hydrant is controlled by a key-operated (curb) valve. Each fire hydrant is provided with a hose house containing 200 feet of 2-1/2-inch hose, 100 feet of 1-1/2-inch hose, hydrant wrenches, hose nozzles, and other equipment. Administrative controls will be established to ensure the availability and reliability of the hydrants and equipment in the hydrant hose houses.

Threads on hydrant outlets and hose connections throughout the plant are compatible with those of fire departments which serve the plant.

We will address the acceptability of the fire water piping system in a supplement to this report.

4.3.1.4 Interior Hose Stations

Interior hose stations equipped with 50 or 75 feet of 1-1/2-inch diameter woven jacket lined fire hose are provided in all areas of the plant except primary containment, residual heat removal heat exchanger room B, several areas in the administration building, the diesel generator rooms, most of the turbine building elevation 252' and parts of other elevations, the east and west cable tunnels, and a portion of the west electrical bay.

Additional hose on reels is provided at some hose stations.

To extend the manual fire suppression capabilities, new hose stations will be installed within the plant to assure that all points in safety-related areas and other plant areas which contain major fire hazards can be effectively reached by at least one hose stream.

Electrically safe nozzles will be provided for interior hose stations located to protect areas containing electrical equipment.

Drip valves will be installed on all interior hose standpipes to protect the stored fire hose against accelerated deterioration resulting from water leakage through the hose outlet valves.

Unlined linen hose at hose stations which protect safety-related areas of the plant will be replaced with 300 psi test, single jacket, lined hose.

Administrative controls will be established to prevent access to manual hose stations from being restricted.

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

4.3.1.5 Fixed Water Suppression Systems

Wet-pipe automatic sprinkler systems have been provided in most of the turbine building and in the auxiliary boiler room, radwaste boiler room, diesel fire pump room, and in portions of the administration building. Automatic water spray systems have been provided to protect the oil filled transformers located outside of the turbine building, and to protect the east and west cable tunnels. Preaction sprinkler systems are provided in the recirculation pumps motor generator set room, and in the emergency diesel generator rooms. Manual water spray systems are installed to protect the HPCI pump, the RCIC pump, the standby gas treatment systems, reactor feed-pump turbine areas, hydrogen seal oil unit, and turbine generator bearing boxes and oil piping.

The main control valve for each sprinkler or water spray system is electrically supervised. Valve closure is alarmed and annunciated in the control room. Water flow in these systems is also alarmed and annunciated in the control room.

During the site visit, it was observed that the sprinklers in the diesel fire pump room did not appear to provide coverage for the entire room. The licensee will perform an engineering study to verify that the diesel fire pump room sprinkler head arrangement provides adequate coverage that protects the entire room.

The licensee has provided the design discharge density and total demand (flow and pressure) requirements for each water suppression system in the plant. This information will be evaluated by the staff with the review of the plant's fire water piping system (4.3.1) and the fire pump capacity (4.3.1.2).

We will address the acceptability of the water suppression systems in a supplement to this report.

4.3.1.6 Foam

The main condenser liquid collection pit is protected by an automatic low expansion air foam system designed and installed in accordance with NFPA 11. A foam pickup tube and applicator nozzle for 2-1/2-inch hose are provided for manual fire-fighting in the collection pit area. One additional foam pickup tube and applicator nozzle for 2-1/2-inch hose with an adapter for 1-1/2-inch hose will be purchased and stored with the foam cart.

We find that, subject to the implementation to the above described modification, the foam suppression system satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.3.2 Gas Fire Suppression Systems

Total flooding carbon dioxide suppression systems are provided for the cable spreading room, relay room, each of the two cable run tunnels to the reactor building, each of the two electrical bay switchgear rooms, and each of the two emergency diesel generator switchgear rooms. Rate anticipation type heat detectors in each of these areas alarm in the control room in case of fire. Except for the manually actuated system in the relay room, the heat detectors automatically actuate the carbon dioxide systems in these areas, following a predischarge alarm.

The carbon dioxide suppression systems are electrically powered by a 125-volt DC battery system, backed up by a charging system fed from the plants 4160-volt AC emergency buses.

Low level and high and low pressure conditions in either of the CO_2 storage tanks are alarmed and annunciated in the control room. Loss of power to the heat detectors in any area protected by a carbon dioxide system is also annunciated in the control room.

The amount of carbon dioxide discharged into a particular area is controlled by a timer. A 3-ton low pressure storage tank supplies the systems in the emergency diesel generator switchgear rooms and nearby CO_2 hose reel stations in the turbine building. A 10-ton low pressure storage tank supplies the remaining systems and several more CO_2 hose reel stations in the turbine building. The 10-ton tank also provides carbon dioxide to purge the main generator hydrogen system. The tank is equipped with a float valve to prevent the level of carbon dioxide from being reduced below the minimum required for two discharges of carbon dioxide into the largest area protected by this supply.

Interlocks are provided which will close dampers in the supply and exhaust ducts to the electric bays, and close dampers on the supply ducts and close the fire doors at the emergency diesel generator switchgear rooms upon actuation of the carbon dioxide system protection for the particular area.

Room ventilation exhaust fans are installed in the exterior walls of the emergency diesel generator rooms, and draw air from the associated emergency diesel generator switchgear rooms through transfer grills. These fans are not interlocked to the CO_2 suppression systems protecting the emergency diesel generator switchgear rooms. If a fan is operating when the suppression system is actuated, it will exhaust from the switchgear room reducing the concentration of CO_2, consequently lessening its effectiveness.

Modifications will be made to the emergency diesel generator room ventilation systems to preclude an inadvertent loss or dilution of the carbon dioxide.

CO_2 purge (exhaust) systems are installed in the cable spreading room and the two cable run tunnels. The exhaust fans in these systems are not interlocked to the CO_2 suppression systems protecting these areas. If a purge system fan is operating inadvertently when the suppression system is actuated, it will exhaust from the area reducing the concentration of CO_2, consequently lessening its effectiveness.

Modifications will be made to the cable room and cable run tunnel CO_2 purge system to preclude an inadvertent loss or dilution of the carbon dioxide.

The CO_2 suppression system protecting the relay room is a manually actuated system. The system can be actuated from push button stations at the fire protection panel (main control room) or near the protected area. The ventilation system serving the relay room is not interlocked to the CO_2 suppression system protecting the area. To prevent dilution of the suppression agent (CO_2 gas), the ventilation system must be manually secured from the control room before the CO_2 system is actuated. Securing the relay room ventilation cannot be accomplished from the remote CO_2 actuation stations.

Modifications will be made to the relay room ventilation systems to preclude an inadvertent loss or dilution of the carbon dioxide.

The licensee has not provided sufficient design information and/or the results of tests which demonstrate that an adequate concentration of carbon dioxide extinguishant can be achieved and maintained for the design period. Discharge tests of the carbon dioxide fire suppression systems installed in the safety-related areas of the plant will be performed to demonstrate that a satisfactory concentration of carbon dioxide can be achieved and maintained for the design period in all parts of the protected areas if additional documentation (to be furnished by the licensee) cannot support or establish that the system provides adequate protection.

We will address the acceptability of the CO^2 fire suppression systems in a supplement to this report.

4.3.3 Portable Fire Extinguishers

Portable fire extinguishers have been distributed throughout the plant in accordance with the provisions of NFPA 10.

We find that the type and distribution of portable fire extinguishers conforms to the provisions of Appendix A of Branch Technical Position 9.5-1 and are, therefore, acceptable.

4.4 Ventilation Systems and Breathing Equipment

4.4.1 Smoke Removal

Ventilation systems are provided for all indoor plant areas, but these systems are not designed specifically for smoke removal. Nevertheless, the installed air handling systems are capable of exhausting limited volumes of smoke, generally direct to the outside. Major exceptions include the electric bays which discharge into the turbine building, and the screenwell area from which air is drawn into safety-related pump rooms SP-1 and SP-2.

Ventilation system discharge from the reactor building, turbine building, and radwaste building is monitored for radioactive contamination. In case high radiation levels are detected in these areas, system air intake and exhaust are terminated automatically. If smoke exhaust operations are in progress, these will also be terminated. The fans and other equipment in the air handling systems are not designed to withstand high temperatures, and could be rendered inoperative by the heat from a significant fire.

Heat-operated dampers in fire barriers may close automatically, precluding smoke removal. To aid in manual smoke removal activities, the licensee has proposed to provide portable smoke ejectors and portable ductwork of the type used for public fire fighting. The number and rating of the proposed smoke ejectors is acceptable.

Subject to implementation of this modification, we find that the smoke removal capability satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.4.2 Filters

Charcoal filters are installed in the reactor building, the off-gas building, the standby gas treatment building, and the control room HVAC room. Charcoal filters in the standby gas treatment building and the control room HVAC room are normally not in use. No ignition sources are located near the charcoal filters nor can the buildup of radioactive products generate sufficient heat to cause ignition. The amount of combustibles in the area of these filters, other than the filters themselves, is also low. The charcoal filters in the standby gas treatment building are protected by automatic heat detection and manual water spray suppression systems. HEPA and other filters used in the plant are of noncombustible construction.

We find that the fire protection for the charcoal filters satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.4.3 Breathing Equipment

Eighteen self-contained breathing units with 18 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. In addition, the licensee has proposed to provide a compressor and a cascade charging system with the capacity to supply breathing air for 10 men for 6 hours at the rate of three (1/2-hour rated) bottles per man per hour.

We find that the breathing equipment conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.4.4 Battery Room Ventilation

Continuous ventilation is necessary to prevent a flammable concentration of hydrogen from accumulating in station battery rooms. Differential pressure switches at the discharge of supply fans, across supply air filters, and at the intake of exhaust fans initiate an alarm in the control room when the air flow is reduced or interrupted. The loss of air flow signal at the exhaust fan will also start a redundant fan.

We find that the protection against hydrogen accumulation in battery rooms conforms to the provisions of Appendix A of BTP 9.5-1 and is, therefore, acceptable.

4.5 Flood Drains and Curbs

The plant has 4-inch floor drains throughout, each rated at approximately 100 GPM. Floor drains are either adequate to carry off automatic and manual fire suppression water, or the water will flow out other passages without damaging safety-related equipment. All safety-related mechanical equipment is located on minimum 6-inch pedestals. Motor control centers do not have relays or other components which could be subject to water damage within 6 inches of the floor. Running traps have been installed where horizontal drains cross fire walls to prevent possible spread of fire via the drain system.

The curbed areas surrounding the combustible liquid tanks in the diesel fire pump room, the dirty oil storage room and the main oil sump room are adequate to contain the full contents of the tanks plus an additional volume for fire water.

The turbine oil system valves and other piping system valves that could allow drainage of combustible fluids if improperly positioned will be locked in the proper position, and checked monthly.

We find that the drains and curbs in the plant conform to the provisions of Appendix A to BTP 9.5-1 and are, therefore, acceptable.

4.6 Emergency Lighting

In addition to the normal AC powered lighting system, there are two emergency lighting systems. The emergency AC lighting system receives power from the emergency diesel generator buses. Fixtures are provided in areas required for control and maintenance of safety-related equipment. The emergency DC lighting system receives power from either individual batteries or the plant station batteries.

A number of access and egress routes have the potential for being without normal and emergency lighting due to a fire. These include the cable spreading room entrance, relay room entrance, east cable tunnel entrance and escape hatch, and the west cable tunnel entrance. Modifications will be made to the DC lighting system to provide lighting for these areas.

An identification system and administrative controls for maintenance of the emergency lighting systems will be established.

Sealed beam battery powered hand lights are provided for emergency use. A hand light will be provided in each exterior hose house.

We find that, subject to implementation of the above described modifications, the lighting systems will provide adequate lighting in a fire emergency and are, therefore, acceptable.

4.7 Communications

There are three communication systems within the plant. The primary system is a combination paging and party system; in addition there is a sound powered phone system and a standard telephone system.

The sound powered phone system utilizes a separate patch panel and has separate hard wiring from the paging and party system. Stations for both systems are located in each area of the plant.

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

4.8 Electrical Cables

The majority of the electrical cables were purchased and installed prior to the publication of IEEE 383, the standard for flame testing electrical cables. The conductor insulation for the various types of instrument control and power cables is ethylene propylene rubber, cross linked polyethylene and alkane imide; the jacket material is neoprene. The power cable is armored.

Most of the cabling types now installed at the plant were required to pass flame tests conducted in accordance with the provisions of ASTM D2633 or IPCEA S-19-81 before acceptance. While such tests provide some measure of fire behavior of cables in laboratory situations, they cannot be considered indicative of cable fire behavior when in the configurations found at the plant. Accordingly, fire protection features have been or will be implemented for areas containing grouped electrical cables as described in Section 5.0 of this report.

4.9 Fire Barrier Penetrations

Fire barriers are penetrated by doorways, ventilation ducts, electrical cables, conduit and piping. The means of preventing a fire from crossing a fire barrier through these various penetrations is discussed below.

4.9.1 Doorways

Fire barriers separating various fire areas are penetrated by numerous doorways. Three-hour rated doors, rated frames and hardware are provided for most of these penetrations. Fire barrier penetrations protected by less than 3-hour rated doors have either been analyzed and found acceptable based on the combustible loading in the adjacent areas, or will be replaced. The licensee has proposed to replace the door between the east and west electric bays with a labeled door having a rating of 3 hours. Two stairway doors on elevations 286 and 300 will be replaced with 1-1/2-hour rated doors, and the control room door on elevation 300 will be replaced with a 3-hour rated door.

Fire doors in the plant are either normally closed and locked, supervised to alarm in the control room if left open, or arranged to close automatically in the event of fire. An engineering study will be performed to determine the modifications required to lock or electrically supervise the position of all fire doors, not now locked or supervised, in barriers which separate safety-related areas from each other and nonsafety-related areas, or areas containing large amounts of combustibles.

We will address the acceptability of the methods of assuring fire doors remain closed in a supplement to this report.

4.9.2 Ventilation Duct Penetrations

Fire dampers are installed in selected ventilation duct penetrations through fire barriers in various parts of the plant. The fire dampers are Underwriters Laboratory rated for 1-1/2 hours. The licensee has proposed to install physically separated supply ventilation systems with automatically actuated 3-hour rated dampers in safety-related pump rooms SP-1 and SP-2. In addition, the licensee has proposed to install rated UL-listed fusible link operated fire dampers in the ventilation ducts penetrating the fire barriers enclosing the control room, cable spreading room, relay room and standby gas treatment room.

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

4.9.3 Electrical Cable Penetrations

An engineering study will be performed and tests conducted to determine the fire resistance rating of the cable penetration seals. Where found to have lesser rating, the existing penetration will be upgraded to provide a 3-hour fire resistant rated seal.

4.9.4 Piping Penetrations

Piping penetrations through fire barriers, except for those in the reactor building and other undesignated locations, are not sealed. The licensee has not indicated the construction or fire resistance rating of those penetrations which are sealed.

The licensee has proposed to perform a study of the critical piping penetrations to determine which ones warrant sealing, or upgraded seals, and the method of sealing to be used. We will address the acceptability of the piping penetration seals in a supplement to this report.

4.10 Cable Separation

The design and construction of the plant predates present industry standards on physical separation of electrical systems. The engineered safeguard systems are separated into two divisions. In addition, there are four redundant reactor protection trip input groups. The plant design cable separation criteria was based on the protection afforded by physical distance, barriers, enclosed cable trays, conduit and armored cable. Where cables of redundant divisions are routed through one fire area,

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protection is provided by either a physical separation of greater than 3 feet horizontal and 7 feet vertical distance between open cable trays or less spacial distance combined with covered trays, conduit, or armored cable.

Recognizing that the above described physical separation may not be 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.

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

4.11 Fire Barriers

Fire areas are enclosed by floors, walls, and ceilings which have 3-hour fire resistance ratings. However, there are many plant areas in which the failure of exposed structural steel supporting these fire barriers could impair the safe shutdown capability of the plant. These areas include the reactor building, turbine building, control building, diesel generator building, and others.

The licensee has proposed to protect exposed structural steel against fire damage where the failure of such steel could jeopardize the safe shutdown capability of the plant.

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

4.12 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.

4.13 Toxic and Corrosive Combustion Products

The products of combustion of many polymers are toxic to humans and corrosive to metals. Prompt fire detection and extinguishment are relied upon to reduce the quantity of such products produced during a fire. Means of smoke removal, as discussed in Section 4.4.1, are provided as an aid in fire fighting access. Members of the fire brigade will be provided with, and trained in the use of, emergency breathing apparatus for fighting fires involving such materials.

We find that, subject to implementation of the modifications described elsewhere in this report, the precautions taken to reduce the effects of toxic and corrosive products satisfy the objectives identified in Section 2.2 of this report and are, therefore, acceptable.

4.14 Nonsafety-Related Areas

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

The licensee has evaluated the effects of fires in radwaste areas as to the potential releases to the environment. We have reviewed the licensee's evaluation and find that the releases resulting from fire in these areas are acceptably low.

On this basis, we find the fire protection provided for radwaste areas acceptable.

5.0 EVALUATION OF SPECIFIC PLANT AREAS

The licensee has performed a fire hazards analysis of the facility to determine the fire loading in various plant areas, to identify the consequences of fires in safety-related and adjoining nonsafety-related areas, and to evaluate the adequacy of existing and proposed fire protection systems. The results of the fire hazards analysis, other docketed information and site visit observations were used in the staff's evaluation of specific plant areas. The staff's evaluation of specific areas is discussed in the following sections.

As stated in Section 3.2 of this report, the licensee has committed to perform additional studies on certain issues such as safe shutdown analysis, pipe penetrations, fire water piping systems, etc., to identify problematic areas and propose, if necessary, additional modifications. Exactly which plant areas 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 modifications, 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 Primary Containment

5.1.1 Safety-Related Equipment

Safety-related equipment in the primary containment includes the reactor vessel, reactor recirculation system, electrical cable and isolation valves.

5.1.2 Combustibles

The significant combustibles in the primary containment are lubricating oil for the recirculation pumps, neutron shielding, and electrical cables. The cables are in metal conduit.

5.1.3 Consequences if No Fire Suppression

During operation the containment is maintained in a nitrogen atmosphere. The nitrogen inerting serves as protection by preventing the initiation of fires.

5.1.4 Fire Protection Systems

The primary containment atmosphere is inerted when the reactor is at power. During periods when the primary containment is deinerted, such as during refueling outages, hoses will be brought in through the access doors to locations that will reach all hazards. Temporary portable extinguisher stations will be established and strategically located within this

area. Fire detectors are not provided. However, containment temperature monitors which indicate in the control room, and recirculation pump temperature monitors which alarm in the control room, are provided. In addition, the containment spray system will be available for fire suppression.

5.1.5 Adequacy of Fire Protection

Inerting the primary containment with nitrogen is considered an acceptable means of protection against fires during plant operation. For periods when deinerted, temperature monitors will provide indication prior to significant damage of equipment.

5.1.6 Modifications

We find that fire protection fc the primary containment conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.2 Reactor Building Crescent Area

5.2.1 Safety-Related Equipment

The crescent area is divided into two smaller areas by a watertight steel bulkhead. One core spray pump, two residual heat removal pumps, the turbine-driven high pressure coolant injection pump, six unit space coolers, and several motor control centers are located on the east side of this bulkhead. One core spray pump, two residual heat removal pumps, the turbine-driven reactor core isolation cooling pump, four unit space coolers, and several motor control centers are located on the west side of the bulkhead.

5.2.2 Combustibles

The significant combustible materials in the crescent area include large amounts of lubricating oil for the turbines and pumps and cable insulation. Transient combustibles may also be introduced into this area.

5.2.3 Consequences if No Suppression

Postulated fires at this elevation would damage the turbine-driven pump on one side of the bulkhead, and could result in damage to electric cables associated with redundant equipment located on both sides of the bulkhead.

5.2.4 Fire Protection Systems

Fire detection for this area consists of one rate compensation type heat detector over the RCIC pump and two such detectors over the HPCI pump. Fire suppression consists of manually actuated water spray systems protecting the RCIC and HPCI pumps, and an interior hose station in each side of the crescent area.

5.2.5 Adequacy of Fire Protection

The existing fire detection would be adequate to detect a fire at the HPCI or RCIC pumps. Lack of detection throughout the other parts of the crescent area would allow a fire to develop undetected. Plant procedures require a visual verification of the fire before a water spray system is actuated. In addition, the local actuation stations for the water spray systems are located inside a fenced (locked) enclosure. The time delay now inherent in initiating a fire suppression effort in this area will allow a fire to continue unnecessarily in an area containing safety-related equipment. The existing steel bulkhead in the crescent area may not provide sufficient protection for redundant electric cables and equipment in one side of the crescent area in the event of a fire in the other side.

5.2.6 Modifications

The licensee has proposed the following modifications:

(1) provide additional fire detection systems in the crescent area for each warning indication of a fire in the vicinity of safety related cabels and equipment, and

(2) relocate the water spray system actuation pull boxes outside of the fenced (locked) area.

In addition the licensee will perform engineering studies to determine (1) the modifications required to provide a three hour rated fire barrier between the crescent area halves to separate redundant cables and equipment and (2) the feasibility and desirability of converting the suppression systems protecting the HPCI and RCIC turbines to automatically actuated systems.

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

5.3 Reactor Building, Elevation 272' and Above

5.3.1 Safety-Related Equipment

Safety-related equipment on elevation 272' includes control rod drive hydraulic control units and associated accessories, control rod drive water pumps, residual heat removal heat exchangers, and several motor control centers. Safety-related equipment on elevation 300' includes two transformers and 600-volt AC load centers for ECCS equipment. Safety-related equipment and cables on elevation 326' include the standby liquid control tank, test tank and pump, and accumulators. Safety-related equipment on elevation 344' includes batteries and chargers associated with the low pressure safety injection system. Safety-related cables are located on all levels except the 369' elevation.

5.3.2 Combustibles

The combustible materials on these levels of the reactor building include cable insulation, lubricating oil, charcoal (in filters on elevation 344'), resin and Solka floc on elevation 326', plastic battery cases on elevation 344', and transient combustibles on all levels. Hydrogen buildup from battery charging is precluded by a continuously operating ventilation system.

5.3.3 Consequences if No Fire Suppression

The reactor building contains cable and equipment of both divisions of systems that are required for safe shutdown. The licensee is continuing the fire hazard analysis to determine the consequences of a fire in this area.

5.3.4 Fire Protection Systems

Fire protection in these areas of the reactor building consists of portable carbon dioxide extinguishers and 1-1/2-inch hose lines from hose stations on each level. Physical separation and barriers are used to separate redundant divisions of safety-related cables.

5.3.5 Adequacy of Fire Protection

The adequacy of fire protection in these areas cannot be fully assessed until a revised fire hazard analysis has been received from the licensee. However, the lack of fire detection systems will allow any fire which may start here to continue.

5.3.6 Modifications

The licensee will perform an analysis for this area to verify the effectiveness of spacial separation, tray covers, and fire stops in preventing simultaneous damage to redundant safety systems from an exposure fire. The analysis will also consider the effects of smoke and heat propagation and water spray damage from fire hose streams. Corrective modifications will be proposed where the analysis indicates that the present design is inadequate.

In addition, fire detection and signaling systems will be installed to provide early warning indication of a fire in the reactor building on elevations 272', 300', 326', 344', and 369'.

We will address the acceptability of the fire protection in the reactor building on elevations 272' and above in a supplement to this report.

5.4 Screenwell House - Safety-Related Pump Rooms SP-1, SP-2

5.4.1 Safety-Related Equipment

The safety-related equipment in the screenwell house consists of redundant emergency service water pumps, residual heat removal service water pumps, associated auxiliaries ventilation equipment and electrical cables. The redundant safety-related pumps are located in two adjacent fire areas separated by 3-hour rated barriers.

5.4.2 Combustibles

Combustible materials in the screenwell house include cable insulation, lubricating oil, transient combustibles, and fuel oil in the diesel driven fire pump fuel oil storage tank.

5.4.3 Consequences if No Fire Suppression

The ventilation air intakes for the adjacent safety-related pump rooms face a common area. Fire dampers are not provided in these openings. A fire in the screenwell house, outside the two safety-related pump rooms, could cause simultaneous damage to the redundant safety-related pumps. A fire in other rooms within the screenwell house would be confined by the barriers enclosing the room.

5.4.4 Fire Protection Systems

Ionization type smoke detectors and a wet pipe automatic sprinkler system are installed in the diesel fire pump room. Fire protection for the remaining areas in the screenwell house is provided by portable carbon dioxide extinguishers and 1-1/2-inch hose lines from interior hose stations.

5.4.5 Adequacy of Fire Protection

The adequacy of fire protection in these areas cannot be fully assessed until a revised fire hazard analysis has been received from the licensee. However, the ventilation system arrangement for the safety-related pump rooms SP-1 and SP-2 will allow a fire in the screenwell house to affect redundant components. The lack of fire detection systems will allow any fire which may start here to continue. During the site visit tour, it was observed that the sprinkler heads in the diesel fire pump room did not appear to provide coverage for the entire room.

5.4.6 Modifications

The licensee will perform an analysis for this area to verify the effectiveness of spatial separation, tray covers and fire stops in preventing simultaneous damage to redundant safety systems from an exposure fire. Corrective modifications will be proposed where the analysis indicates that the present design is inadequate.

The licensee will provide physically separated supply ventilation systems with automatically actuated 3-hour rated fire dampers for the safety-related pump rooms. In addition, the licensee will provide the results of a study which verifies that the sprinkler head arrangement in the diesel fire pump room provides coverage which adequately protects the entire room.

Fire detection and signaling systems will be installed in the safety-related pump rooms to provide early warning indication of fire.

We will address the acceptability of the fire protection in the screenwell house in a supplement to this report.

5.5 Diesel Generator Rooms

5.5.1 Safety-Related Equipment

Safety-related equipment in each of the four diesel generator rooms includes the emergency diesel generator and associated controls, air compressors and starting air receivers, fuel oil day tank and transfer pumps, and electric cables. Safety-related equipment in the adjoining and redundant diesel generator switchgear rooms includes switchgear, associated control panels, and electric cables.

5.5.2 Combustibles

Principal combustible materials in each diesel generator room include fuel oil in the day tank, lubricating oil, and electric cable insulation. Combustible material in each emergency diesel generator switchgear room is principally cable insulation.

5.5.3 Consequences if No Fire Suppression

Each diesel generator room is separated from the other diesel generator rooms, from the diesel generator switchgear rooms, and from other plant areas by 3-hour rated fire barriers. Each diesel generator switchgear room is similarly separated from other rooms and plant areas. Doors in these walls are all 3-hour rated. An unsuppressed fire in one of the diesel generator rooms or diesel generator switchgear rooms could incapacitate the equipment in that room. Room ventilation exhaust fans are installed in the exterior walls of the emergency diesel generator rooms, and draw air from the associated emergency diesel generator switchgear rooms through transfer grills. If the fans are operating with a fire in a switchgear room, the fire could propagate to the adjacent associated diesel generator rooms.

5.5.4 Fire Protection Systems

Each diesel generator room is provided with a preaction sprinkler system. Each diesel generator switchgear room is provided with ionization type smoke detectors to provide early warning of fire, and an automatic total flooding carbon dioxide suppression system actuated by rate compensation

type heat detectors. Upon actuation, the carbon dioxide system will close supply and exhaust ventilation dampers to the affected room, and three of the four fire doors to the room. Portable carbon dioxide extinguishers are also provided in each of these rooms.

5.5.5 Adequacy of Fire Protection

Fire protection for these areas is not adequate. The ventilation system exhaust fans are not interlocked to the fire suppression system in the emergency diesel generator switchgear rooms and could, by continued operation during a fire, reduce the concentration of extinguishant in the room and/or allow the fire to spread. Further, the licensee has not provided sufficient detailed information on the suppression systems in these areas for the staff to evaluate the validity of the conclusions presented by the licensee.

5.5.6 Modifications

Modifications will be made to the emergency diesel generator room ventilation systems to preclude an inadvertent loss of dilution of the carbon dioxide. Tests of the carbon dioxide fire suppression systems installed in the emergency diesel generator switchgear rooms will be performed to demonstrate that a satisfactory concentration of carbon dioxide can be achieved and maintained for the design period in all parts of the rooms if additional documentation (to be furnished by the licensee) cannot support or establish that the system provides adequate protection.

We will address the acceptability of the fire protection for the emergency diesel generator rooms in a supplement to this report.

5.6 Cable Spreading Room

5.6.1 Safety-Related Equipment

Safety-related equipment in the cable spreading room includes control and instrumentation cables associated with systems required for safe shutdown.

5.6.2 Combustibles

The combustible material in this area is a large quantity of cable insulation in stacked open cable trays.

5.6.3 Consequences if No Fire Suppression

An unmitigated fire in this area could cause the loss of control and instrumentation for systems required to achieve and maintain safe shutdown conditions.

Ventilation duct penetrations through the barriers surrounding the cable spreading room do not include fire dampers. An unmitigated fire in the cable spreading room could spread via the ventilation ductwork to other areas of the plant.

5.6.4 Fire Protection Systems

The cable spreading room is provided with ionization type smoke detectors and an automatic carbon dioxide suppression system actuated by rate compensation type heat detectors. Hose stations are also provided in adjacent areas. Physical separation and barriers are used to separate redundant divisions of safety-related cables.

5.6.5 Adequacy of Fire Protection

Fire protection for this area is not adequate. The separation between redundant divisions of cables is not sufficient to preserve a shutdown capability in the event of an unmitigated fire.

A CO_2 purge (exhaust) system has been installed in the cable spreading room. The exhaust fan in this system is not interlocked to the gas suppression system protecting the area. If the purge system is inadvertently operating when the suppression system is actuated to extinguish a fire, it will exhaust from the area diluting the concentration of CO_2 consequently lessening its effectiveness. Further, the licensee has not provided sufficient detailed information on the design of the gas suppression system in this area for the staff to conclude that it will be adequate to suppress fires.

Lighting for fire fighting is limited due to inadequate light coverage at the entrance to the cable spreading room.

5.6.6 Modifications

An alternate shutdown capability independent of the cabling and equipment in the cable spreading room will be provided. The emergency lighting system serving the entrance to the cable spreading room will be modified to provide additional lighting coverage. Rated, UL listed, fusible link operated dampers will be installed in the ventilation ducts penetrating the fire barriers enclosing the cable spreading room.

Modifications will be made to the cable spreading room CO_2 purge system to preclude an inadvertent loss of the carbon dioxide. Tests of the carbon dioxide fire suppression system installed in the cable spreading room will be performed to demonstrate that a satisfactory concentration of carbon dioxide can be achieved and maintained for the design period in all parts of the room if additional documentation (to be furnished by the licensee) cannot support or establish that the system provides adequate protection.

We will address the acceptability of the fire protection for the cable spreading room in a supplement to this report.

5.7 Relay Room

5.7.1 Safety-Related Equipment

The safety-related equipment in the relay room includes relay panels and cables.

5.7.2 Combustibles

The principal combustible materials in the relay room include electric cable insulation and paper associated with the plant's nonsafety-related computer.

5.7.3 Consequences if No Fire Suppression

An unmitigated fire in this area could cause the loss of relays and cables associated with systems required to achieve and maintain safe shutdown conditions.

Ventilation duct penetrations through the fire barriers enclosing the relay room do not include fire dampers. An unmitigated fire in the relay room could spread via the ventilation system ductwork to other areas of the plant.

5.7.4 Fire Protection Systems

The relay room is provided with ionization type smoke detectors, rate compensation type heat detectors, and a manually actuated total flooding carbon dioxide fire suppression system. Hose stations and portable extinguishers are also provided in adjacent areas. Physical separation and barriers are used to separate redundant divisions of safety-related cables.

5.7.5 Adequacy of Fire Protection

Fire protection for this area is not presently considered adequate to prevent involvement of redundant safe shutdown systems. The separation between redundant divisions of cables is not sufficient to preserve a shutdown capability in the event of an unmitigated fire.

The CO_2 fire suppression system protecting the relay room is a manually actuated system. The system can be actuated from push button stations at the fire protection panel (main control room) or near the protected area. The ventilation system serving the relay room is not interlocked to the CO_2 fire suppression system protecting the area. To prevent dilution of the suppression agent (CO_2 gas), the ventilation system must be manually

secured from the control room before the CO_2 system is actuated. Securing the relay room ventilation cannot be accomplished from the remote (CO_2) actuation stations. Further, the licensee has not provided sufficient detailed information on the design of the gas suppression system in this area for the staff to conclude that it will be adequate to suppress fires.

Lighting for fire fighting is limited due to inadequate light coverage at the entrance to the relay room.

5.7.6 Modifications

An alternate shutdown capability independent of the cabling and equipment located in the relay room will be provided.

The emergency lighting system serving this area will be modified to provide additional lighting coverage at the entrance.

Rated UL listed fusible link operated dampers will be installed in the ventilation ducts penetrating the fire barriers enclosing the relay room.

Modifications will be made to the relay room ventilation systems to preclude an inadvertent loss or dilution of the carbon dioxide. Tests of the carbon dioxide system installed in the relay room will be performed to demonstrate that a satisfactory concentration of carbon dioxide can be achieved and maintained for the design period in all parts of the room if additional documentation (to be furnished by the licensee) cannot support or establish that the system provides adequate protection.

We will address the acceptability of the fire protection for the relay room in a supplement to this report.

5.8 Control Room Complex

5.8.1 Safety-Related Equipment

The control room contains safety-related control cabinets and consoles associated with the systems required for safe shutdown.

5.8.2 Combustibles

The combustibles in the area consist mainly of electrical cable insulation contained within the cabinets, paper, lube oil and charcoal associated with the area ventilation system.

5.8.3 Consequences if No Fire Suppression

An unmitigated fire in most of the control panels would probably be limited to one section involving only one division of safe shutdown equipment, due to the low combustible loading and physical separation provided. However,

there are some cabinets which contain cables of redundant divisions of safety-related equipment with minimal separation. A sustained fire in one of these cabinets could endanger safe shutdown. A fire in the kitchen area could produce conditions which would require the evacuation of the control room.

Ventilation duct penetrations through the barriers enclosing and within the control room complex do not include fire dampers. An unmitigated fire in the control room complex could propagate via the ventilation ductwork.

5.8.4 Fire Protection Systems

Fire protection in the control room complex consists of portable extinguishers and 1-1/2-inch hose lines located in an adjacent area.

5.8.5 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 reduce the extent of damage within each safety-related cabinet to an acceptable level. Additional protection is also needed to prevent the control room from being exposed to hazards from adjacent support rooms and the kitchen.

5.8.6 Modifications

The licensee has proposed to: (1) provide a rated fire barrier between the kitchen and the control room operating areas, (2) replace the wood cabinets in the kitchen area with cabinets of noncombustible construction, (3) remove the wooden bookcase and provide noncombustible file cabinets for papers, logs, operating manuals and other combustibles located within the control room complex, (4) replace the control room door on elevation 300' with a 3-hour rated door, (5) install UL listed, fusible link operated fire dampers in the ventilation ducts, (6) install fire detection and signaling systems in the control room HVAC air intakes and in the safety related control room cabinets.

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

5.9 Switchgear Rooms

5.9.1 Safety-Related Equipment

There are two redundant switchgear rooms each containing one division of safety-related equipment. Each room contains a transformer and load center, motor generator set, switchgear, and safety-related motor control centers.

5.9.2 Combustibles

The combustibles in these rooms consist of bus bar insulation, and electrical cable insulation in the motor control centers and switchgear units.

5.9.3 Consequences if No Fire Suppression

An unmitigated fire in either switchgear room could cause loss of some equipment related to one division of redundant safe shutdown systems but would not affect the redundant systems due to the barriers separating the rooms.

5.9.4 Fire Protection Systems

Each switchgear room is provided with ionization type smoke detectors and an automatic carbon dioxide suppression system actuated by rate compensation type heat detectors. Hose stations are also provided in adjacent areas.

5.9.5 Adequacy of Fire Protection

The licensee has not provided sufficient detailed information on the design of the gas suppression system for this area for the staff to conclude that it will be adequate to suppress fires.

5.9.6 Modifications

The licensee has proposed to replace the fire door between the east and west switchgear rooms with a 3-hour rated door.

Tests of the carbon dioxide fire suppression systems installed in the switchgear rooms will be performed to demonstrate that a satisfactory concentration of carbon dioxide can be achieved and maintained for the design period in all parts of the room if additional documentation (to be furnished by the licensee) cannot support or establish that the system provides adequate protection.

We will address the acceptability of the fire protection for the switchgear rooms in a supplement to this report.

5.10 Battery Rooms

5.10.1 Safety-Related Equipment

The two redundant trains of safety-related batteries are housed each in its own individual 3-hour fire rated enclosure.

5.10.2 Combustibles

The significant combustibles in the battery rooms are the plastic battery cases and a small amount of electrical cable insulation. Hydrogen buildup from battery charging is precluded by a continuously operating ventilation system.

5.10.3 Consequences if No Fire Suppression

An unsuppressed fire in one of the battery rooms could cause the loss of one, but not both, of the battery banks due to the fire barriers between the rooms.

5.10.4 Fire Protection Systems

Fire protection for the battery rooms consists of portable extinguishers and a 1-1/2-inch hose line located in an adjacent area. Differential pressure switches at the discharge of the supply fans, across the supply air filters, and at the intake of exhaust fans initiate an alarm in the control room when air flow for a battery room is reduced or interrupted. In addition, loss of air flow signal will automatically start a redundant exhaust fan.

5.10.5 Adequacy of Fire Protection

Considering the limited quantity of combustible and separation of the station batteries by 3-hour rated barriers, manual fire protection would be adequate to extinguish fires in these rooms.

5.10.6 Modifications

No modifications are required. We find that the fire protection for the station battery rooms conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.11 Battery Charging Rooms

5.11.1 Safety Related Equipment

The two redundant safety-related battery chargers are housed each in its own individual 3-hour rated enclosure.

5.11.2 Combustibles

The combustibles in these areas consist of electrical cable insulation and electrical components associated with the battery chargers, and trays of electrical cable insulation associated with other plant systems.

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5.11.3 Consequences if No Fire Suppression

An unmitigated fire in either of the two battery charging rooms could cause the loss of one of the redundant main station battery chargers. This would not cause a complete loss of DC power; however, it would affect a portion of the 125-volt DC system. The redundant D.C. bus, battery bank, and full capacity battery charger would be available.

5.11.4 Fire Protection Systems

Fire protection in the battery charging rooms consists of portable extinguishers and a 1-1/2-inch hose line located in an adjacent area.

5.11.5 Adequacy of Fire Protection

The manual fire fighting equipment would be adequate to control a fire in one battery charger room, although lack of detection would allow the fire to continue unnecessarily.

5.11.6 Modifications

Fire detection and signaling systems will be installed in the battery charger rooms for early warning indication of a fire.

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

5.12 Battery Room Corridor

5.12.1 Safety-Related Equipment

The safety-related equipment in this area consists of safety-related cables.

5.12.2 Combustibles

The combustibles in this area consist of electrical cable insulation.

5.12.3 Consequences if No Fire Suppression

The battery room corridor contains cable associated with both divisions of systems that are required for safe shutdown. The licensee is continuing the fire hazard analysis to determine the consequences of a fire in this area.

5.12.4 Fire Protection Systems

Fire protection in the battery room corridor consists of portable extinguishers and a 1-1/2-inch hose line in an adjacent area. Physical separation and barriers are used to separate redundant divisions of safety-related cables.

5.12.5 Adequacy of Fire Protection

The adequacy of the fire protection in this area cannot be fully assessed until a revised fire hazard analysis has been received from the licensee. However, the lack of a fire detection system will allow any fire which may start here to continue unnecessarily.

5.12.6 Modifications

The licensee will perform an analysis for this area to verify the effectiveness of spacial separation, tray covers and fire stops in preventing simultaneous damage to redundant safety systems from an exposure fire. Corrective modifications will be proposed where the analysis indicates that the present design is inadequate.

A fire detection and signaling system will be installed in the battery room corridor to provide early warning indication of a fire.

We will address the acceptability of the fire protection in the battery room corridor in a supplement to this report.

5.13 Cable Tunnels (Administration Building - Elevation 286')

5.13.1 Safety-Related Equipment

The safety-related equipment in this area consists of safety-related cable in cable trays, conduit and armored shielding.

5.13.2 Combustibles

The combustibles in this area consist of electrical cable insulation.

5.13.3 Consequences if No Fire Suppression

The plant design criteria recommended that the safety-related cable in cable trays be routed such that each tunnel contained trays of only one safety-related division. However, this design criteria permitted redundant divisions of cable in conduit and armor shielding to be routed in the same tunnel. The licensee is continuing the fire hazard analysis to determine the consequences of a fire in this area.

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5.13.4 Fire Protection Systems

The cable tunnels on Elevation 286' are provided with ionization type smoke detectors and automatic total flooding carbon dioxide suppression systems actuated by rate compensation type heat detectors. Portable extinguishers are also provided in adjacent areas.

5.13.5 Adequacy of Fire Protection

The adequacy of the fire protection in these areas cannot be fully assessed until a revised fire hazard analysis has been received from the licensee.

CO_2 purge (exhaust) systems have been installed in the cable tunnels. The exhaust fans in these systems are not interlocked to the total flooding gas systems protecting the cable tunnels. If a purge system is inadvertently operating when the suppression system is actuated to suppress a fire, it will exhaust from the area reducing the concentration of CO_2 consequently lessening its effectiveness. Further, the licensee has not provided sufficient detailed information on the design of the gas suppression systems protecting the cable tunnels for the staff to conclude that they will be adequate to suppress fires.

5.13.6 Modifications

The licensee will perform an analysis for these areas to identify the function and location of the redundant cables routed through the cable tunnels. The analysis will also verify the effectiveness of the spacial separation and other features provided to prevent simultaneous damage to redundant systems required for safe shutdown from an exposure fire. Corrective modifications will be proposed where the analysis indicates that the present design is inadequate.

Modifications will be made to the cable tunnel CO2 purge systems to preclude an inadvertent loss or dilution of the carbon dioxide. Tests of the carbon dioxide fire suppression systems, installed in the cable tunnels, will be performed to demonstrate that a satisfactory concentration of carbon dioxide can be achieved and maintained for the design period in all parts of the rooms. The licensee will provide additional information to support or establish that the system provides adequate protection. We will address the acceptability of the fire protection in the cable tunnels in a supplement to this report.

5.14 Cable Tunnels (West and East - Elevation 258')

5.14.1 Safety-Related Equipment

The safety-related equipment in this area consists of safety-related cables routed in cable trays, conduit and armored shielding.

5.14.2 Combustibles

The combustibles in this area consist of electrical cable insulation.

5.14.3 Consequences if No Fire Suppression

The plant engineering criteria for separation of cables recommended that the safety-related cable in cable trays be routed such that each tunnel contained trays of only one safety-related division. However, this criteria permitted redundant divisions of cable in conduit and armor shielding to be routed in the same tunnel. The licensee is continuing the fire hazard analysis to determine the consequences of a fire in this area.

5.14.4 Fire Protection Systems

The cable tunnels on Elevation 258' are provided with ionization type smoke detectors and automatic water spray systems actuated by rate compensation type heat detectors. Portable extinguishers are provided in adjacent areas.

5.14.5 Adequacy of Fire Protection

The adequacy of the fire protection in these areas cannot be fully assessed until a revised fire hazard analysis has been received from the licensee.

Lighting for fire fighting would be limited due to inadequate light coverage at the east tunnel entrance and escape hatch, and at the west tunnel entrance.

5.14.6 Modifications

The licensee will perform an analysis for these areas to identify the function and location of redundant cables routed through the cable tunnels. The analysis will also verify the effectiveness of the spacial separation and other features provided to prevent simultaneous damage to redundant systems required for safe shutdown from an exposure fire. Corrective modifications will be proposed where the analysis indicates that the present design is inadequate.

The emergency lighting system serving this area will be modified to provide additional lighting coverage.

We will address the acceptability of the fire protection in the cable tunnels in a supplement to this report.

5.15 Yard Area

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5.15.1 Safety-Related Equipment

There is no safety-related equipment in the yard area.

5.15.2 Combustibles

The significant combustible materials in the yard area include oil in five transformers, fuel oil in the 170,000-gallon above-ground auxiliary boiler fuel storage tank, various flammable and nonflammable compressed gases in a metal frame storage building located north of the diesel generator building, a number of 55-gallon metal drums of oils and flammable liquids adjacent to the south side of the diesel generator building, and a bank of compressed hydrogen cylinders located about 125 feet west of the diesel generator building.

5.15.3 Consequences if No Fire Suppression

An unsuppressed fire involving the fixed combustibles in the yard area would not present a significant fire exposure to safety-related systems because of intervening distance and barriers. However, a fire involving the transient combustibles being stored adjacent to the south side of the diesel generator building could propagate to the interior of this building via ventilation air intakes.

5.15.4 Fire Protection Systems

Yard hydrants and hose lines stored in hose houses are available for manual fire suppression. The oil filled transformers are protected by automatic water spray systems. The diesel fuel storage tank is diked to prevent the combustible liquid from flowing into other areas.

5.15.5 Adequacy of Fire Protection

The fire protection for the fixed combustibles in the yard area is considered adequate since a fire here will not prevent a safe shutdown of the plant. Fire protection for transient combustibles stored adjacent to walls of safety-related areas is not considered adequate because a fire here may impair the safe shutdown capability of the plant.

Doors at some hose houses are damaged and difficult to open. Hose houses, in general, are installed so that there is insufficient ground clearance for the doors.

5.15.6 Modifications

The licensee has proposed the following modifications:

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(1) Establish administrative controls to prohibit the storage of flammable and combustible materials in yard areas adjacent to safety-related structures.

(2) Repair or replace damaged doors on hose houses.

(3) Mount hose houses on concrete pedestals with doors adjusted to provide sufficient ground clearance for ease of operation.

(4) Establish various administrative controls to ensure the availability and reliability of hydrants and hose lines.

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

5.16 Turbine Building

5.16.1 Safety-Related Equipment

No safety-related equipment or cables are located in the turbine building. Many adjoining areas contain safety-related cables or equipment; these are separated from the turbine building by 3-hour fire barriers with 3-hour rated fire doors.

5.16.2 Combustibles

Major combustible materials in the turbine building include large quantities of turbine lubricating and other oils, electrical cable insulation, resin, and transient combustibles.

5.16.3 Consequences if No Fire Suppression

An unmitigated fire in this area could cause significant damage and loss of nonsafety-related equipment, but would not affect the safe shutdown capability of the plant.

5.16.4 Fire Protection Systems

Wet pipe automatic sprinkler systems are provided to protect the 252' and 272' levels of the turbine building. An automatic air foam system is provided for the condenser pit on elevation 244'. A manual water spray system is provided to protect the hydrogen seal oil unit. A pre-action sprinkler system is provided to protect the turbine generator bearing boxes.

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Interior hose lines are available from hose stations in the turbine building and adjacent areas. Exterior hose lines are also available from outside hydrants.

5.16.5 Adequacy of Fire Protection

The major sources of combustibles are adequately protected with automatic suppression systems. Drains in the turbine lube oil rooms could provide a path for combustible liquids to spread to adjacent areas, if the drain valves were open.

5.16.6 Modifications

The turbine oil system valves and other piping system valves that could allow drainage of combustible fluids if improperly positioned will be locked in the proper position and checked monthly.

We find that the fire protection for the turbine building 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 programs 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, by letters dated March 31, 1978, and October 23, 1978, has proposed to amend the existing fire protection administrative program to conform to the recommendations 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. We have evaluated the plant specific considerations at FitzPatrick Nuclear Power Plant to determine the minimum required fire brigade size to cope with the fires that may occur, and have determined that a five-man brigade is required.

Quality Assurance provisions have been established for the design procurement, installation, testing and administrative controls for fire protection within the plant 10 CFR Part 50 Appendix B quality assurance program. Activities related to fire protection are performed in accordance with the quality assurance requirements of Appendix A to BTP 9.5-1.

We find that, subject to implementation of the above described programmatic changes the organizational and administrative aspects of the fire protection program conform to the NRC's guidance documents, "Nuclear Plant Fire Protection Functional Responsibilities Administrative Controls and Quality Assurance," and are, therefore, acceptable.

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7.0 TECHNICAL SPECIFICATIONS

The interim technical specifications for fire protection were issued as Amendment No. 34 to Facility Operating License DPR-59, to include Limiting Conditions for Operation and Suveillance Requirements for the existing fire protection systems and administrative controls. Following the implementation of the modifications to the fire protection systems and administrative controls resulting from this review, the technical specifications will be modified to adequately address all of the existing fire protection systems, and to incorporate Limiting Conditions for Operation and Surveillance Requirements for these modifications.

8.0 CONCLUSIONS

The licensee has performed a fire hazards analysis and has proposed certain modifications to improve the fire protection program. During the course of our review, additional modifications were proposed by the licensee 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 James A. FitzPatrick Nuclear Power Plant will satisfy the provisions of BTP 9.5-1 and Appendix A thereto, which the staff has established for satisfactory long-term 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:

> "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.

9.0 CONSULTANTS' REPORT

Under contract to 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 in the preparation of this report. Their letter, "Fire Protection in Operating Nuclear Power Stations - James A. FitzPatrick Safety Evaluation Report Review," dated February 20, 1979, discusses several matters which have been addressed in this report. These elements of the consultants' recommendations which we have not adopted are identified in Appendix "B" along with our bases therefor.

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, the Power Authority of the State of New York was requested to compare the existing fire protection provisions at their facility with the 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 dated May 24, 1976, the Power Authority of the State of New York stated that the schedule for the evaluation of the James A. FitzPatrick Nuclear Power Plant fire protection program would be submitted by June 28, 1976.

By letter dated June 28, 1976, the Power Authority of the State of New York stated that the evaluation of the James A. FitzPatrick Nuclear Power Plant fire protection program would be submitted by April 1, 1977.

By letter dated September 30, 1976, the Power Authority of the State of New York was requested to provide the results of a fire hazard analysis and propose Technical Specifications pertaining to fire protection. The Power Authority of the State of New York was also provided a copy of Appendix A, which includes acceptable alternatives to the guidelines of Standard Review Plan 9.5-1.

By letters dated December 2 and December 14, 1976, we provided model Technical Specifications and requested submittal of fire protection Technical Specifications.

By letter dated January 11, 1977, the Power Authority of the State of New York provided their response to our request of May 11, 1976. This response provided a comparison of the James A. FitzPatrick Nuclear Power Plant fire protection program to the guidelines presented in Standard Review Plan 9.5-1, Branch Technical Position APCSB 9.5-1, and Appendix A to APCSB 9.5-1.

By letter dated March 30, 1977, the Power Authority of the State of New York stated that a detailed evaluation, in accordance with the

guidelines presented in the NRC's September 30, 1976 letter, would be submitted by April 29, 1977.

By letter dated March 31, 1977, the Power Authority of the State of New York committed to submit proposed Technical Specifications for the plant fire protection systems by April 15, 1977.

By letter dated April 19, 1977, the Power Authority of the State of New York submitted proposed Technical Specifications for the plant fire protection systems.

By letter dated April 29, 1977, the Power Authority of the State of New York provided their response to our request of September 30, 1976. This response provided a detailed fire hazard analysis for the James A. FitzPatrick Nuclear Power Plant.

By letter dated June 16, 1977, we provided revised model Technical Specifications for fire protection and requested the licensee to propose interim Technical Specifications based on the revised model Technical Specifications within 20 days of receipt of the letter.

By letter dated July 19, 1977, the Power Authority of the State of New York committed to submit revised Technical Specifications for the plant fire protection systems by August 12, 1977.

By letter dated August 4, 1977, we provided supplemental guidance for the organizational and administrative aspects of the licensee's fire protection program, "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance."

By letter dated August 12, 1977, the Power Authority of the State of New York submitted proposed Technical Specifications for the plant fire protection systems. This submittal superseded the licensee's April 19, 1977 submittal, and was based on the revised model Technical Specifications per NRC's June 16, 1977 letter.

By letter dated November 29, 1977, we provided revised Technical Specifications based on the licensee's August 12, 1977 submittal.

By letter dated December 16, 1977, the Power Authority of the State of New York submitted their objections to the provisions of the revised Technical Specifications in a document entitled "Objections to Specific Requirements of Interim Fire Protection System Technical Specification Revisions Transmitted by the U.S. Nuclear Regulatory Commission Via Letter to the Power Authority Dated November 29, 1977."

On January 31, 1978, Amendment No. 34 was issued to Facility Operating License No. DPR-59 incorporating Technical Specifications for the plant's fire protection systems.

By letter dated March 31, 1978, the Power Authority of the State of New York provided a response to the NRC's August 4, 1977 letter on the organizational and administrative aspects of the plant's fire protection program.

By letter dated April 5, 1978, we requested the licensee to provide additional information for the staff's review and evaluation of the James A. FitzPatrick Nuclear Power Plant fire protection program.

By letter dated May 23, 1978, the Power Authority of the State of New York committed to submit a response to the NRC's April 5, 1978 request for information by June 19, 1978.

On July 10, 1978, members of the NRC staff and representatives of the Power Authority of the State of New York met at Bethesda, MD, to discuss the licensee's proposed response to the April 5, 1978 request for additional information.

By letter dated August 3, 1978, the Power Authority of the State of New York provided their response to our April 5, 1978 request for information.

On August 14-18, 1978, the DOR fire protection review team visited the James A. FitzPatrick Nuclear Power Plant. On August 18, 1978, an exit meeting was held at the plant at which the review team presented staff positions and requests for additional information.

By letter dated September 22, 1978, we formally transmitted the staff positions and requests for additional information presented to the licensee at the August 18, 1978 plant tour exit meeting.

By letters dated October 23, October 27 and December 21, 1978, the Power Authority of the State of New York provided a partial response to our September 22, 1978 staff positions.

On January 19, 1979, the draft Safety Evaluation Report was transmitted from the Plant Systems Branch to the Chief of Operating Reactors Branch #3.

By letter dated February 8, 1979, March 7, 1979 and May 7, 1979 the Power Authority of the State of New York provided implementation schedules and additional information concerning the fire protection program.

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 - James A. FitzPatrick Safety Evaluation Report Review," presents certain recommendations and comments. The consultants' recommendations and comments and our resolution of these matters are given below.

Fire Water System Control Valve Supervision

It is recommended that the electrical supervision (of certain fire protection system valves) be extended to (include) all sectional valves and valves controlling the supply of water for fire protection.

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 with 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.

Smoke Removal

SER item 4.4.1 indicates that portable smoke ejectors and flexible ducting will be provided to aid in manual smoke removal activities in the plant in addition to the installed ventilating systems which serve many plant areas, and that these measures constitute acceptable provisions for smoke removal during fires. Reevaluation of this aspect of nuclear power plant fire protection has produced additional concerns on the part of our consultant. His concern is: "Effective smoke removal can be defined as transporting smoke from the fire area at a rate which will reduce its effects on property and personnal to tolerable levels. Property refers to those materials not yet involved in the fire, including those in the path by which the smoke is transported from the fire area to a location where

effects are tolerable (usually outside). Personnel refers mainly to those fighting the fire. The principal effects of smoke are probably toxicity, obscuration of vision, corrosiveness, and radiant and convective heat transfer capacity.

Estimating the rate of generation of the smoke and its character are necessary first steps in evaluating the effectiveness of a smoke removal plan. The rate of generation of smoke depends on the rate of burning, which has not been estimated by the licensee. The character of the smoke depends on the material being burned and the nature of the burning, neither of which have been adequately quantified by the licensee. Installed systems may have to be significantly alerted to provide effective smoke removal in all plant areas." Our consultant recommends that a complete evaluation of smoke generation potential and smoke removal methods be made by the licensee so that conclusions drawn by the NRC staff will have a fire technical basis.

Staff Response:

Additional information and improved equipment would provide some benefit in the design and construction of fixed ventilation systems to be used for smoke removal in future plants. However, a massive plant redesign of current plant ventilation sytems is not warranted because portable smoke removal equipment can be used in those areas with inadequate fixed smoke removal systems. Portable smoke removal units have been used in fire service for a sufficient length of time so that the limits on their use are well understood.

In plants where smoke removal is dependent on such equipment, smoke removal is not generally initiated until the room atmosphere is cooled sufficiently, by fixed sprinkler operation or manual hose fogging to permit entry by fire fighting personnel. Ventilation prior to this time serves no purpose but to add oxygen to active fire sites. The current fire service portable smoke removal units have a sufficiently high temperature capability to remove smoke when the hot gases are cooled enough for fire brigade entry. The manual fire fighting consultants have made their evaluations of the fire fighting capabilities of a number of plants and have recommended use of the portable smoke exhaust systems. We require the licensees and applicants to develop prefire plans which include the proper use of ventilation equipment in each plant area of concern. This is addressed in our Administrative Controls review.

Consequently, there is adequate information available at this time to continue to evaluate plant smoke removal capability. The use of fire suppression equipment, fire barriers and other fire protection measures is evaluated based on the need for immediate access into an area and the limitations imposed by the currently available portable smoke removal units. These concerns are evaluated on an area basis at each plant with due consideration of the advice of the manual fire fighting consultants.