FIRE PROTECTION

SAFETY EVALUATION REPORT

BY THE

OFFICE OF NUCLEAR REACTOR REGULATION

U.S. NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF

ARKANSAS POWER & LIGHT COMPANY

ARKANSAS NUCLEAR ONE - UNIT 1

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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 a 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 for a comprehensive review of all new license 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:

a) "Standard Review Plan for the Review of Safety Analysis Reports 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.

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

c) "Supplementary Guidance on Information Needed for Fire Protection Program Evaluation," October 21, 1976.

d) "Sample Technical Specifications," May 12, 1977.

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

f) "Manpower Requirements for Operating Reactors," memo from E.G.Case to R. Boyd, V. Stello, and R. Mattson dated May 11, 1978.

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

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

This report summarizes the status of our evaluation of the fire protection program at Arkansas Power and Light Company's Arkansas Nuclear One - Unit 1 Plant.

2.0 FIRE PROTECTION GUIDELINES

2.1 General Design Criterion 3 - "Fire Protection"

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

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

2.2 Supplementary Guidance

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

Appendix A provides for a comprehensive program assuring a substantial level of fire protection, beyond minimums that might be deemed to satisfy GDC-3.

The overall objectives of the fire protection program embodied in BTP 9.5-1 and Appendix A, are to:

(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 material if fires occur.

We have used the guidance of Appendix A as appropriate in our review. We have evaluated alternatives proposed by the licensee to various specific aspects of Appendix A using the overall objectives outlined

above to assure that these objectives are met for the actual relationship of combustibles, safety related equipment and fire protection features of the facility.

3.0 SUMMARY OF 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. The proposed modifications are summarized below. The implementation schedule for these modifications is in Table 3.1. The licensee has agreed to this schedule. The sections of this report which discuss the modifications are noted in parentheses.

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, test results, or acceptance criteria to assure that the design is acceptable prior to actual implementation of these modifications. The balance of other modifications has been described in an acceptable level of detail.

3.1 Portable Radio Communication Equipment

Portable radio communication equipment will be provided, and available for fire brigade use (4.7).

*3.2 Separation of Power Cables in Manholes

Redundant power cables for service water pumps and fuel transfer pumps will be separated by a barrier where redundant cables are in a common manhole in the yard area (5.14).

*3.3 Protection of Redundant Cables in the Hallway - Elevation 372 Feet

To protect redundant safe shutdown cables in the auxiliary building hallway - elevation 372 feet, either a deluge system actuated by heat and smoke detectors and coating of cables where redundant cables are in proximity will be provided, or all cables will be coated and smoke detectors and a wet pipe sprinkler system installed (5.2).

*3.4 Protection of Redundant Cables in the Switchgear Rooms

Cables which are from the opposite division to the cables in each switchgear room will be separated by a fire retardant board or blanket where redundant cables are in proximity to each other (5.7).

3.5 Protection of Redundant Cables in the Condensate Demineralizer Area

An existing wet pipe sprinkler system will be extended to protect redundant safe shutdown cables (5.3).

3.6 Protection of Redundant Circuitry in the Control Room False Floor Space

The Halon system in the control room false ceiling and floor will be modified to be actuated by smoke detectors (5.11).

All exposed cables in the false floor space will be coated with a flame retardant coating (5.11).

*3.7 Protection of Redundant Cables in the Cable Spreading Room

To protect redundant cables, either a deluge system actuated by heat and smoke detectors will be provided, or all exposed cables in cable trays will be coated with a flame retardant coating (5.8).

*3.8 Protection of Redundant Cables in the Upper North Electrical Penetration Room

Where redundant diesel generator cables are in proximity, a barrier will be provided between the cables, and the manual sprinkler system will be converted to automatic operation (5.5).

3.9 Portable Extinguisher for the Control Room

A portable water or halon extinguisher will be provided in or adjacent to the control room (5.11).

3.10 Smoke Detectors

Smoke detectors will be provided in each control room cabinet which contains safe shutdown equipment (5.11).

Additional smoke detectors will be provided such that detectors are provided in all safety-related areas containing significant combustibles (4.2)

Smoke detectors will be provided in various safety-related areas which contain no combustibles but which contain redundant safe shutdown cabling in conduit (4.2).

Power supplies for fire detectors will be modified so that all fire detectors will be powered from an emergency power source (4.2).

* 3.11 Manual Hose Stations

Manual hose stations accessible to all safety-related equipment on elevation 317 feet of the auxiliary building will be provided (5.1).

Manual hose stations will be provided in the reactor building (5.12).

*3.12 Cable Penetration Firestops

The cable penetration firestop design will be tested, and existing firestops upgraded where required by the testing (4.9.3).

3.13 Portable Smoke Exhaust Equipment

Portable smoke exhaust units with flexible ductwork will be provided so that three units are available for each ANO-1 and ANO-2 (4.4.1).

3.14 Emergency Lighting

Fixed emergency lights will be provided in the control room independent of existing normal and emergency lighting (4.6).

Portable hand held sealed beam lanterns will be provided for fire brigade use (4.6).

*3.15 Reactor Coolant Pump Oil Collection System

The reactor coolant pump oil collection system will be upgraded to provide collection capability at all potential leakage points (5.12).

*3.16 Associated Circuits

The effects of fires involving associated circuits (circuits which are connected to safety systems but perform non-safety functions) are being evaluated by the licensee. Results of the evaluation will be provided by January 15, 1979. Where a fire involving associated circuits may affect operation of safe shutdown equipment, modifications such as rerouting of cables or installation of relay contacts will be made to preclude disabling of safe shutdown equipment.(4.10)

3.17 Automatic Actuation of Sprinkler Systems

The manually actuated sprinkler systems in the diesel generator rooms will be modified to automatic actuation (5.10).

*3.18 Control of Fire Doors

Fire doors which separate redundant safe shutdown equipment or which separate safe shutdown equipment from large oil hazards will either be locked or provided with electrical supervision to alarm if opened (4.9.1).

3.19 Administrative Control Changes

Procedures are being developed or changed to incorporate controls over combustible materials and ignition sources, fire brigade staffing and training, fire fighting procedures, quality assurance provisions, and definition of fire protection duties and responsibilities (6.0).

Table 3.1

Implementation Dates for Proposed Modifications

		Implementation Dates
3.1	Portable Radio Communication Equipment	March 31, 1979
3.2	Separation of Power Cables in Manholes	End of 1980 Refueling
3.3	Protection of Redundant Cables in the Hallway - Elevation 372 Feet (98J)	*
3.4	Protection of Redundant Cables in the Switchgear Rooms (99-M, 100-N)	*
3.5	Protection of Redundant Cables in the Condensate Dimineralizer Area (73-W)	July 1979
3.6	Protection of Redundant Circuitry in the Control Room False Floor Space (129-F)	*
3.7	Protection of Redundant Cables in the Cable Spreading Room (97-R)	*
3.8	Protection of Redundant Cables in the Upper North Electrical Penetration Room (149-E)	*
3.9	Portable Extinguisher for the Control Room (129-F)	November 15, 1978
3.10	Smoke Detectors	*
3.11	Manual Hose Stations (Reactor Building and Elevation 317 Feet of the Auxiliary Building)	*
3.12	Cable Penetration Firestops	End of 1980 Refueling
3.13	Portable Smoke Exhaust Equipment	December 1, 1978
3.14	Emergency Lighting	December 1, 1978
3.15	Reactor Coolant Pump Oil Collection System	End of 1980 Refueling
3.16	Associated Circuits	End of 1980 Refueling
3.17	Automatic Operation of Sprinkler Systems (149-E, 86-G, 87-H)	*
3.18	Control of Fire Doors	March 31, 1979
3.19	Administrative Control Changes	90 days after SER issuance

(Numbers in parentheses refer to fire zone designations in the AP&L fire hazards analysis.)

* - By the end of the next refueling outage.

4.0 EVALUATION OF PLANT FEATURES

4.1 Safe Shutdown Systems

There are several arrangements of safe shutdown systems which are capable of achieving safe shut down 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. To preclude a single event from affecting redundant systems, these systems are separated into two safety divisions, either of which would be capable of achieving safe shutdown.

During or subsequent to a fire, safe shutdown could be achieved using safety-related equipment such as: the reactor trip system; the borated water tank, makeup pumps, and parts of the letdown and makeup and chemical additive systems for volume and reactivity control; emergency feedwater system; condensate storage tank; residual heat removal system; and steam relief. These safety-related systems could be used to bring the reactor down to hot shutdown conditions, and then be used for cooldown to cold shutdown conditions. Supporting systems and equipment such as the emergency diesel generators, engineered safety features batteries, and service water system would also be required.

We have evaluated the separation between redundant safe shutdown systems and components to determine that they are either separated from each other or protected by suppression systems such that a fire will not affect redundant equipment, and therefore a sufficient number of systems and components will be available to perform their shutdown function following a fire. The adequacy of separation between redundant shutdown equipment is discussed in other sections of this report.

4.2 Fire Detection and Signaling System

The plant has a protective signaling system which transmits fire alarm and supervisory signals to the control room for audible and visual operator notification. The system includes actuation and trouble signals from fire detectors, water spray systems, and fire pumps.

In general, the system complies with those portions of the NFPA Standards which are considered essential for a facility of this type. Some components of the signaling system are not provided with an emergency power supply if offsite AC power is lost; however, the licensee has proposed to provide a suitable emergency power source for these components. The main annunciator panel in the control room is not listed by a recognized testing laboratory; however, an increased frequency of testing to assure operability will be performed as required by the technical specifications. Some fire detectors are not listed by a recognized testing laboratory; the

licensee has proposed to replace these units where located in areas containing safety-related systems.

Smoke detectors have been provided in many areas of the plant and in the control room ventilation system to provide fire notification. Heat detectors are used to actuate Halon suppression systems in the control room ceiling and raised floor areas. Infra-red detectors are provided in the diesel generator rooms. Pneumatic rate-of-rise type detectors which actuate water spray systems are provided at potential turbine building oil fire hazards and outside transformers.

There are several areas in the plant that contain safety-related equipment and cabling which are not provided with fire detectors. The licensee has proposed to install detectors in such areas which contain combustibles and in certain areas containing redundant safe shutdown systems with no combustible loading. The licensee has also proposed to improve fire protection in the control room by the addition of smoke detectors in cabinets containing safe shutdown systems, and by the use of smoke detectors in lieu of heat detectors to actuate halon suppression systems in the area.

We find that, subject to implementation of these modifications, the fire detection and signaling system satisfies the objectives outlined in Section 2.2 of this report and is, therefore, acceptable.

4.3 Fire Control Systems

4.3.1 Water Systems

4.3.1.1 Water Supply

Fire water is supplied by two fire pumps located in the intake structure. These pumps are shared by Unit 1 and Unit 2. The two fire pumps take suction from separate service water bays which are normally supplied from Dardanelle Reservoir through intake screens. The service bays can also be supplied from the emergency cooling water pond which is the ultimate heat sink. The ultimate heat sink would not be degraded by fire water supply requirements.

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

4.3.1.2 Fire Pumps

Two vertical shaft centrifugal fire pumps are provided, each with a design capacity of 2,500 gallons per minute at a discharge pressure of 125 pounds per square inch gauge. One fire pump is electric motor driven; the other is driven by a diesel engine having an 8-hour fuel supply tank located in the same room as the pump. Additional diesel fuel is available from onsite storage tanks. Either of the two fire pumps has sufficient capacity to supply the maximum sprinkler demand with adequate reserve available for fire hoses.

An automatic electric jockey pump maintains pressure on the fire water piping system. The fire pumps are arranged to start automatically when a large amount of flow drops the pressure on the system; the pumps can also be started manually from the control room. Both fire pumps will continue to operate until they are shut off manually; the electric pump can be stopped from the control room, but the diesel pump can only be stopped at the intake structure.

The two fire pumps are housed in the fire resistant intake structure in individual rooms, separated by a fire barrier. The controller for each fire pump is located in the associated pump room. Both controllers are approved for fire pump service.

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

4.3.1.3 Fire Water Piping System

Each of the two fire pumps has a separate discharge into the 12-inch underground fire loop which encircles both Unit 1 and Unit 2. Valving is arranged so that a single break in the discharge piping will not remove both fire pumps from service. All yard fire hydrants, fixed water suppression systems, and interior fire hose stations are supplied by the fire loop. Sectionalizing valves are provided on the loop to allow isolation of various sections for maintenance or repair. For certain areas inside the plant, both fixed suppression systems and interior fire hose stations are supplied by a common piping system, so that both primary and backup protection could be lost by a single break or closure of a control valve. For such piping system failures, hoses could be run from outside hydrants to provide protection during the short interval while repairs are being made. Such alternative protection is required to be provided by the technical specifications. Valve position is assured as follows:

Some fire water system control valves are electrically supervised; others, including those on the underground fire loop and at the fire pumps, are not. The facility's technical specifications require a periodic check of the position for those valves which are not locked, sealed, electrically supervised, or otherwise secured in position to assure that valves are maintained in the open position.

Yard fire hydrants have been provided at approximately 250- to 300-foot intervals around the exterior of the plant. An auxiliary gate valve is provided on each hydrant lateral to permit maintenance without removing a portion of the fire loop from service. A hose house at each fire hydrant is equipped with 2-1/2-inch fire hose and other manual fire fighting tools. The hydrant hose threads are compatible with those of the local fire department.

We find that the fire water piping system satisfies the objectives of Section 2.2 of this report and is, therefore, acceptable.

4.3.1.4 Interior Fire Hose Stations

Stations with 75 feet of 1-1/2-inch fire hose have been provided throughout the plant, except in containment. There are a few areas in the auxiliary building that contain safety-related systems which cannot be reached from the existing hose stations. The licensee has proposed to install additional fire hose stations so that all such areas containing combustibles can be reached with not greater than 100 feet of hose; fire hose station capability will also be provided inside containment.

Nozzles on the hose lines are of the adjustable spray type; in areas of potential electrical fires, they are of a type rated for this service.

We find that, subject to implementation of these modifications, the interior fire hose installation satisfies the objectives of Section 2.2 of this report and is, therefore, acceptable.

4.3.1.5 Water Suppression Systems

Automatic wet pipe sprinklers are provided in portions of the turbine building containing lube oil piping, and in some areas of the auxiliary building including the cable spreading room. Automatic water spray systems are provided on outside oil-filled transformers and on lube oil storage and pump areas in the turbine building. Manually operated deluge systems are provided in the diesel generator rooms and diesel fuel tank bunkers. Manually operated closed head sprinklers are provided in the electrical penetration areas, both inside and outside containment. The licensee has proposed to change the manually operated systems in the diesel generator rooms, and in one electrical penetration area to automatic operation.

In some areas containing multiple tiers of electrical cable on trays, ceiling level sprinklers may be unable to effectively suppress fires in the lower trays. However, our review of these areas indicates that with the separation provided and the modifications proposed, the protective systems as installed will prevent loss of redundant systems required for safe shutdown.

For details of each specific area, see Section 5.0.

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

4.3.1.6 Foam

The plant has available a supply of foam and a nozzle for manual fire fighting. We find that the foam and the nozzle for manual fire fighting conforms to the provisions of Appendix A to BTP 9.5-1, and are therefore acceptable.

4.3.1.7 Effects of Suppression Systems on Safety Systems

The discharge of water from the operation of fire suppression systems has been considered in the plant design. Floor drainage has been provided in all plant areas having sprinklers and fire hose. In areas where the floor drainage capacity is such that the expected maximum discharge of fire suppression systems could cause a water build-up in excess of 2 inches, all safety-related equipment necessary for safe shutdown has been located to preclude damage. Water spray from automatic suppression system actuation or piping breaks will not incapacitate safe shutdown systems.

We find that the protection provided safety systems from the effects of suppression systems satisfies the objectives of Section 2.2 of this report and is, therefore, acceptable.

4.3.2 Gas Fire Suppression Systems

Separate automatic, total flooding Halon 1301 fire suppression systems are provided for the control room ceiling space, the auxiliary control room raised floor space and ceiling space, and the record storage room. A low pressure carbon dioxide system is being installed to protect the main turbine bearings and exciter housing.

The gas suppression systems are designed to comply with NFPA standards 12 and 12A, as applicable.

The systems in the control room concealed ceiling space and auxiliary control room concealed ceiling and floor space are activated by heat detectors which could delay response. The licensee has proposed to modify these systems to provide actuation by smoke detectors to increase their operating speed and effectiveness.

For details of each specific area, see Section 5.0.

We find that, subject to implementation of these modifications, the gas fire suppression systems conform to the provisions of Appendix A to BTP 9.5-1 and are, therefore, acceptable.

4.3.3 Portable Fire Extinguishers

Portable carbon dioxide and dry chemical fire extinguishers have been provided throughout the plant in accordance with the requirements of NFPA 10, "Portable Fire Extinguishers." The licensee has proposed to provide a water or Halon 1211 type extinguisher at the control room to combat deep-seated fires in electrical insulation and fires in Class A combustibles.

Subject to implementation of the above described modification, we find the portable fire extinguisher installation conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.4 Ventilation Systems and Breathing Equipment

4.4.1 Smoke Removal

The plant has special ventilation systems in the control room and the computer room that may be used for smoke removal. Smoke and heat relief vents are provided in the turbine building roof. The ESF pump rooms are provided with an airpurge damper that could be used to remove smoke via the building ventilation system. The diesel generator rooms' exhaust ventilation systems could be utilized to remove smoke and heat from these areas.

Other portions of the plant did not have exhaust systems designed specifically for smoke removal. However, the ventilation systems in most areas could be used for limited smoke removal. The effectiveness of these systems is limited because: fans and other equipment may not be able to withstand high temperatures and could be rendered inoperative by heat from a significant fire; the capacity and configuration of the normal air-handling system may preclude effective smoke removal; heat actuated dampers may close; and some ventilation system power supply cables may be affected by a fire.

In view of the potential limitations of dependence upon normal air handling systems for smoke removal, the licensee has proposed to provide portable smoke removal fans and ducting of a type used in public fire fighting and which we find acceptable for nuclear power facilities. Subject to implementation of this modification; the smoke removal capability satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.4.2 Filters

The pre-filters and HEPA filters utilize a low fire hazard filter media. Charcoal filter units are enclosed in substantial metal housings and the units serving the control room and the penetration rooms are provided with detectors which will alarm in the control room if overheating occurs. The filter units do not present a significant fire exposure to safe shutdown systems.

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

4.4.3 Breathing Equipment

A sufficient number of self-contained breathing units with spare bottles and refill capability is provided at the facility to supply the operating crew and fire brigade for a period of at least 6 hours. We find that the breathing equipment conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.5 Floor Drains

The floor drainage system for the auxiliary building is separate from that of the turbine building, except for the diesel generator rooms and one small equipment drain. The drains for the diesel generator rooms have been equipped with backwater valves to prevent the spreading of flammable liquid fires via the floor drain system. The elevation of the equipment drain with respect to the main drainage header precludes fire spread.

The diesel fuel storage vaults are equipped with individual sump pumps that are connected to a main sump by drains with normally closed valves; this will prevent a fire from involving more than one vault through the floor drain system.

We find that the protection to prevent the spread of fire through floor drain systems satisfies the objectives of Section 2.2 of this report and is, therefore, acceptable.

4.6 Lighting Systems

In addition to the normal plant lighting, emergency lighting systems powered by either the emergency generators or the 125-volt station battery system are provided. Battery powered wall mounted emergency lighting units are provided in some areas. The licensee has proposed to install additional battery powered wall mounted emergency lighting units in the control room, since this room could lose both normal and emergency lighting as a result of fire damage to distribution panels and associated electrical cables in the turbine building. Fires in other areas would not cause loss of both normal and emergency lighting to areas providing access to the fire area.

The licensee has also proposed to provide battery powered sealed beam portable lights for use by fire brigade personnel.

We find that, subject to implementation of these modifications, the lighting systems satisfy the objectives of Section 2.2 of this report and are, therefore, acceptable.

4.7 Communication Systems

Communication systems include an in-plant PAX and a 4-channel intercom system. Portable radios and fixed repeaters are being provided for security use which will also be available for emergency use by the fire brigade, should the PAX and intercom systems be damaged by a fire.

The communications systems meet the objectives outlined in Section 2.2 of this report and are, therefore, acceptable.

4.8 Electrical Cable

The cables used in the plant were required to pass IPCEA Standard S-19-81 flame tests.

The flame tests showed that the ANO-1 cabling does not burn vigorously in the configurations used in the test. We find that retest to the IEEE Standard 383 procedure and criteria would not provide information that would change any of our recommendations or conclusions. Accordingly, we find the electrical cables used at the Arkansas Unit 1 plant acceptable.

4.9 Fire Barrier Penetrations

4.9.1 Fire Doors

Doorway penetrations in barriers between fire areas are equipped with 3-hour labeled fire doors. The licensee has proposed to either lock or alarm fire doors immediately separating fire zones containing safe shutdown equipment from redundant equipment or from large fire hazards.

We find that protection of doorway penetrations in fire barriers conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.9.2 Ventilation Duct Penetrations

Fire dampers equivalent to the barrier requirements have been provided where ventilation ducts pass through fire barriers. We find that this conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

4.9.3 Electrical Cable Penetrations

Electrical cable penetrations in fire barriers have been sealed with constructions using mineral board, ceramic fiber and sprayed mastic or cellular concrete. The licensee has proposed to provide the results of fire tests to demonstrate the fire resistance of cable penetration seals when exposed to an ASTM E-119 type test fire, and to upgrade seals to acceptable standards.

Subject to implementation of these modifications, the cable penetration seals in fire barriers meet the objectives outlined in Section 2.2 of this report and are, therefore, acceptable.

4.10 Separation Criteria

The licensee has stated that the separation of the reactor protection system and engineered safety features is accomplished by spatial separation in accordance with the following criteria:

"(1) Separation distances for trays containing redundant cables are as follows:

(a) Horizontal Separation

In rooms containing heavy rotating machinery or high pressure pipe lines, a minimum separation of 20 feet or a 6-inch thick reinforced concrete wall is provided. In fire hazard areas a separation of 3 feet or a barrier equivalent to one inch of transite, covered with a sheet of 16 guage steel is provided.

(b) Vertical Separation

A vertical separation of 5 feet is generally provided. Where physical conditions do not permit 5 feet of separation, either the lower tray is equipped with a solid steel cover or the upper tray is equipped with a solid steel bottom, or a barrier, similar to the one described for horizontal separation, is provided.

(2) Redundant cables are routed only in conduits inside the cable spreading room and under the raised floor in the control room.

(3) Redundant wiring and components in control boards, panels, and racks are either separated by a steel barrier or at least 6 inches of space. Some wiring and components are common to the two redundant

safeguard channels. Also in many cases interlocks are required between equipment of different channels to perform certain safety functions. The cables containing these common or interlocking conductors are color coded green when they are routed through the raceway system between panels belonging to different safeguard channels. These cables are run in flexible steel conduits inside the control panels. The flexible steel conduit is extended as close to the terminals as physically possible.

(4) Separate cable tray, conduit and penetration systems are installed for the following classes of cable; 8 KV, 5 KV, 600-volt power and control, and the instrumentation cable. In general, power cables are run in the top trays, with control and instrumentation in the lower trays.

(5) Shielded instrumentation cables and thermocouple cables are not run in the same trays as the control cables.

(6) Non-engineered safeguard circuits and engineered safeguard circuits may share the same cable trays, but the routing is controlled such that the non-engineered safeguards circuits will not cross over into other redundant engineered cable trays. Where a non-vital cable from a channel "2" redundant source (ac or dc) is routed with the vital cables that are supplied from the other redundant source, channel "1", and vice versa, this non-vital cable is run in steel conduit between the channel "2" source and the channel "1" cable tray and vice versa.

(7) Protection system, safety feature system, and Class 1E electrical system components mounted on control boards, panels, and relay racks are designed for operator convenience and physical separation between redundant wiring and components.

Generally, redundant channel wiring enters the control panels in conduits. The bulk of redundant wiring inside control panels are separated by a steel barrier. However, wiring which is common to two different redundant channels exist. These common wires are color coded green. For example this necessitates that in certain cases green wires must pass through red compartments. However these wires are routed in conduits inside the panels except where physically impossible. In this case, with the approval of engineering and QA, these wires will be fireproofed using a suitable fireproofing tape. The conduit is terminated or the wires are taped as close as possible to the device to which these wires are connected. "

In general, separation between redundant divisions far exceeds these minimum requirements and is such that most fires would not cause functional loss of redundant safe shutdown equipment. The separation criteria does not preclude the crossing of such cables nor does it consider the possibility of heat buildup in a room. However, the licensee has performed a detailed fire hazards analysis for each area of the plant containing safety-related

equipment to determine the possible effects of fires on safe plant shutdown. Each of the safety-related areas is discussed in more detail in Section 5.0 of this report. In various areas the licensee has proposed certain modifications where the existing cable separation was found inadequate to assure that fire will not cause damage to redundant safe shutdown equipment. The specific areas where this additional protection is to be provided are identified in Section 5.0 of this report.

The licensee has proposed to evaluate the effects of fires on nonsafety-related circuits associated with safe shutdown systems to determine whether these systems could be disabled by a fire involving associated circuits. Where such disabling may occur, the licensee has proposed to eliminate the possibility by modifications. This may include rerouting of cables or isolating the associated circuits with relay contacts. We find that either of these modifications provides an acceptable solution should any such situations be discovered in the evaluation.

4.11 Fire Barriers

Substantial fire barriers have been provided throughout the plant. The licensee's fire hazards analysis concludes that the basic wall, floor and ceiling structures bounding each fire area have adequate resistance to prevent the spread of an unsuppressed fire through the barrier. In some cases, fire zone boundaries are not established by fire barriers. However, the licensee's fire hazards analysis indicates that sufficient separation is provided by space, low combustible loading and other construction features to preclude fire spread between zones. The staff did not identify in its review any barriers that required modifications to a higher fire resistance rating, or areas where separation of fire zones was inadequate to prevent involvement of equipment in adjacent zones by a fire.

The fire barriers meet the objectives outlined in Section 2.2 of this report and are, therefore, acceptable.

4.12 Access and Egress

All safety-related areas and areas containing safe shutdown equipment are reasonably accessible in a fire situation with many areas having two or more entrances. Fires in the few safe shutdown areas having only one entrance would not hinder access to the areas, and the light to moderate combustible loading in these areas would not prevent entrance into these areas to suppress fires which may occur. On this basis, we find that existing access and egress capability is acceptable.

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 is relied upon to minimize the generation of such products. Additionally, proposals have been made by the licensee for portable smoke removal equipment and training of the fire brigade in the use of this equipment and in the use of emergency breathing appliances. We find that, subject to implementation

of the proposed modifications described in this report, the measures taken to control and prevent development of toxic and corrosive combustion products satisfy the objectives in Section 2.2 of this report and are, therefore, acceptable.

4.14 Nonsafety-Related Areas

We have evaluated the separation by distance or by fire barriers of safe shutdown systems from nonsafety-related areas to determine that fires in such areas will not adversely affect the ability to safely shut down the plant. Nonsafety-related areas which potentially pose a fire hazard to safe shutdown equipment are addressed in Section 5.0 of this report.

The licensee has considered the effects of fires in radwaste areas in performing the fire hazards analysis and found that no fires would result in releases of plant effluents to the plant environment.

5.0 EVALUATION OF SPECIFIC PLANT AREAS

The licensee has performed a fire hazards analysis of the facility to determine the fire loading of 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. We have evaluated the assumptions, methodology, and conclusions of the fire hazards analysis in detail, as well as supplemental drawings showing cable routing and separation. 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 to assure that the objectives stated in Section 2.1 were met. The staff's evaluation of specific areas is discussed in the following subsections.

5.1 Auxiliary Building-Elevation 317 Feet

5.1.1 Safety-Related Equipment

The safety-related equipment in these areas include the decay heat removal heat exchangers and pumps, the reactor building spray pumps, and safety related cabling. The equipment that may be required for safe shutdown in a fire emergency includes the decay heat removal heat exchangers and pumps, and safety-related cabling.

The pumps for each division are located in separate rooms. However, the walls are not three-hour fire-rated.

5.1.2 Combustibles

The significant combustible in this area is a moderate amount of lubricating oil associated with the pumps. Cabling for the pumps is contained in conduit.

5.1.3 Consequences if No Fire Suppression

An unmitigated lubricating oil fire in the pump rooms would not likely spread out of the affected room, due to the limited amount of oil in each pump.

An unmitigated lubricating oil fire in these areas would not affect redundant safe shutdown related cables due to the low-combustible loading, and the separation from each other and from combustibles in the area.

5.1.4 Fire Protection Systems

There is no fire detection or automatic suppression for the pump rooms or access areas. The licensee relies on portable extinguishers, and hose stations at the next higher elevation, to fight fires in these areas.

5.1.5 Adequacy of Fire Protection

With prompt fire detection, manual suppression would be adequate to extinguish fires in these areas and limit involvement of safety equipment. However, the fire protection for these areas is inadequate due to the lack of smoke detectors and water hose stations.

5.1.6 Modifications and Recommendations

The licensee has proposed to provide smoke detectors in these areas and hose stations that can reach the combustibles in these areas with an effective hose stream.

Subject to implementation of these modifications, we find that fire protection for these areas satisfies the objectives detailed in Section 2.2 of this report and is, therefore, acceptable.

5.2 Auxiliary Building Hallway at Elevation 372 Feet

5.2.1 Safety-Related Equipment

This area is adjacent to the cable spreading room and a battery room on one side, and the other battery room and a switchgear room on the other side, and has a doorway to the turbine building. The area is bounded by three-hour fire-rated walls. A considerable quantity of safety-related and nonsafety-related cables are in open trays and in conduits. Safe shutdown systems that potentially may be affected are service water, diesel generators, makeup pumps, and emergency feedwater.

5.2.2 Combustibles

The significant combustible material in this area consists of a large quantity of electrical cable insulation in open cable trays.

5.2.3 Consequences if No Fire Suppression

An unmitigated fire in this area could involve redundant safety divisions due to heat generation, radiant energy, or direct flame impingement. The licensee's fire hazards analysis shows that separation of safe shutdown cables is generally good. However, there are a few locations where cables affecting redundant safe shutdown systems cross and an unmitigated fire in this area could cause loss of control of these systems from the control room, requiring manual operation of valves and switchgear to operate safe shutdown equipment.

5.2.4 Fire Protection Systems

There is no automatic suppression or fire detection capability in this area. Manual hose stations and hand held extinguishers are available for fighting fires in this area.

5.2.5 Adequacy of Fire Protection

The existing manual suppression capability would be adequate to control fires in this area if promptly detected; however, it may not be adequate to prevent involvement of redundant safe shutdown equipment.

5.2.6 Modifications and Recommendations

The licensee has proposed to provide a directional spray system actuated by heat and smoke detection and provide flame retardant cable coating where redundancies are in proximity, or coat all trays with flame retardant and provide smoke detection and a wet pipe sprinkler system. We find that, subject to implementation of either of the above described modifications, fire protection for the hallway-elevation 372 feet of the auxiliary building satisfies the objectives detailed in Section 2.2 of this report and is, therefore, acceptable.

5.3 Auxiliary Building

5.3.1 Safety-Related Equipment

The safety-related control room, cable spreading room, switchgear rooms, electrical penetration areas, piping penetration areas, diesel generator rooms, battery rooms, auxiliary feedwater pump rooms and hallway at elevation 372 feet are in the auxiliary building, but are addressed in other sections of this report. The remainder of the auxiliary building contains areas with safety-related cables; a few of these areas contain redundant safe shutdown cables. The makeup pumps are also within this area, each located in a separate room. The makeup pumps would be required for safe shutdown to provide primary system makeup and boration.

5.3.2 Combustibles

The significant combustibles in these areas of the auxiliary building are a small amount of cable insulation and a moderate amount of lubricating oil associated with the makeup pumps.

5.3.3 Consequences if No Fire Suppression

The licensee has evaluated the consequences of fires in these rooms and shown that, in most areas, the separation of redundant cables from combustibles or the separation between redundant cables is such that it is highly unlikely that an unmitigated fire would involve such cables. In the condensate demineralizer area, however, an unmitigated fire may cause loss of redundant safe shutdown systems.

5.3.4 Fire Protection System

There are no detection devices in these areas of the auxiliary building. Two areas are provided with sprinkler protection, the laboratory/demineralizer area and the controlled access area. Hose stations are accessible to all areas and portable extinguishers are provided.

5.3.5 Adequacy of Fire Protection

With prompt fire detection, manual suppression would be adequate to control fires in these areas and limit the effects of the fire. Lack of detection may allow the fire to continue unnecessarily. Despite suppression, in the condensate demineralizer area a fire may affect redundant safe shutdown systems due to the proximity of the cables to each other.

5.3.6 Modifications and Recommendations

The licensee has proposed to install smoke detection devices in these areas to detect cable fires or other fires that may jeopardize safety related equipment. Additionally, an automatic wet pipe sprinkler system will be extended to protect redundant safe shutdown cabling in the condensate demineralizer area. Subject to implementation of these modifications, we find fire protection for these areas satisfies the objectives detailed in Section 2.2 of this report and is, therefore, acceptable.

5.4 Piping Penetration Areas - Auxiliary Building

5.4.1 Safety-Related Equipment

Each of the piping penetration areas generally has cables and valves associated with one of the redundant divisions. There are, however, a few cables and valves from the redundant division located in these areas. Some of this equipment would be required for safe shutdown.

5.4.2 Combustibles

These areas contain no exposed combustibles. Cabling is contained in conduit.

5.4.3 Consequences if No Fire Suppression

Postulated fires in these areas could only result from transient combustibles. Due to the separation of redundant cables, fires in most locations would not affect redundant equipment. In a few locations, redundant safe shutdown cabling is in proximity to each other and may be damaged in a fire involving transients, although unlikely.

5.4.4 Fire Protection Systems

Fire detection or automatic suppression equipment has not been provided in these areas. Portable extinguishers are located within and adjacent to these areas. Manual hose stations are not accessible to all of these areas with the existing hose available at the hose station.

5.4.5 Adequacy of Fire Protection

Due to the low combustible loading, manual fire protection using portable extinguishers would be adequate to extinguish fires in these areas and to prevent the loss of redundant safe shutdown equipment. However, without adequate detection in these areas, fires could proceed undetected and allow the damage of safety-related equipment some of which may be used for safe shutdown.

5.4.6 Modifications and Recommendations

The licensee has proposed to install smoke detectors in the piping penetration areas to detect fires in transient combustibles.

Subject to implementation of this modification, we find that fire protection for the piping penetration areas satisfies the objectives of Section 2.2 of this report and is, therefore, acceptable.

5.5 Containment Electrical Penetration Areas

5.5.1 Safety-Related Equipment

There are four containment electrical penetration areas in the auxiliary building. These areas are mainly devoted to the passing of cables of one division into containment. There are, however, a few cables from the redundant division routed through these areas in two of the four areas.

5.5.2 Combustibles

The significant combustible materials in these areas consist of a moderate amount of organic type electrical cable insulation in open trays and in a motor control center cabinet.

5.5.3 Consequences if No Fire Suppression

A few cables from the redundant division were routed through two of these areas. The licensee has evaluated the loss of cables in these areas and has found that for three areas the complete loss of the cables would not affect redundant safe shutdown equipment. In one of the areas, diesel generator exhaust fans could be affected.

5.5.4 Fire Protection Systems

The primary means of fire suppression in each of these areas is a closed head sprinkler system with a manually initiated inline control valve.

The ionization type detectors are provided for early warning to allow manual fire suppression before the postulated fire is able to significantly propagate. Manual hose stations and hand held portable extinguishers are provided as backup.

5.5.5 Adequacy of Fire Protection

For three of the penetration areas the existing sprinkler system protection is adequate to prevent involvement of redundant safe shutdown equipment. For the one penetration area where redundant cables required for safe shutdown are located, the separation is not sufficient to assure a fire could be extinguished prior to involvement of redundant cables. A local fire could cause damage to occur to redundant safe shutdown cables due to the proximity of the cables and the lack of automatic initiation of the suppression system.

5.5.6 Modifications and Recommendations

The licensee has proposed, in the upper north electrical penetration area, to modify the existing sprinkler system to provide automatic actuation and to install barriers between redundant safe shutdown related cables to protect against both being affected by a fire.

Subject to implementation of the above described modifications we find that the fire protection for these areas satisfies the objectives of Section 2.2 of this report and is, therefore, acceptable.

5.6 Emergency Feedwater Pump Room

5.6.1 Safety-Related Equipment

The two safety-related emergency feedwater pumps are located in this room. At least one emergency feedwater pump should be available for safe shutdown.

5.6.2 Combustibles

The significant combustible in these rooms is a few quarts of lube oil associated with the pumps.

5.6.3 Consequences if No Fire Suppression

Due to the low combustible contents of the area, there is sufficient separation between the emergency fuel water pumps that only one pump would be effected by an unmitigated fire.

5.6.4 Fire Protection Systems

There is no detection or automatic fire suppression for this room. A manual hose station accessible to this room is available.

5.6.5 Adequacy of Fire Protection

With prompt fire detection, manual fire suppression capability provided would be adequate to suppress fires in the emergency feedwater pump rooms and may allow suppression of a fire before either emergency feedwater pump is lost. The lack of detection would allow the fire to continue unnecessarily.

5.6.6 Modifications and Recommendations

The licensee has proposed to add smoke detection devices in this area to provide prompt notification to the control room for fires in these areas.

Subject to implementation of this modification, we find that fire protection for these areas conforms to the provisions of Appendix "A" to BTP 9.5-1 and is, therefore, acceptable.

5.7 Switchgear Rooms

5.7.1 Safety-Related Equipment

The two switchgear rooms are located on elevation 372 feet of the auxiliary building. Each of the rooms contains primarily four kilovolt switchgear and associated cabling of one safety division. There are a few cables from the redundant division routed through each of the switchgear rooms.

5.7.2 Combustibles

The switchgear rooms contain combustible electrical cable insulation in trays and inside electrical cabinets. The trays are lightly loaded and represent only a moderate fire load.

5.7.3 Consequences if No Fire Suppression

In either switchgear room, an unsuppressed fire could result in severe damage to the electrical cables and cabinets of the associated safety train. In addition, an unsuppressed fire in either of the switchgear rooms could potentially result in the loss of redundant safety-related equipment some of which is required for safe shutdown.

5.7.4 Fire Protection Systems

There are no automatic fire suppression systems provided for the switchgear rooms. Each room is enclosed by walls with a three-hour fire rating. Ionization smoke detectors are installed to provide prompt warning in the control room. The fire suppression capability consists of manual hose stations and portable extinguishers.

5.7.5 Adequacy of Fire Protection

The manual fire protection provided for these areas would be adequate to control and extinguish a fire in either of these areas. However, there is a remote possibility that a fire in either switchgear room could affect redundant safe shutdown cables prior to suppression of the fire due to the proximity of certain cables.

5.7.6 Modifications and Recommendations

The licensee has proposed to provide fire retardant board or blanket barriers to prevent fire from involving redundant cables required for safe shutdown in each of the switchgear rooms.

We find that, subject to implementation of this modification, fire protection for the switchgear rooms satisfies the objectives of Section 2.2 of this report and is, therefore, acceptable.

5.8 Cable Spreading Room

5.8.1 Safety-Related Equipment

The cable spreading room is located at elevation 374 feet directly below the control room. Redundant divisions of safety-related cables are routed through the room.

5.8.2 Combustibles

The significant combustibles in this area consist of a large amount of organic type electrical cable insulation. All safety-related cables are in conduit located above the nonsafety cables in open trays.

5.8.3 Consequences if No Fire Suppression

An unmitigated fire in this room could become large enough to affect cables from both redundant divisions due to direct involvement or due to heat buildup in the room. A loss of the cable spreading room would cause the loss of control of redundant safe shutdown equipment from the control room.

5.8.4 Fire Protection Systems

Automatic smoke detectors mounted at ceiling level are provided. Detectors provide alarms in the control room. An automatic closed head sprinkler system is provided to suppress fires. Hose stations accessible to the area are also available.

5.8.5 Adequacy of Fire Protection

The ionization type smoke detector will provide rapid response to incipient fires in cable trays. The automatic suppression system provided may not be adequate to suppress localized fires rapidly enough to prevent the involvement of redundant safe shutdown equipment due to the location of the sprinkler heads and the need for heat buildup to actuate

the system. Some redundant cables may become involved in a fire in a localized area. Hose stations are easily accessible to the room and adequate access is provided to fight fires manually.

5.8.6 Modifications and Recommendations

The licensee has proposed to either: modify the existing sprinkler system to a spray system actuated by heat and smoke detectors; or to provide flame retardant coatings for each open cable tray in conjunction with the existing sprinkler system.

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

5.9 Battery Rooms

5.9.1 Safety-Related Equipment

There are two engineered safety features battery rooms located at elevation 372 feet, each is enclosed by three-hour fire rated walls, floor, and ceiling. Each room contains the batteries and cables from only one of the two redundant divisions of safety equipment.

5.9.2 Combustibles

The significant combustibles in the battery rooms are the plastic battery cases. Hydrogen buildup is precluded by continuously operating ventilation exhaust fans. An alarm in the control room is provided to signal loss of ventilation flow.

5.9.3 Consequences if No Fire Suppression

An unsuppressed fire in a battery room could cause the loss of one of the redundant batteries, but would not affect the redundant battery.

5.9.4 Fire Protection Systems

Automatic smoke detection which alarms to the control room is provided. Portable extinguishers are available and fire hose stations are accessible to the rooms.

5.9.5 Adequacy of Fire Protection

In view of the limited quantity of combustibles, the redundant battery would not be affected since the fire would be contained by the three-hour rated fire enclosure. The detection and suporession provided is adequate to detect and extinguish fires which may occur in these rooms.

5.9.6 Modifications and Recommendations

We find the fire protection for the battery rooms conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.10 Diesel Generator Rooms

5.10.1 Safety-Related Equipment

Each of the two redundant diesel generator rooms contains a diesel generator unit along with associated safety-related control panels, cabling, and fuel oil day tank. Only one division of this equipment is necessary for safe shutdown upon loss of offsite power.

5.10.2 Combustible

Significant combustibles in each room include diesel-generator lubricating oil, diesel fuel oil in fuel lines and the day tank, and electrical cable insulation. The day tanks are located integral with the base of the diesel generator in a heavy welded steel enclosure.

5.10.3 Consequences if No Fire Suppression

An unmitigated fire in one diesel generator room could cause loss of availability of one redundant division of safety-related equipment if normal AC power is also not available. The redundant diesel generator would not be affected due to the separation of the diesels by three-hour fire-rated walls and doors.

5.10.4 Fire Protection Systems

The primary suppression in each room is a manually actuated deluge system which can be operated from the control room. Backup suppression is provided by a hose station located outside of the rooms and portable extinguishers. Early warning fire detection is provided by flame and smoke detectors.

5.10.5 Adequacy of Fire Protection

The sprinkler system would be adequate to control large fires and suppress small fires, once manual action was taken to activate the sprinkler system. However, the lack of automatic actuation could allow fires to become unnecessarily large prior to manual actuation.

Smoke detection is adequate to provide early warning of fires.

5.10.6 Modifications and Recommendations

The licensee has proposed to modify the suppression system for the diesel generator rooms to be an automatically actuated system to insure prompt suppression of fires in these areas.

Subject to implementation of this modification, we find that fire protection for the diesel generator rooms conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.11 Control Room

5.11.1 Safety-Related Equipment

The control room contains safety-related cables within control cabinets and consoles. Certain of these cables and control cabinets would be required for safe shutdown. Redundant safety-related cables, some of which are required for safe shutdown, are located in the below/floor space.

5.11.2 Combustibles

The significant combustibles in this area consist of electrical cable insulation, electrical components in panels and consoles, and a small amount of class A combustibles such as log books, drawings, operating procedures and computer printouts.

The below/floor space contains a moderate amount of cable insulation.

5.11.3 Consequences if No Fire Suppression

A postulated unmitigated fire in the control room below/floor space has the potential for damaging redundant safety-related cabling some of which may be required for safe shutdown. The safety related cabling is in conduit, but may be exposed by fires in nonsafety related cables in open trays.

A postulated fire in certain control room cabinets or consoles would affect safe shutdown systems. The redundant systems are, however, located in separate cabinets. Due to the separation provided and the low combustible load, it is unlikely that an unmitigated fire would affect redundant systems.

5.11.4 Fire Protection Systems

Smoke detectors are located above the ceiling and in the exhaust ducts which ventilate the control cabinets. Smoke detectors are not provided inside of panels or consoles. Automatic Halon systems actuated by heat detectors are provided for the above ceiling and below floor spaces.

Portable fire extinguishers are located in the control room, and a manual hose station is located outside the control room. However, no Class A rated extinguisher is provided.

5.11.5 Adequacy of Fire Protection

The location of the detectors in the ventilation exhaust duct is such that the combustion products from a small fire in a panel would be diluted by air from other sources causing a reduction in the system's capability to detect such a fire. Fires may, therefore, cause significant damage to safety-related systems. In view of the light combustible loading and the separation provided, with prompt detection, manual suppression would be adequate to control and suppress fires which may occur.

The automatic Halon system for the below floor space uses heat sensors to actuate the system which act more slowly than smoke detectors and hence, may allow damage to redundant safe shutdown systems prior to actuation.

5.11.6 Modifications and Recommendations

The licensee has proposed to install smoke detectors in each safety-related cabinet and console containing safe shutdown equipment and to provide a portable water or Halon 1211 class A extinguisher.

The licensee has also proposed to modify the Halon systems for the below floor and above ceiling spaces to provide a faster response by using smoke detectors for actuation. In addition, to prevent damage to redundant systems prior to actuation of the Halon system, the licensee has proposed to coat the exposed nonsafety-related cable in open trays in the below/floor space with a flame retardant coating.

Subject to implementation of these modifications, we find fire protection for the control room conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.12 Reactor Building

5.12.1 Safety-Related Equipment

Safety-related equipment in containment includes: reactor vessel primary coolant piping, core flood tanks, pressurizer, instrumentation, containment air coolers, valves, and associated cabling.

5.12.2 Combustibles

Significant combustibles in containment include a large quantity of electrical cable insulation and the lubricating oil associated with each of the four reactor coolant pump motors. The cable insulation is most highly concentrated at the penetration areas in containment; however, the cables are divisionally separated into different widely separated penetration areas.

5.12.3 Consequences if No Fire Suppression

An unmitigated fire involving oil from a reactor coolant pump would most likely result in damage to only one pump due to the oil containment system for oil leaks which limits the amount of oil available to burn to a small amount and because the pumps are widely separated in separate cubicles, thus, there is sufficient physical separation. The separation of cables is such that a fire in the vicinity of one pump would not cause loss of safe shutdown capability. However, the adequacy of the oil collection system has not been demonstrated by the licensee.

An unsuppressed fire in electrical cables at the penetration areas inside containment would cause significant damage to safety-related cables, but would only involve cables from one safety division and would not affect safe shutdown of the plant.

5.12.4 Fire Protection Systems

Manually controlled closed-head fire suppression systems are provided at the electrical penetration areas in containment. These systems have fusible element heads, and control valves actuated by control switches in the control room or from a pull box near the control valve. In addition, ionization detectors are provided to give early warning of fire conditions.

Portable extinguishers are provided at various elevations in containment; however, no manual hose stations are provided.

Lubricating oil catch basins for the reactor coolant pumps are provided which would drain oil leakage to a container, and thus mitigate the effects of a reactor coolant pump motor fire; however, the adequacy of these basins to collect oil from all potential leakage points has not been demonstrated by the licensee.

5.12.5 Adequacy of Fire Protection

The sprinkler systems at the cable penetration areas would be adequate to control fires in these areas and reduce the loss of safety-related equipment.

The reactor oil catch basins which drain to diked tanks at the bottom floor of the reactor building may not serve for all possible leaks.

Portable extinguishers would not be adequate to suppress cable insulation fires or in residual oil on the reactor coolant pump.

5.12.6 Modifications and Recommendations

The licensee has proposed to (1) evaluate the reactor coolant pump oil containment system and to upgrade the containment system where necessary to assure that oil leaks are contained in accordance with guidelines given by the staff and committed to by the licensee, and (2) provide hose stations within containment to fight fires.

We find that, subject to implementation of these modifications, the fire protection for the reactor building conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

5.13 Intake Structure - Service Water Pumps

5.13.1 Safety-Related Equipment

The intake structure contains three service water pumps and the electrical cabling associated with these pumps. At least one of these pumps would be required for safe shutdown. The two fire pumps are also located in this area, in separate three-hour fire-rated enclosures.

5.13.2 Combustibles

The significant combustibles in this area include a small amount of lubricating oil associated with the service water pumps, a small amount of electrical cable insulation, and the lube oil and day tank fuel supply for the diesel fire pump.

5.13.3 Consequences if No Fire Suppression

An unsuppressed service water pump lubricating oil fire would not affect more than one service water pump due to the small quantity of oil, the physical separation and barriers between pumps, and the open vents to atmosphere to relieve any heat buildup. An unsuppressed fire in either fire pump soon would only affect that pump due to the fire rated enclosure.

5.13.4 Fire Protection Systems

There is no fire detection or automatic fire suppression in this area. Yard hydrants and hose houses are located within reach of this area.

5.13.5 Adequacy of Fire Protection

Fire protection for this area is inadequate in that no means to detect fire in this area which contains safety-related equipment has been provided. With prompt detection, manual hoses and extinguishers would be adequate to extinguish fires in the area.

5.13.6 Modifications and Recommendations

The licensee has proposed to install smoke detectors in the intake structure to alarm in the control room in event of a fire.

Subject to implementation of this modification, we find fire protection for the intake structure satisfies the objectives detailed in Section 2.2 of this report and is, therefore, acceptable.

5.14 Yard Area

5.14.1 Safety-Related Equipment

The safety-related equipment in the yard area includes underground power cables to the service water pumps at the intake structure, the two underground diesel fuel storage tanks, and the refueling water tank.

5.14.2 Combustibles

The significant combustibles which were considered because of their potential for exposure to safety-related systems included oil-filled transformers, underground diesel storage tanks, and an oil-fired auxiliary boiler and fuel tank. In addition, the potential exists for the introduction of significant combustibles to the yard area, such as fuel oil trucks. No significant combustibles are located in the area of the refueling water storage tank.

5.14.3 Consequences if No Fire Suppression

An unsuppressed fire in the transformers auxiliary boiler, or storage tanks in the yard area would not present a significant fire exposure to safety-related systems because of intervening distance or barriers. However, the manholes contain redundant electrical cables which extend to the service water pumps at the intake structure. These cables are located in open trays within the manholes

separated vertically by about twelve inches with no barriers. An electrical fault in one cable may cause loss of the redundant cable.

5.14.4 Fire Protection Systems

Yard hydrants and hose lines stored in hose houses are available for manual suppression as discussed in Section 4.3 of this report. Automatic water sprays are provided on the main and auxiliary station transformers.

5.14.5 Adequacy of Fire Protection

We find that the fire protection provided in the yard area is adequate to suppress fires that may occur and protect safety-related equipment. The exception to this is the manholes where manual suppression would not be adequate to prevent involvement of redundant service water pump power cables in an electrical fault.

5.14.6 Modifications and Recommendations

The licensee has proposed to install an adequate barrier between cable trays to assure that faults in service water pump cables in the manholes are prevented from affecting the redundant service water pump cables.

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

5.15 Fuel Oil Storage Vault

5.15.1 Safety-Related Equipment

The fuel oil storage vault is located outside, remote from other buildings. The vault contains the four main storage tanks for the emergency diesel generators. Each of the fuel tanks is located within a separate concrete enclosure in the vault building. These tanks supply the diesels for both Units 1 and 2.

5.15.2 Combustibles

Each of the fuel oil storage tanks contains 22,500 gallons of fuel oil.

5.15.3 Consequences if No Fire Suppression

An unmitigated fire in the hallway would not involve any of the fuel tanks due to the three-hour rated fire barriers between the hall and the tank rooms. In addition, a fire in any of the tank rooms would not involve other tanks in as much as three-hour rated fire barriers exist between each tank.

5.15.4 Fire Protection Systems

The fire suppression system provided for each of the diesel fuel tank rooms is manually actuated dry pipe sprinkler systems. Smoke detectors which alarm in the control room are the means of detection for each fuel tank room. Each of the fuel tanks is located in a pit to prevent oil spills from leaking into other areas and are separated from each other by three-hour fire rated walls. Outside fire hydrants are within easy access of the building.

5.15.5 Adequacy of Fire Protection Systems

The fire protection systems in the fuel oil storage vault are adequate to limit involvement to one fuel tank and to extinguish fires in the tank rooms.

5.15.6 Modifications and Recommendations

No modifications are proposed or recommended for this area.

We find that the fire protection for the fuel oil storage facility conforms to the provisions of BTP 9.5-1, Appendix A, and is acceptable.

5.16 Electrical Equipment Room - Elevation 368 Feet

5.16.1 Safety-Related Equipment

This area contains primarily electrical cables and equipment (480 volt switchgear) related to one division of safety equipment. A few of the redundant division cables are located within the area.

5.16.2 Combustibles

The significant combustible in this area is a moderate amount of electrical cable insulation.

5.16.3 Consequences if No Fire Suppression

An unmitigated fire in this area could affect cables from a large number of safety-related systems of one division and a few cables of the redundant division. However, safe shutdown of the plant would not be affected due to the availability of redundant systems which are not affected by a fire in this area.

5.16.4 Fire Protection Systems

The primary protection for this area is afforded by portable extinguishers and by hose stations. No detection is provided.

5.16.5 Adequacy of Fire Protection

The suppression capability for this area is adequate to extinguish fires. However, the lack of fire detection capability would allow a fire to continue in this safety-related area and to involve safety systems unnecessarily.

5.16.6 Modifications and Recommendations

The licensee has proposed to install ionization type smoke detectors to detect fires in their incipient stages to allow for prompt fire brigade response and thereby reduce potential damage.

We find that, subject to implementation of this modification, fire protection for this electrical equipment room satisfies the objectives of Section 2.2 of this report and is, therefore, acceptable.

5.17 Turbine Building

5.17.1 Safety-Related Equipment

The licensee's fire hazards analysis shows that no safety-related equipment is located in the turbine building.

5.17.2 Combustibles

The significant combustibles in the turbine building include cable insulation, oil associated with turbine lubrication, hydrogen seal oil, feedwater pumps, and other equipment, and hydrogen. The turbine lubricating oil piping is guarded pipe. The lubricating oil reservoir, conditioner, and clean and dirty lubricating oil storage tanks are located in three-hour fire-rated enclosures.

5.17.3 Consequences if No Fire Suppression

The fire barriers separating safety-related areas from the turbine building assure that unmitigated turbine building fires have no adverse consequences on safety-related equipment located in adjacent areas. The licensee's fire hazards analysis shows that safe shutdown equipment is not located in the turbine building and therefore fires in this area would not cause loss of capability to perform safe shutdown.

5.17.4 Fire Protection Systems

Automatic sprinkler systems designed in accordance with NFPA No. 13 requirements are provided for a portion of the turbine building below the operating floor and for the lubricating oil storage tanks.

Automatic deluge systems actuated by heat detectors, are provided for the feedwater pump lubricating oil reservoir, turbine lubricating oil reservoir and the hydrogen seal oil unit.

The turbine bearing and the exciter housing are protected by automatic CO_2 systems.

In addition, manual hose stations and portable extinguishers are provided throughout the turbine building.

5.17.5 Adequacy of Fire Protection

Since the major sources of combustibles are protected with automatic suppression systems and because fires in the turbine building would not prevent safe shutdown of the plant, we conclude that the fire protection for the turbine building is adequate.

5.17.6 Modifications and Recommendations

We find that the fire protection for the turbine building conforms to the provisions of Appendix A to BTP 9.5-1 and is, therefore, acceptable.

6.0 ADMINISTRATIVE CONTROLS

The administrative controls for fire protection consist of the fire protection organization, the qualifications and training for fire protection personnel, the controls to be exercised over combustibles and ignition sources, plans and procedures for fighting fires in the various plant areas, and the quality assurance provisions for fire protection. The licensee has provided a detailed description of proposed administrative controls. 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 are being developed and implemented. The program and its implementing procedures as provided by letter from the licensee dated April 26, 1978, as supplemented by letters dated June 13, June 15, June 29 and July 7, 1978 are found acceptable by the staff using items referenced in Sections 1.0(e) and 1.0(f).

We have evaluated the areas at ANO-1 to determine the minimum required fire brigade size to cope with fires that may occur, and have determined that a five man brigade is required. The licensee has proposed a five man fire brigade to be available on site during all shifts, and independent of demands placed on operating personnel and the security force in a fire situation. This requirement is being incorporated into the Technical Specifications with implementation 90 days after issuance of this report.

All five of the brigade members receive the same instruction and practice, including familiarization with the contents of the prefire plans with the exception that two members will not receive fire fighting strategy training because they are under the direction of a trained brigade leader. These two members do receive an acceptable level of training to perform their assigned tasks. Strategy training is only required for brigade leaders and includes decision factors, direction of brigade, problem sessions and coordination of various pieces of equipment.

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

7.0 TECHNICAL SPECIFICATIONS

The Technical Specifications have previously been modified to incorporate interim Technical Specifications which include limiting conditions for operation and surveillance requirements for existing fire protection systems and administrative controls. A proposed Technical Specification change is to require that at least five individuals with fire protection training be on site at all times. This would be an increase in the size Fire Brigade. We find the change acceptable. Following the implementation of the modifications of fire protection systems resulting from this review, the Technical Specifications will be similarly modified to incorporate the 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. Additional modifications have been proposed by the licensee during the course of our review of the fire hazards analysis and our onsite evaluation of the fire protection program. These proposed modifications are summarized in Section 3.

In summary, significant steps are being taken to assure that safe shutdown can be accomplished and the plant maintained in a safe condition during and following potential fire situations. Upon implementation of the licensee's proposed modifications summarized in Section 3, we find that the provisions of Section 2.0 are satisfied and that:

(1) Combustibles in safety-related areas are limited to the extent practicable;

(2) Fire detection and suppression systems will minimize, consistent with other safety requirements, the effects of fire on safety-related systems and will not in themselves significantly impair the capability of safety-related systems.

(3) Redundant safe shutdown systems are separated from each other and, where practicable, from significant combustibles by barriers or distances, or are adequately protected by fire suppression systems, such that a fire in any fire area will not prevent safe shutdown of the plant;

(4) A fire in any fire zone will not damage safety-related structures such that they cannot perform their safety function;

(5) The fire protection organization has the professional qualifications to implement the fire protection program, and administrative controls are adequate to maintain control of combustibles, ignition sources, and the fire protection organization; and

(6) A fire in any fire zone will not cause the release of amounts of radioactive material in excess of those considered in previous safety evaluations.

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.

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 our conclusion that the continued operation of the facility, pending implementation of all facility modifications, does not present an undue risk to the health and safety of the public.

> "A probability assessment of public safety or risk in quantitative terms is given in the Reactor Safety Study (WASH-1400). As the result of the calculation based on the Browns Ferry fire, the study concludes that the potential for a significant release of radioactivity from such a fire is about 20% of that calculated from all other causes analyzed. This indicates that predicted potential accident risks from all causes were not greatly affected by consideration of the Browns Ferry fire. This is one of the reasons that urgent action in regard to reducing risks due to potential fires is not required. The study (WASH-1400) also points out that 'rather straightforward measures, such as may already exist at other nuclear plants, can significantly reduce the likelihood of a potential core melt accident that might result from a large fire.'
>
> "Fires occur rather frequently; however, fires involving equipment unavailability comparable to the Browns Ferry fire are quite infrequent (see Section 3.3 of [NUREG-0050]). The Review Group believes that steps already taken since March 1975 (see Section 3.3.2) have reduced this frequency significantly.
>
> "Based on its review of the events transpiring before, during and after the Browns Ferry fire, the Review Group concludes that the probability of disruptive fires of the magnitude of the Browns Ferry event is small, and that there is no need to restrict operation of nuclear power plants for public safety. However, it is clear that much can and should be done to reduce even further the likelihood of disabling fires and to improve assurance of rapid extinguishment of fires that occur. Consideration should be given also to features that would increase further the ability of nuclear facilities to withstand large fires without loss of important functions should such fires occur."

We 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 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.

Dated: August 22, 1978

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 the Safety Evaluation Report (SER). Their report, "Fire Protection in Operating Nuclear Power Stations - Arkansas-Unit 1," dated July 1978, discusses several matters which have been addressed in the SER. The consultants' report contains recommendations which have, for the most part, been implemented during our evaluation. The consultants' recommendations which we have not adopted, along with our basis therefor, are identified herein.

1. Consultants' Comment: Minimize Fire Effects

"SER Item 8.0(2) concludes that fire detection and suppression will minimize the effects of fire on safety-related systems. The consultant does not concur in this conclusion. There are usually several protective approaches that can be utilized for a given fire hazard, with each approach offering certain advantages and disadvantages in terms of limiting the fire extent, damage due to the fire suppression agents employed, reliability, and cost effectiveness. In most cases, it is technically possible to reduce the damage potential to a very low level, but cost penalties often become severe. The fire protection systems that are being provided and recommended are to assure safe shutdown capability and will not necessarily minimize fire damage to all safety-related systems."

Staff Response

We agree with the consultants' comments that additional steps could always be taken to further reduce physical damage to structures, systems and components important to safety. However, we are using in our conclusion the term "minimize" in the context of its use in Appendix A to BTP 9.5-1 and GDC-3 where it means a general level of detection and suppression capability to provide reasonably prompt detection and suppression. This level of protection is afforded to all safety systems, not only where required to prevent loss of safe shutdown capability.

2. Consultants' Comment: Valve Supervision

"SER Item 4.3.1.3 indicates that the position of fire protection system valves will be controlled by locks or seals with periodic inspections. Locking or sealing programs depend upon ongoing administrative controls that are subject to human failure. Locks can also prevent prompt water shutoff if piping ruptures. It is recommended that electrical supervision be required on all control valves for fire protection systems protecting areas containing or exposing safety-related equipment."

Staff Response

The guidelines of Appendix A to BTP 9.5-1 allow electrical supervision, locking, or sealing with tamper proof seals with periodic inspection as means of assuring that valves in fire protection water system are in the correct position. Valves on other systems in the plant are presently under similar administrative control. The plant Technical Specifications require a monthly check of all valves in the flow path to fire suppression systems. A review by the staff of Licensee Event Reports for all plants using such periodic checks indicates that valves being in the incorrect position have not been a significant contributor to valve related failures. Additionally, standing water as a result of failure of suppression system piping will not damage safety-related equipment due to curbs, drains, mounting of equipment above floor level, grating and doorways. To date, the staff has not found any data that indicates that electrical valve supervision will significantly improve the availability of fire suppression systems in nuclear power plants.

3. Consultants' Comment: Seismic Damage

"The SER does not consider the effect of seismic damage on primary and back-up fire protection systems, although Branch Technical Position 9.5-1 addresses this item for new plants. It is recommended that the potential that a seismic event could cause both a fire and damage to the protective features provided to cope with the fire be further evaluated. This should include fires started in non-seismically qualified systems or areas that spread to safety-related systems because protective systems are damaged."

Staff Response

Although BTP 9.5-1 calls for certain fire protection piping to be seismically qualified for new plants, the guidelines of Appendix A to BTP 9.5-1 do not require seismic qualification for fire protection systems at operating plants. The basis for the Appendix A position is the acceptably low likelihood of an earthquake caused fire of safety significance. This low likelihood is a result of the lack of self-ignitable combustibles in the safety-related areas of the plant, the barriers between fire zones, the defense-in-depth approach to fire protection (control of combustibles, fire suppression, detectors, trained on-site fire brigades) and the seismic qualification of safety-related structures.

4. Consultants' Comment: Smoke Removal

"SER Item 4.4.1 indicates that portable fans and ducts will be accepted as the means for removing smoke from many plant areas. Fires in electrical insulation can generate copious amounts of dense smoke which hamper fire control efforts by rendering the atmosphere toxic and reducing visibility in the area. Properly used, self-contained breathing apparatus can minimize the problem of toxic atmosphere, but little can be done to improve visibility except to remove the smoke from the building.

Massive changes will be required in most areas of this plant if effective permanent smoke removal systems are required, the design of which would also have to include consideration of radioactivity releases. While portable fans and ducts may be effective for smoke control in many

instances, there is concern that they will not be sufficient for a major fire in some areas of the plant. It is recommended that this item be held open until better guidelines are developed for the evaluation of smoke generation potential and smoke removal system design."

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 systems is not warranted because portable smoke removal equipment can be used in those plant 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 is 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 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 are 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.

5. Consultants' Comment: Unsuppressed Turbine Building Fires

"SER Item 5.17 concludes that fire protection in the turbine building is acceptable. However, the licensee's fire hazard analysis does not adequately address the consequences of an unsuppressed lube oil fire in the turbine building (see October 24, 1977 letter from L. P. Herman to R. E. Hall on this subject)."

Staff Response

In the above mentioned letter, Mr. Herman states his belief that manual fire fighting would not provide an effective backup to automatic suppression systems in the turbine building, and that automatic suppression systems are not highly reliable. He suggests that all plants should be

designed to sustain an unsuppressed turbine building fire that could result in collapse of the turbine building.

The staff does not deem such a design basis event assumption to be consistent with criteria used in evaluating other plant areas. In other areas such as in the cable spreading room, our conclusions are based on the effects of fire with automatic and manual suppression systems. We, therefore, have allowed the licensee to evaluate the effects of fires in the turbine building assuming the automatic suppression systems protecting major oil hazards functions as designed.

We have determined that the oil hazards in the turbine building are protected as follows: automatic sprinklers are provided for a portion of the turbine building below the operating floor and for the lubricating oil storage tanks. Automatic deluge water systems are provided for the feedwater pumps, lubricating oil reservoir, turbine lubricating oil reservoir, and the hydrogen seal oil unit. In addition, manual hose stations and portable extinguishers are provided throughout the turbine building to supplement these automatic suppression systems.

We have found that these systems provide adequate protection to assure the integrity of the turbine building. The staff believes that the reliability of such systems is at least equivalent to suppression systems in other areas of the plant and does not warrant design of the turbine building to sustain an unsuppressed fire.