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NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 23 TO LICENSE NO. DPR-72

FLORIDA POWER CORPORATION, ET AL

CRYSTAL RIVER UNIT 3 NUCLEAR GENERATING PLANT

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1.0 INTRODUCTION

Following a fire at the Browns Ferry Nuclear Station in March 1975, the Nuclear Regulatory Commission initiated an evaluation of the need for improving the fire protection programs at all licensed nuclear power plants. As part of this continuing evaluation, the NRC, in February 1976, published 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

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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 Florida Power Corporation's Crystal River Unit 3 plant.

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2.0 FIRE PROTECTION GUIDELINES

2.1 General Design Criterion 3 - "Fire Protection

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

> "Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions."
>
> "Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and the control room."
>
> "Fire detection and protection systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety."
>
> "Fire fighting systems shall be designed to assure that their rupture or inadvertant 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, "Guidlines 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.

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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.

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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 will be proposed by the licensee within 30 days from the date of this Safety Evaluation. 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 implementation of these modifications. The balance of other modifications has been described in an acceptable level of detail.

*3.1 Safe Shutdown Systems

A remote safe shutdown control station will be installed which is independent of the control room or cable spreading room. (4.1)(4.3.2)(5.10.6)(5.11.6)

3.2 Fire Detection Signaling System

Emergency power will be supplied to those portions of the detection and signaling system serving areas containing safety related equipment. (4.2)(4.3.1.5)

3.3 Fire Pump House Floor Drains

The floor drain pipe trench in the fire pump house will be modified to preclude spreading of an oil spill. (4.3.1.2)

3.4 Yard Post Indicator Valves

Traffic guards will be installed around the yard post indicator valves. (4.3.1.3)(5.16.6)

*3.5 Reactor Containment Building Standpipe System

A fire standpipe system will be installed inside the reactor containment building with a suitable number of stations at each elevation in order that potential fire areas of the containment can be reached by an effective fire stream. (4.3.1.4)(5.9.6)

3.6 Drip Protection

Drip protection will be provided for safety-related motor control centers in areas where automatic sprinkler systems are installed. (4.3.1.7)

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3.7 Cable Spreading Room Halon Fire Protection

A second set of halon storage spheres will be installed as backup to the present halon system in the cable spreading room. (4.3.2) (5.11.6)

3.8 Cable Spreading Room Recirculation Fans

The cable spreading room recirculation fans will be powered from an emergency power source. (4.3.2)

3.9 Control Room Portable Fire Extinguishers

Two water-type fire extinguishers will be installed in the control room. (4.3.3)

3.10 Emergency Lighting

Emergency lighting will be installed in the makeup pump areas. (4.6)

3.11 Portable Radios

At least 2 portable radios will be reserved for use of fire brigade members. (4.7)

3.12 Fire Doors

3.12.1 A 3-hour fire door will be installed in the wall opening separating the shop facilities from the auxiliary building. (4.9.1)

3.13 Electrical Cable and Other Penetrations

All openings in the fire wall between the turbine and intermediate buildings will be upgraded to at least a three-hour fire rating. (4.9.3)

*3.14 Cable Spreading Room Floor and Ceiling

The cable spreading room floor will be coated/insulated to provide a one-hour fire resistance. The metal plates in the ceiling will be coated with a three-hour fire resistance rated material. (4.11)

*3.15 Automatic Fire Detection Systems

Automatic fire detection systems will be installed in the following areas:

a. Auxiliary building-elevation 119 feet in zones 1, 5, 7, 18, 25 and 26. (5.3.6)(5.6.6.)

b. Auxiliary building-elevation 95 feet in zones 17, 18, and 22. (5.4.6)

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c. Auxiliary building-elevation 7[illegible] feet in zones 1 and 2. (5.5.6)

d. Intermediate building-elevation 119 feet, in the pressurizer control cabinet area and in the containment personnel access area, and zones 1 and 4. (5.7.6)(5.6.6)

e. Intermediate building-elevation 95 feet for the steam driven auxiliary feedwater pump area. (5.8.6)

f. In the reactor containment building in the vicinity of the reactor coolant pumps, in ventilation units, and near cable concentrations, throughout the reactor building. (5.9.6)

3.16 Waste Drumming Station

The waste drumming station and/or hose reel will be relocated to permit free access to the fire hose reel in the area. (5.3.6)

*3.17 Cable Tray Fire Stops

Cable Tray Fire stops will be installed in the following areas:

a. Auxiliary building at elevation 95 feet in zones 5 and 13. (5.4.6)

b. Containment electrical penetration areas on the non-safeguards instrumentation cable runs between safeguards channels A and B. (5.6.6)

c. On elevations 95 and 119 feet in the reactor building. (5.9.6)

*3.18 Steam Driven Emergency Feedwater Pump

An automatic fire detector system and suitable fire barriers will be installed to protect safety-related cables in the emergency feedwater pump area. (5.8.6)

3.19 Control Room

3.19.1 Combustible supplies in the control room will be removed or properly stored in metal cabinets. (5.10.6)

3.19.2 The kitchen stove in the control room will be moved to a nonsafety-related area and/or disconnected. (5.10.6)

3.19.3 Continuous observation by the security guard will be maintained on the control room door until the station security system is completed. At that time the door will be equipped with automatic

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closure and will require key cards for opening from the outside. The guard has been instructed to close this door in the event of fire. (5.10.6)

3.20 Battery Room Ventilation

The battery room exhaust ducts will be relocated near the ceiling. One monitor for each battery room shall be provided to locally indicate ventilation flow. (5.13.6)

3.21 Diesel Generator Rooms

3.21.1 Curbs will be provided at doorways in the diesel generator rooms. (5.14.6)

3.21.2 The diesel generator floor drain system will be modified by installation of weirs to eleminate this avenue of potential fire spread. (5.14.6)

3.21.3 The Smoke detectors in the diesel generator control rooms will be relocated to improve the response time. (5.14.6)

3.21.4 A sump alarm will be provided to ensure that the control room personnel are alerted to a potential diesel oil fuel leak. (5.14.6)

3.22 Fire Alarm Unsupervised Circuits

Monthly testing will be required on unsupervised circuits leading from the fire alarm control panel to the annunciator panel. (4.2)

*3.23 Fire Detector Locations

Provide drawings for staff review on locations of new fire detectors. (4.2)

3.24 Interior Fire Hose Station

Verify that all safety-related areas including the control complex can be reached with at least one effective fire hose stream utilizing no more than 100 feet of hose. (4.3.1.4)

*3.25 Evaluation and Corrective Action For Fire Consequences In Certain Areas

Evaluate the fire consequences in certain areas of the auxiliary and intermediate buildings which contain redundant safe shutdown electrical cables. In some of these areas automatic water suppression systems and/or barriers will be required to prevent unacceptable fire damage, the design of which will be examined by the

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staff prior to its implementation. (4.3.1.5) (Note: Items 3.28, 3.29, 3.31 and 3.32 are related to the above evaluation and corrective actions)

3.26 Battery Power Emergency Lighting

Battery powered lighting units will be provided for areas 1, 5, 7, and 13 in auxiliary building elevation 95. (4.6)

3.27 Auxiliary Building at Elevation 119 Feet

Protective measures for safe shutdown systems will be provided in fire zones 1 (west end), 7, and 18 by one of the following measures: (1) reroute certain cables required for safe shutdown; (2) provide a wet pipe fusible link water spray system to protect safe shutdown cables in the area; (3) provide a fire wall to protect circuits required for safe shutdown.

The east end of fire zone 1 and all of zone 5 will be protected against postulated fires from transient combustibles with wet pipe fusible link sprinkler systems with the sprinkler heads located below the cable trays. (5.3.6)

*3.28 Auxiliary Building at Elevation 95 Feet

Protective measures for safe shutdown systems will be provided in fire zones 1, 5, 13 and 16 by one of the following measures: (1) reroute certain cables required for safe shutdown; (2) provide a wet pipe fusible link water spray system to protect safe shutdown cables in the area; or (3) provide a fire wall to protect circuits required for safe shutdown. (5.4.6)

*3.29 Make-Up Pump Rooms

An automatic detection system and suitable fire barriers around safety related cables will be provided for the make-up pump rooms. (5.4.6)

*3.30 Intermediate Building at Elevation 119 Feet

Protective measures for safe shutdown systems will be provided in fire zone 5 by the installation of a wet pipe fusible link sprinkler system to extinguish postulated fires in clothing, paper or transient materials.

Redundant safety related cables in the area will be examined to determine the effects on safe shutdown capability of the loss of all cables. If this examination shows that safe shutdown capability will be lost, one of the following appropriate measures will

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be taken: (1) reroute certain cables required for safe shutdown; or (2) provide a wet-pipe fusible-link water spray system to protect against fires in clothing and other materials and to protect redundant safe shutdown cable trays in the area. (5.7.6)

*3.31 Reactor Containment Building Analysis

The results of a analysis for zone 1 in the reactor building will be provided which demonstrates that redundant safe shutdown systems will not be damaged by an unsuppressed fire. (5.9.6)

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TABLE 3.1

IMPLEMENTATION DATES FOR PROPOSED MODIFICATIONS

	MODIFICATION	IMPLEMENTATION DATES
*3.1	Safe Shutdown System	TO BE PROPOSED
3.2	Fire Detection Signaling System	
3.3	Fire Pump House Floor Drains	
3.4	Yard Post Indicator Valves	
*3.5	Reactor Containment Building Standpipe System	
3.6	Drip Protection	
3.7	Cable Spreading Room Halon Fire Protection	
3.8	Cable Spreading Room Recirculation Fans	
3.9	Control Room Portable Fire Extinguishers	
3.10	Emergency Lighting	
3.11	Portable Radios	
3.12	Fire Doors	
3.13	Electrical Cable and Other Penetrations	
*3.14	Cable Spreading Room Floor and Ceiling	
*3.15	Automatic Fire Detection Systems	
3.16	Waste Druming Station and/or Hose Station Relocation	
3.17	Fire Stops	
*3.18	Steam Driven Emergency Feedwater Pump	
3.19	Control Room	
3.20	Battery Room Ventilation	
3.21	Diesel Generator Rooms	
3.22	Fire Alarm Unsupervised Circuits	
*3.23	Fire Detector Locations	
3.24	Interior Fire Hose Stations	
*3.25	Evaluation of Fire Consequences in Certain Areas	
*3.26	Loss of Normal and Emergency Lighting Evaluation	
*3.27	Auxiliary Building at Elevation 119 Feet	
*3.28	Auxiliary Building at Elevation 95 feet	
*3.29	Make-Up Pump Rooms	
*3.30	Intermediate Building at Elevation 119 Feet	
*3.31	Reactor Containment Building Analysis	

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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, control stations, and interconnecting control and instrumentation cabling.

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; decay 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 cooling water systems 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.

We have also evaluated those control and indication functions necessary to properly and efficiently accomplish remote safe shutdown following a fire involving safety-related equipment in the control room or cable spreading room. This evaluation considered equipment location, accessibility, redundancy, cable routing, and communication. The present remote shutdown capability appears to be inadequate to accomplish proper and efficient safe shutdown for the following reasons:

a. Power supplies for instrumentation necessary for safe shutdown are presently located in the control room.

b. Control and instrumentation cables necessary for safe shutdown are presently routed from the control room through the cable

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spreading room to the remote shutdown panel or switchgear with no isolation capability.

c. Sufficient control and parameter monitoring capability does not presently exist at the remote shutdown panel.

d. Local feedwater and steam relief control stations are relatively inaccessible and capability for control of these necessary functions from the remote shutdown panel presently does not exist.

The licensee has committed to upgrading the remote safe shutdown system to satisfy the above concerns. The proposed design changes will be submitted for review and acceptance by the NRC staff prior to the implementation of these modifications.

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

4.2 Fire Detection and Signaling System

The plant has a protective signaling system that transmits fire and supervisory signals to the control room where audible and visual alarms are provided. The system transmits alarm signals from actuation of area and ventilation system fire detectors, actuation of automatic suppression systems (sprinklers, water spray, Halon and carbon dioxide), fire pump running, and manual pull stations. Supervisory signals are transmitted from tamper switches on some water suppression system control valves, fire pump trouble and low fuel, fire water tank low level, and carbon dioxide system high and low pressure.

Portions of the fire detection and signaling system are not provided with an emergency power supply on loss of offsite and station power. The licensee has proposed to provide emergency power to those portions of the detectors and signaling system serving areas containing safety-related equipment. Circuits in the fire detection and signaling system are electrically supervised and alarm in the control room except for the circuits leading from the control panel to the annunciator panel. The annunciator panel in the control room is not listed for signaling system use by a recognized national testing laboratory. Increased testing of this panel and the unsupervised circuits leading to it is being required.

Area fire detection is provided on all six levels of the control complex, the office building, the turbine building heater bay, and the fire pump house. The ventilation systems in various portions of the plant are also provided with fire detectors.

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Fire detectors providing area coverage are ionization smoke detectors; detectors in the ventilation systems are both ionization smoke detectors and rate-compensation heat detectors. The automatic water spray, pre-action sprinklers and carbon dioxide systems are actuated by rate-compensation heat detectors; the Halon system in the cable spreading room is actuated by a cross-zoned smoke detection system; the charcoal filter water spray systems are actuated by fixed-temperature heat detectors.

There are areas in the auxiliary, intermediate and reactor buildings which contain safety-related equipment and electrical cables which are not provided with fire detection. The licensee has proposed to install fire detectors in most of these areas. During the fire protection review, certain other areas were identified as requiring fire detection. The licensee has agreed to provide detectors in these areas. The licensee has also been asked to provide drawings on the proposed new fire detector locations.

We find that, subject to implementation of the above described modifications, the fire detection and signaling system satisfies the objectives identified 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

Water for fire protection is supplied by three fire pumps taking suction from two ground level storage tanks. The tanks each have a capacity of 360,000 gallons and are reserved for fire protection use only. In addition, an emergency connection is provided so that the Unit 3 nuclear plant can be supplied from the adjacent Unit 2 fossil fuel plant fire water system.

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

4.3.1.2 Fire Pumps

The three fire pumps each have a capacity of 2,000 gpm at 125 psi. Two of the pumps are diesel engine driven and the third is electric motor driven. A small electric jockey pump is provided to maintain pressure on the fire water system; the fire pumps are arranged to start automatically when a large water demand causes a drop in the system pressure. The capacity of any two of the fire pumps is adequate to provide the largest design water demand

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from automatic suppression systems plus hose streams for manual firefighting. The capacity of one pump is adequate for fire suppression in safety-related areas.

In the fire pump house, a floordrain pipe trench extends the full length of the building and a diesel oil spill fire could damage all three pumps or their control systems. The licensee has proposed to modify the pipe trench to preclude such damage.

We find that, subject to the implementation of the above described modification, the fire pumps satisfy the objectives of Section 2.2 of this report and are, therefore, acceptable.

4.3.1.3 Fire Water Piping System

The fire pumps discharge into an underground fire loop that encircles the plant supplying fixed water suppression systems, interior fire hose stations, and exterior fire hydrants.

The suction and discharge piping and valves at the fire pumps are arranged so that a single pipe break will not cause loss of supply from all three fire pumps. Sectionalizing valves of the post indicator type are provided on the fire loop to allow isolation of various sections for maintenance or repair. Some of the sectionalizing valves are exposed to vehicular traffic damage and the licensee has proposed to install guard posts.

Fire hydrants are strategically placed around the exterior of the plant. Each hydrant lateral is provided with an auxiliary gate valve to permit the hydrant to be repaired without shutting off a section of the fire loop. A hose house with 250 feet of 2½-inch and 200 feet of 1-1/2-inch woven jacketed fire hose, nozzles and other manual firefighting tools is provided at each hydrant.

Certain interior control valves on automatic sprinkler systems are electrically supervised; however, valves on the exterior fire loop and some interior valves are not supervised. The valves on the fire water system are provided with plastic seals and are periodically inspected.

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

4.3.1.4 Interior Fire Hose Stations

Hard rubber 1-1/2-inch fire hose in 50-feet lengths has been provided on reels in the turbine, intermediate, auxiliary and shop buildings. Linen fire hose in 50-feet lengths has been provided in the office building. Cotton jacketed, rubber lined

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fire hose has been provided outside the cable spreading room. The interior fire hoses are equipped with electrical type fog nozzles.

There is insufficient fire hose on the reels to reach all areas; however, plant firefighting procedures call for the fire brigade to respond with additional woven jacketed fire hose to be attached to the hard rubber hose if necessary to provide adequate length. The licensee has verified that, with this arrangement, all safety-related areas, including the control complex, can be reached with at least one effective fire hose stream utilizing no more than 100 feet of hose.

The licensee has proposed to install a standpipe with a suitable number of stations inside the reactor building.

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

4.3.1.5 Water Suppression Systems

Automatic wet pipe sprinklers are provided in the two lower levels of the turbine building, the office building record storage vault, and the fire pump house. Automatic pre-action sprinklers are provided in the diesel generator rooms, diesel generator controls rooms and elevation 95 feet of the control complex. Automatic water spray systems are provided on the turbine lube oil storage tank and purifier, hydrogen seal oil unit, feedwater pump console, charcoal filters, yard transformers, and the turbine building wall adjacent to the yard transformers. The existing systems have been designed to provide acceptable protection for the hazards covered.

The licensee has been requested to evaluate fire consequences in certain areas of the auxiliary and intermediate buildings which contain redundant safe shutdown equipment electrical cables. In some of these areas, automatic water suppression systems will be required to prevent unacceptable fire damage, the design of which will be examined by the staff prior to its implementation.

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

4.3.1.6 Foam

The plant has not been provided with fixed foam fire suppression systems and none are being required. Manual foam fire suppression is available for small fires. We find that manual foam capability

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satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.3.1.7 Effects of Suppression Systems on Safety Systems

Fixed fire suppression systems have not been installed where their operation or failure could cause unacceptable damage to safety-related equipment. Water discharge from the pre-action automatic sprinkler system in the diesel generator rooms would affect only one of the redundant units.

Water used for manual firefighting will be removed by floor drains in all areas except the control complex where it will be drained through an equipment hatch and the stair tower, or through doorways leading into the turbine building. The licensee will provide drip protection for safety-related motor control centers in areas where automatic sprinkler systems are installed.

We find that subject, to the implementation of the above described modification, the effects of suppression system operation on safety-related systems satisfies the objectives identified in Section 2.2 and is, therefore, acceptable.

4.3.2 Gas Fire Suppression Systems

An automatic Halon 1301 system has been provided in the cable spreading room. The system, utilizing eleven spherical storage containers distributed throughout the room, has been designed to meet the requirements of NFPA 12A with a minimum agent concentration of five percent. Fans have been provided in the cable spreading room to properly distribute the agent after discharge. The licensee has proposed to provide emergency power to these fans.

The licensee has proposed to install a second set of Halon storage spheres as a backup agent supply. The secondary supply will utilize the existing automatic fire detection/actuation system with a manual throwover to be operated after discharge of the primary supply.

Because of concerns about effectiveness and reliability, gaseous fire suppression systems alone are not acceptable protection for areas containing large quantities of redundant safe-shutdown electrical cables. Therefore the licensee has proposed to provide a means to achieve safe shutdown, even if the cable spreading room or control room are lost due to fire damage, from remote control panel(s) located in 4160 volt switchgear room 3A and 3B.

An automatic carbon dioxide system has been provided to protect the turbine-generator bearings and main feedwater pumps. The system is supplied by a 5-ton low pressure tank and is designed

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to meet the requirements of NFPA 12 for local application systems. This system does not protect any equipment which is required for safe shutdown.

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

4.3.3 Portable Fire Extinguishers

Portable fire extinguishers have been provided throughout the plant except inside containment during power operation, in accordance with the requirements of the NFPA Standard. The licensee has provided two water type extinguishers in the control room to combat small deep-seated fires in electrical installation and ordinary combustibles.

We find that, the utilization of portable fire extinguishers satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.4 Ventilation Systems and Breathing Equipment

4.4.1 Smoke Removal

The plant does not have exhaust systems designed specifically for smoke removal except for fusible link operated roof vents in the turbine building and a smoke detector actuated exhaust mode capability in the control complex air-handling system. The normal and/or emergency ventilation systems in most areas can be used for smoke removal; however, 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 systems may preclude effective smoke removal; heat or smoke actuated dampers may close preventing air movement; and ventilation system power supplies could be affected by the fire.

In view of the potential limitations of dependence upon normal air handling systems for smoke removal, the licensee has provided portable smoke exhausters and ducting for fire brigade use which we find acceptable for nuclear power facilities. The smoke removal capability satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.4.2 Filters

Charcoal filters are enclosed in substantial metal housings and protected by automatic deluge water suppression systems. The filters are separated from ignition sources and the amount of

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contained radioactive material is insufficient to cause ignition. Therefore, filter units do not present a significant fire exposure to safe shutdown systems.

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

4.5 Floor Drains

The floor drains from the fire pumps building and the diesel generator rooms drain by long runs of piping into the turbine building sump. The reactor building tendon gallery sump is pumped to the nuclear services seawater sump. It is then pumped to the turbine building sump. The turbine building sump receives all drains from the turbine building. The turbine building sump is discharged to the settling pond which is located outside the building.

The licensee has proposed to modify the floor drain system in the diesel generator rooms as discussed in Sections 5.14.6.

Floor drains in the reactor containment building and the auxiliary building are treated as potentially contaminated drains. These drains are collected in the auxiliary building sump and are processed as nuclear waste.

We find that, subject to the implementation of the proposed modification, the floor drains system satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable

4.6 Lighting Systems

Normal lighting is supplied from nonsafety-related power sources. Emergency lighting is provided in the Reactor Building, Auxiliary Building and Turbine Building. Emergency lighting fixtures are identical to the ones which provide normal lighting but are on separate circuits. They are located throughout these buildings to provide emergency lighting for access and egress and in accessible areas in which equipment used for safe shutdown is located except for the decay heat pits and the makeup pump rooms. The decay heat pits are not normally occupied or entered. Power for

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the emergency lighting circuits is automatically supplied from the emergency diesel generator in the event of loss of normal sources.

In the control complex, redundant lighting systems are provided in all areas. Power for each lighting system is automatically supplied from the emergency diesel generators, in the event of loss of normal sources. The Control Room, in addition to the redundant lighting systems discussed above, has a third lighting system which utilizes DC power from the plant batteries.

The licensee has proposed to install emergency lighting in the make-up pump area as a result of a study of areas that must be manned for safe shutdown and in access and egress routes for all fire areas.

The licensee has proposed to physically identify and mark the emergency lighting fixtures located throughout the power plant.

The licensee has provided the results of a study identifying any safety-related areas where a fire could cause loss of both normal and emergency lighting so that firefighting access would be hampered. As a result of this study battery powered lighting units will be provided for areas 1, 5, 7 and 13 in the auxiliary building elevation 95.

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

4.7 Communication Systems

The plant has both a telephone type paging/call-back system for normal communications and, in lieu of a sound powered system, a separate safeguards paging/call-back system with stations located in areas containing safeguard and safe shutdown equipment. Both systems can be supplied power from the emergency diesel generators. Separate maintenance and reactor building jack station systems are also provided. In addition, the plant has portable radios available, two of which are reserved for use of fire brigade members.

We find that, the communication systems satisfy the objectives identified in Section 2.2 of this report and are, therefore, acceptable.

4.8 Electrical Cable

Electrical cables used in the plant are classified as power, control, and instrumentation.

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Power cables used inside and outside the reactor containment building are insulated with high temperature Kerite insulation and jacketed with fire retardant material of Kerite or neoprene. The power cables outside the containment building with conductors of size AWG No. 6 or larger have a galvanized-steel, interlocked armor protective cover.

Instrumentation cables for the most part use silicone rubber for insulation and jacket material.

Coaxial and triaxial cables use polyethylene insulation and most of these cables use asbestos or glass-braid jacket.

Control cables are insulated with Kerite FR and are jacketed with the same material.

The licensee has performed a flame test on the cables similar to the tests required by IEEE 383-1974. The tests were performed on cable trays filled to mock up the actual in plant conditions. All cables passed the flame test with the exception of instrumentation cables manufactured by Rockbestos Company. These cables are EK-24A-#16 iron constantan silicon rubber insulated. The licensee states that these cables represent approxmiately 2½ percent of all cables installed in Crystal River No. 3.

We find that the electrical cable satisfies the objectives identified in Section 2.2 of this report and is, threfore, acceptable.

4.9 Fire Barrier Penetrations

4.9.1 Fire Doors

Doors in critical fire barriers are 3-hour rated with listed frames. These include doors in walls separating the turbine, control, auxiliary and intermediate buildings, as well as walls providing fire barriers around battery systems, switchgear rooms, diesel generators, the control complex stairwell, and other areas.

The licensee has proposed to install a 3-hour fire door in the wall separating the shop facilities from the auxiliary building.

We find that, subject to the implementation of the above modification, the protection of doorway penetration in fire barriers satisfies the objective identified in Section 2.2 of this report and is, therefore, acceptable.

4.9.2 Ventilation Duct Penetrations

Ventilation ducts through critical fire barriers are provided with dampers having a 3-hour fire rating. The dampers close

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automatically on operation of a fusible link, and some dampers in the control complex, intermediate building, diesel generator rooms and turbine building switchgear rooms are operated by smoke and/or heat detections systems.

We find that the ventilation duct penetrations in fire barriers satisfy the objectives of Section 2.2 of this report and are, therefore, acceptable.

4.9.3 Electrical Cable and Other Penetrations

Electrical cable penetrations in fire barriers are sealed with assemblies utilizing mineral insulation, inorganic board, metal plates and fire retardant mastic. Small cable openings in the control room floor are packed with mineral insulation and covered with flame retardant mastic. The licensee has clarified the details of the cable penetration seal construction and provided test data to substantiate that adequate fire resistance is provided. The licensee has proposed to upgrade any deficient seals.

The licensee has proposed to upgrade openings in the fire wall between the turbine and intermediate buildings and in the floor between the cable spreading room and control room.

We find that, subject to the above describe modification, the electrical cable and other penetrations satisfy the objectives identified in Section 2.2 of this report and are, therefore, acceptable.

4.10 Separation Criteria

The licensee has stated that cable and cable trays serving engineered safeguards and nuclear instrumentation and protection functions are separated by channels in accordance with the following criteria:

(1) Cables for redundant channels or equipment are run in separate trays, conduits, ducts or penetrations.

(2) Cables, trays, conduit, etc., which are a part of safeguards or protective systems are color coded. A different color is used for each channel.

(3) Horizontal distance between redundant safeguards channel trays is three feet. Where this spatial separation cannot be maintained, a physical barrier is provided. Where horizontal trays cross, the barrier consists of an inverted peaked cover under the upper tray, with a peaked cover over the lower tray. These covers are coated with a fire retardant coating. A non-combustible asbestos-silicic board is used as a barrier between parallel horizontal or vertical cable tray runs.

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(4) Vertical separation between redundant channel trays is provided by use of barriers between trays. The vertical distance between power, control, and instrumentation trays of the same channel is nine inches between the top of the lower tray and the bottom of the upper tray.

(5) Separate cable trays are used for 6900-volt and 4160-volt power cables. No other types of cable is carried in the same tray with 480-volt and DC power cables.

(6) Wherever possible redundant safeguards cable trays do not pass through potential missile producing areas. If these areas are unavoidable, either protective shielding is provided for redundant cable trays, or only one safeguards cable tray is allowed to occupy the area.

(7) In some cases a non-designated tray will run between redundant tray systems. In these areas the licensee has proposed to provide fire stops to prevent spread of fire from one safeguards tray system to the other safeguards tray system.

(8) In cases where it is impractical because of terminal equipment arrangement to provide separate wireways, cables for mutually redundant or backup equipment are separated by physical barriers or conduit.

(9) Instrumentation cable trays may also contain telephone and low-level paging circuits. No other types of cables are included in these trays.

(10) Redundant safeguards cable trays in the cable spreading room are separated by one foot horizontally and three feet vertically. Where this separation cannot be maintained, a physical barrier is provided.

(11) Protection systems, safety feature systems, and electrical system components are mounted on control boards, panels, and relay racks and 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 metal barriers. However, wiring which is common to two different redundant channels exists. The conduit is terminated or the wires are taped as close as possible to the device to which these wires are connected.

The separation criteria does not preclude the crossing of such cables nor does it consider the possibility of heat buildup in a room. The licensee has performed a detailed

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fire hazards analysis for each area of the plant containing safety-related equipment to determine the possible effects of fires on safe plant shut down. 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 safety-related equipment. The specific areas where this additional protection is to be provided is identified in Section 5.0 of this report.

We find that, subject to implementation of the modifications described in other sections of this report, the separation criteria satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

4.11 Fire Barriers

Substantial fire barriers have been provided throughout the plant. The licensee's fire hazard analysis concludes that basic wall, floor and ceiling structures are adequate, based on the contained fire load, to prevent the spread of an unsuppressed fire through the barriers.

The licensee verified that the wall separating the turbine building from safety-related areas is free-standing with respect to fire-caused structural collapse of the turbine building. The licensee has proposed to upgrade the cable spreading room floor to provide 1-hour fire resistance.

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

4.12 Access and Egress

Most areas of the plant are reasonably accessible for manual firefighting. Access to the control complex and intermediate building is limited; however, light fire loadings in most of these areas will not result in severe manual firefighting demands. In the cable spreading room, congestion caused by the cable trays could hamper manual fire control and delays could be experienced in entering the reactor building for firefighting purposes.

There are two access doors in the main control room with normal access through the control complex, one of which is an emergency door between the turbine building and the control room. Entrance into the control room by this door is by key lock.

The cable spreading room normal access is through the control complex. There is an emergency trap door from the cable spreading room into the control room.

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The reactor containment building access is normally through the personnel access hatch. Emergency access can be made through the personnel and equipment hatch. Access to elevations in the containment building is by two stairwells. There is also an elevator in the containment building.

With the satisfactory resolution of other concerns and modifications relating to the cable spreading room and the reactor building, access and egress for manual firefighting in safety-related areas, we find the access and egress to plant areas satisfy the objectives identified in Section 2.2 of this report and are, therefore, 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 are relied upon to minimize the generation of such products. In addition, portable smoke removal equipment has been provided for fire brigade use and emergency breathing air is available for fire brigade and operating personnel.

We find that the provisions for handling toxic and corrosive combustion products satisfy the objectives identified in Section 2.2 of this report and are, therefore, acceptable.

4.14 Nonsafety-Related Areas

With the implementation of the other required modifications, nonsafety-related areas will be adequately separated by distance or fire barriers from safety-related systems so that fire damage which could adversely affect safe shutdown will be prevented.

The licensee has evaluated the radiological consequences of fires in radwaste areas and areas containing contaminated materials and determined that fires in these areas would not result in a release of radioactive materials in excess of 10 CFR 20 limits.

4.15 Instrument Air

Instrument and control air is supplied by oil free instrument air compressors. There are certain air operated control valves which are required for system alignment functions during safe shut down operations. These valves are equipped with air accumulators which hold reserve air supply sufficient for at least 3 complete valve operations. The valves can also be operated manually. Fires in other areas which could cause the loss of instrument and control air would not preclude the operation of these valves as required for safe shut down.

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We find that the instrument and control air system satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

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5.0 Evaluation of Specific Plant Areas

The licensee has performed a fire hazard 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 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 identified in Section 2.2 were met. The staff's evaluation of specific areas is discussed in the following subsections.

5.1 Auxiliary Building - Elevation 162 Feet

5.1.1 Safety-Related Equipment

This area contains the new fuel storage, spent fuel storage, and fuel handling equipment. The effects of a fire in this area would not affect safe plant shutdown.

5.1.2 Combustibles

Combustibles in this area include a small quantity of paper, plastic and wood.

5.1.3 Consequences if no Fire Protection

An unmitigated fire in this area is mainly limited by the low combustible loading which can serve as fuel. There is no safety-related cabling in the area.

5.1.4 Fire Protection Systems

There is no fire detection or automatic suppression for this area. The licensee relies on portable extinguishers and hose stations located in the area for fire fighting.

5.1.5 Adequacy of Fire Protection

Manual suppression would be adequate to extinguish fires in these areas.

5.1.6 Modifications

No modifications are proposed for this area. We find that fire protection for this area satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

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5.2 Auxiliary Building at Elevation 143 Feet

5.2.1 Safety-Related Equipment

This elevation is divided into safety-related areas and nonsafety-related areas. The safety-related areas are separated from the adjacent nonsafety-related areas by reinforced concrete walls. The building exterior wall is metal with no adjacent buildings. The safety-related areas contain the chemical mixing equipment (boric acid mixing tank, sodium thiosulphate tank and pumps, caustic mixing tank and pumps, lithium hydroxide mixing tank and pumps, ventilation equipment, and a portable resin hopper).

The auxiliary building exhaust fans, auxiliary building main exhaust charcoal filters 2A, B, C and D, the reactor building purge exhaust filter fans and the reactor building purge exhaust charcoal filters are located adjacent to the chemical mixing area. These areas are separated by reinforced concrete walls.

The charcoal filters are housed in metal enclosures and have automatic deluge water system installed for fire suppression.

The remaining area on this elevation is classified as nonsafety-related and is bounded by the reactor containment building and the control complex by reinforced concrete walls with metal outside walls with no adjacent buildings.

This area contains the spent fuel coolers and filters and the plant vent shaft.

There are no safety-related cable trays in this area.

5.2.2 Combustibles

The significant combustible material in this area consists of a large quantity of electrical cable insulation in cable trays, a large amount of resin in an enclosed container, a small amount of paper and plastic, a small amount of lubricating oil, and a large amount of charcoal enclosed in filters which have automatic water suppression systems.

5.2.3 Consequences of no Fire Suppression

The licensee has evaluated the consequences of fires in these rooms and has shown that spread of fire is limited by bounding walls and low combustible loading which can serve as fuel. Most of the equipment is nonsafety-related. Loss of a single charcoal filter could result from a fire, but spread to other filters and equipment is limited by metal enclosures.

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5.2.4 Fire Protection System

There is no fire detection or automatic suppression system for this area other than the charcoal filters which are enclosed and have automatic detection and suppression systems. The licensee relies on portable extinguishers and hose stations located in the area for fire fighting.

5.2.5 Adequacy of Fire Protection

Due to the limited amount of combustibles, manual suppression should be adequate to control fires in these areas.

5.2.6 Modifications

No modifications are proposed for this area.

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

5.3 Auxiliary Building at Elevation 119 Feet

5.3.1 Safety-Related Equipment

This area is adjacent to the reactor building and the intermediate building on one side with the emergency diesel generator rooms and the hot machine shop on the other side. There are doorways from the auxiliary building into these adjacent areas. This area contains safety-related equipment as well as nonsafety-related equipment. The safety-related equipment in this area consists of spent fuel coolant pumps, filters, demineralizers, and heat exchangers; boric acid storage tank and pumps, reactor coolant bleed tanks, make-up and purification filters and demineralizers, and engineered safeguards motor control centers 3A2, 3B1 and 3AB. The safety-related equipment is located in separated reinforced concrete rooms with 3-hour fire rating. The safety-related areas on this elevation contain safety-related cables; a few of these areas contain redundant safe shutdown cables. Some of the safety-related areas contain only channel A or channel B safety-related cable trays. In areas where both channel A and channel B cable trays are present they are separated by a combination of distance and/or barriers. There are some areas which contain safety-related cable trays A and B as well as a nonsafety-related cable tray. In these areas the licensee has proposed to install additional fire stops on nonsafety-related trays at the crossovers and automatic fire detection systems. The areas on this elevation which are designated as nonsafety-related do not contain safety-related cable trays. These areas are separated from safety-related areas by reinforced concrete walls with offsets. (Note: See Section 5.6 for containment penetrations.)

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5.3.2 Combustibles

The significant combustibles in these areas consist of cable insulation, a small amount of lubricating oil, and a small amount of paper and plastic.

5.3.3 Consequences if no Fire Suppression

The licensee has evaluated the consequences of fires in these areas 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 redundant cables.

5.3.4 Fire Protection System

There are no automatic fire detection devices in this area of the auxiliary building. Manual hose stations and portable fire extinguishers are available for fighting fires in this area. However, a waste drumming station is located adjacent to the interior hose station outside the diesel generator room door. Material waiting to be processed was stacked in front of the hose station at the time of the site review.

5.3.5 Adequacy of FIre Protection

With prompt 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.

5.3.6 Modifications

The licensee has proposed to install additional fire stops on nonsafety-related cable trays, automatic fire detection systems in various areas of safety and nonsafety-related areas. These areas include zone 1, 5, 7, 18, 25 and 26. The hose station adjacent to the waste drumming station has been relocated to permit free access to the fire hose reel in the area. Administrative controls have been instituted to prevent the accumulation of solid waste near the fire hose reel and the safety-related motor control center.

The licensee has proposed to provide automatic sprinkler protection beneath cable trays and to protect against fires and transient combustible materials in zones 1 (east end) and 5; the dry cleaning station in zone 18 will be provided with a suitable sprinkler system or removed from the area.

The licensee has been asked to provide the results of an analysis which demonstrates that redundant safe shutdown systems will not be damaged by an unsuppressed fire in zones 1 (west end), 7 and 18. If the results of this analysis indicates that safe shutdown

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capability will be lost, the licensee has proposed to provide one of the following modifications: (1) reroute certain cables required for safe shutdown; (2) to provide a wet-pipe fusible-link water spray system; or (3) to provide a fire wall, as necessary, to protect redundant cables required for safe shutdown. The east end of fire zones 5 and 7 will be protected against postulated fires from transient combustible with wet-pipe fusible link sprinkler systems with the sprinkler heads located below the cable trays.

Subject to implementation of the above modifications and a review of the information requested, we find that fire protection for these areas satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

5.4 Auxiliary Building at Elevation 95 Feet

5.4.1 Safety-Related Equipment

The area is adjacent to the Reactor Containment building and the intermediate building on one side with all outer walls of reinforced concrete. The entire elevation is made up of compartments of reinforced concrete rooms which house and separate both safety-related and nonsafety-related equipment. The wall penetrations are filled to a minimum seven feet height. Some walls in this area are ten feet high. A considerable quantity of safety-related and nonsafety-related cables are in open trays and conduits. 4160 Volt power cables for channels A and B are present, but each is enclosed in interlocked armour and the trays for the two channels are separated by distance. Safety-related systems that potentially could be affected by a fire are reactor building spray, decay heat, reactor makeup and purification, nuclear services and decay heat seawater, and nuclear services and decay heat closed cycle cooling water systems.

5.4.2 Combustibles

The significant combustible material in this area consists of a large quantity of electrical cable insulation in open cable trays, a moderate amount of lubricating oil in each makeup pump, a small amount of lubricating oil in other areas, and a small amount of paper and plastic.

5.4.3 Consequences if no Fire Protection

The licensee has evaluated the loss of cables in these areas and has found that cables from only one safety division are present in eleven areas and fire spread to redundant divisional cabling is prevented by distance. In three of these areas, the licensee has proposed to install automatic fire detection systems. There are twelve other areas which contain both channel A and B cable trays. The licensee has proposed to install automatic fire

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detection systems in six areas and additional fire stops in two areas. The channel A and B cable trays are separated by distance or barriers. The licensee has evaluated the loss of cables in these areas and has found that complete loss of channel A or channel B cables would not affect redundant safe shutdown equipment.

5.4.4 Fire Protection Systems

Automatic fire detection systems or automatic suppression equipment have not been provided in these areas. Portable extinguishers are located within and adjacent to these areas. Interior hose stations are located throughout the area. With prompt detection, manual suppression would be adequate to control fires in these areas and limit the effects of the fire. Lack of detection systems may allow the fire to continue unnecessarily.

5.4.5 Adequacy of Fire Protection

Due to the low combustible loading, other than cabling, 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 cause damage to safety-related equipment. Some of this equipment could be used for safe shutdown.

5.4.6 Modifications

The licensee has proposed to install automatic fire detection systems in the following areas:

Zone 4 Makeup and purification pump rooms.

Zone 7 Safety-related hallway which contain safety-related channel A cable trays.

Zone 17 Sea water pump room.

Zone 18 Nuclear service booster pump room.

Zone 32 Pump and tank room.

The licensee has proposed to install automatic sprinkler protection for cable trays and other combustibles in zones 1 and 5.

The licensee has been asked to provide drawings and the results of an analysis which demonstrates that redundant safe shutdown systems will not be damaged by an unsuppressed fire in zones 13 and 16. If the results of this analysis indicate that safe shutdown capability will be lost, the licensee has proposed to provide one of the following modification: (1) reroute certain cables required for safe shutdown; (2) to provide a wet-pipe fusible-link water spray system; or (3) to provide a fire wall,

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as necessary, to protect redundant cables required for safe shutdown reinforced concrete rooms.

We find that, subject to implementation of the above described modification and/or a review of the above analysis, the fire protection for these areas satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

5.5 Auxiliary Building at Elevation 75 Feet

5.5.1 Safety-Related Equipment

The safety-related reactor building spray pumps, decay heat pumps and decay heat removal heat exchangers are located in this area. The "A and B" trains of pumps and heat exchangers are located in separate reinforced concrete rooms. At least one decay heat removal pump should be available.

5.5.2 Combustibles

The significant combustibles in these rooms is a small amount of lubricating oil and cable insulation.

5.5.3 Consequences of No Fire Suppression

Due to the low combustible contents and the separation of the areas, only one train would be affected by an unmitigated fire.

5.5.4 Fire Protection Systems

There is no automatic fire detection or suppression systems for this area. Portable fire extinguishers and interior hose stations are available in adjacent areas.

5.5.5 Adequacy of Fire Protection

With prompt fire detection, manual suppression capability provided would be adequate to suppress fires in the area before either train A or B is lost. The lack of detection would allow the fire to continue unnecessarily.

5.5.6 Modifications

The licensee has proposed to add automatic fire detection systems in zones 1 and 2 to provide prompt notification locally and in 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 objectives identified in Section 2.2 of this report and is, therefore, acceptable.

5.6 Containment Electrical Penetration Areas

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5.6.1 Safety-Related Equipment

The containment electrical penetrations areas are located in the auxiliary building and the intermediate building. These areas are safety-related and are bordered by three-hour fire rated walls. One area contains safety-related cable trays for channel A; the other area contains channel A and channel B safety-related cable tray systems. There is one cable tray which contains non-safeguards instrumentation cables. This non-safeguards cable tray runs between the safeguards channel A and B cable trays.

5.6.2 Combustibles

The significant combustible material in these areas consists of a moderate amount of cable insulation in open cable trays.

5.6.3 Consequences if No Fire Protection

Cables from the redundant divisions are routed through one of these areas. The licensee has evaluated the loss of cables in these areas and has found that redundant safety-related cabling is separated by distance or barriers and therefore an unmitigated fire would not affect redundant safe shutdown equipment.

5.6.4 Fire Protection Systems

Fire detection or automatic suppression equipment has not been provided in these areas. Portable fire extinguishers and hose stations are located in the area or adjacent to the areas.

5.6.5 Adequacy of Fire Protection

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

5.6.6 Modifications

The licensee has proposed to install automatic fire detection systems in the areas which will alarm locally and in the control room as discussed in other sections of this report. The licensee has also proposed to install fire stops on the non-safeguards instrumentation cables runs between safeguards channels A and B to prevent the spread of fire between channels.

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

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5.7 Intermediate Building at Elevation 119 Feet

5.7.1 Safety-Related Equipment

This elevation of the intermediate building is bounded on one side by the reactor containment building and on the other three sides by reinforced concrete walls. This area contains the personnel access hatch to the containment building, pressurizer control cabinets 3A and 3B, electrical and piping penetration areas. These areas contain redundant safety-related safe shutdown cables.

5.7.2 Combustibles

Significant combustibles in the area include a large quantity of electrical cable insulation, up to 165 gallons of transient lube oil, a significant supply of anti-C clothing, paper and plastic.

5.7.3 Consequences if No Fire Protection

The licensee has evaluated the consequences of fires in these areas and shown that, in most areas, the separation of redundant cables from combustibles or the separation between redundant cables is such that it is unlikely that an unmitigated fire would involve such cables. In the containment personnel access area, an unmitigated fire involving the oil and/or other combustibles stored in the area may cause loss of redundant safe shutdown systems.

5.7.4 Fire Protection Systems

There are no automatic fire detection or fire suppression systems installed in these areas. Portable fire extinguishers and hose stations are located in and adjacent to the areas.

5.7.5 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, except for the containment access areas. Lack of detection may allow the fire to continue unnecessarily. Without automatic suppression in the containment personnel access area, a fire may affect redundant safe shutdown systems due to the proximity of cables to each other. In this particular area, there are portable fire extinguishers and a interior hose station. The storage of combustible supplies present an unnecessary fire exposure to critical areas.

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5.7.6 Modifications

The licensee has proposed to install automatic fire detection systems in the pressurizer control cabinet area to detect cable fires or other fires that may jeopardize safety-related equipment.

The licensee has proposed to install automatic sprinkler protection to extinguish postulated fires in clothing, paper or transient material in zone 5. This area contains Channel A cables, channel B cables, and non-safety-related cables. The areas inside and above the personnel air lock shield structure will not be covered by this sprinkler system. The function of the cables in this area will be examined by the licensee to determine the effects on safe-shutdown capability of the loss of all cables. If this examination shows that safe shutdown capability will be lost, appropriate additional measures will be taken. These measures will be one of the following: (1) to reroute certain cables required for safe shutdown; or (2) to provide a wet-pipe fusible-link water spray system to protect the cable trays in the area.

Subject to implementation of the above described modifications, and/or a review of the above analysis, the fire protection for these areas satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable.

5.8 Intermediate Building at Elevation 95 Feet

5.8.1 Safety-Related Equipment

This area is bounded on one side by the reactor containment building and on the other three sides by reinforced concrete walls. This area contains the motor driven and steam turbine driven emergency feedwater pumps, penetration cooling fans and one of the pipe penetration areas. At least one emergency feedwater pump is required for safe shutdown.

5.8.2 Combustibles

The significant combustibles in this area consists of a small amount of lubricating oil associated with the pumps and moderate amount of cable insulation in cable trays from channel A only.

5.8.3 Consequences if No Fire Suppression

There is sufficient separation between the emergency feedwater pumps that only one pump would be affected by an unmitigated fire, but the cable for the motor driven pump could be affected by a fire in the vicinity of the steam driven pump.

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5.8.4 Fire Suppression Systems

There is no automatic fire detection or suppression systems for this area. Portable fire extinguishers and interior hose stations are available for fire suppression in this area.

5.8.5 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 disabled. The lack of detection would allow the fire to continue unnecessarily.

5.8.6 Modifications

The licensee has proposed to provide fire detection and suitable one hour fire barriers around safety-related cables and motor operated valves.

The licensee has proposed to install automatic fire detection systems in the area.

Subject to the implementation of the above described modifications, the fire protection system for this area satisfies the objectives in Section 2.2 of this report and is, therefore, acceptable.

5.9 Reactor Building

5.9.1 Safety-Related Equipment

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

5.9.2 Combustibles

The significant combustibles inside the reactor containment building consists of a large quantity of electrical cable insulation and the lubricating oil associated with the reactor coolant pumps. The licensee has installed a oil guard leak collection system around each reactor coolant pump. The collection system is piped to a common collection reservoir located inside the secondary shield wall. The design concept of the oil collection system is based on a failure of one reactor coolant pump oil system at any time. The oil collection reservoir consists of 4 fifty-five gallon oil drums piped together such that the reservoir will contain the total oil capacity from one reactor coolant pump.

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5.9.3 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 collection system which limits the amount of oil available to burn to a small amount and because the pumps are widely separated in separate cubicles. The separation of cables is such that a fire in the vicinity of one pump would not cause loss of safe shutdown capability.

Two areas, elevation 95 feet and elevation 119 feet, both located outside the reactor compartment, contain electrical cabling for trains A and B, and also non-designated cable trays. The licensee has reviewed these areas and find that spread of fire in these areas is limited by separation of major equipment, cable trays and low combustible loading which can serve as fuel. Loss of functional capability of individual components could occur due to a fire, but loss of individual components would not preclude safe shutdown of the plant.

5.9.4 Fire Protection Systems

There is no fire suppression or fire detection equipment installed inside the reactor containment building. Portable fire extinguishers are brought into containment as required for maintenance activities.

5.9.5 Adequacy of Fire Protection

The reactor coolant pumps oil guard collection tanks at the bottom floor of the reactor building have sufficient capacity for leakage from a single pump even if one of the collection tanks is isolated.

Portable fire extinguishers would not be adequate to suppress cable insulation fires or oil fires at the reactor coolant pumps.

5.9.6 Modifications

The licensee has been asked to provide the results of an analysis for Zone 1 which demonstrates that redundant safe shutdown systems will not be damaged by an unsuppressed fire. The licensee has proposed to install automatic fire detection systems in the vicinity of the reactor coolant pumps, in ventilation units, near cable concentrations, and general areas throughout the reactor building. Fire stops will be provided to maintain separation at the two previously discussed areas on elevation 95 feet and 119 feet. The licensee has proposed to install a standpipe system inside the containment building with a suitable number of stations at each elevation in order that all potential fire areas of the containment can be reached by an effective fire stream.

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

5.10 Control Room

5.10.1 Safety-Related Equipment

The control room contains cabinets and consoles within which are components for safety-related systems, including those systems required for safe shutdown of the plant.

5.10.2 Combustibles

The combustibles in this area consist mainly of electrical wiring insulation contained within the cabinets and consoles. There are also ordinary combustibles, primarily paper for operating needs, a computer, and a kitchen area.

5.10.3 Consequences If No Fire Suppression

An unsuppressed fire in the consoles containing safe shutdown equipment could affect wiring of both redundant divisions.

5.10.4 Fire Protection Systems

Fire detection is provided by smoke detectors in the room and in the air handling systems. Portable fire extinguishers are provided for manual fire suppression; however, there are no liquid type extinguishers provided to combat deep-seated fires in ordinary combustibles.

5.10.5 Adequacy of Fire Protection

Fire detection and manual fire suppression may not be sufficient to prevent fires from damaging controls and instrumentation for both redundant divisions of systems required for safe shutdown.

The storage of combustible operating supplies and the kitchen facilities present an unnecessary fire exposure to the critical control room systems.

The lack of portable fire extinguishers suitable for deep-seated fires in ordinary combustibles could cause unnecessary delay in fire control, and excessive water damage if the use of hose lines is required for such fires.

The fire door between the control room and the adjacent hallway is being held open with a wedge and would not operate automatically to isolate the control room.

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5.10.6 Modifications

The licensee has proposed to provide the capability of shutting down the reactor safely at a location remote from the control room regardless of any damage caused by a control room or cable spreading room fire.

The licensee has provided a list of safety-related and non-safety-related cables located in the ceiling above the control room. Control cables in the ceiling have been coated with a fire retardant. A ladder for ceiling access is provided and is stored in or immediately outside the control room.

The licensee has proposed to remove combustible supplies or store them properly in metal cabinets or under sprinkler protection, disconnect and/or remove the kitchen stove from the control room, provide liquid type fire extinguishers for the room, and provide an automatic closing fire door between the control room and the hallway. The licensee has proposed to provide continuous observation by the security guard on the control room door until the station security system is completed.

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

5.11 Cable Spreading Room

5.11.1 Safety-Related Equipment

This area located on elevation 134 feet of the control complex contains control and instrumentation cables, some of which are for safety-related systems required for safe shutdown.

5.11.2 Combustibles

The significant combustible in this area is a large quantity of electrical cable in both covered and open trays, and in conduit.

5.11.3 Consequences If No Fire Suppression

Although there is some separation of redundant channels by distance and fire shields, an unsuppressed fire in the area could cause loss of control from the control room of redundant systems required for safe shutdown.

An unsuppressed cable spreading room fire could also spread to the safety-related 480 Volt switchgear room below through the unprotected metal floor, and to the control room above through unprotected metal plates in the concrete ceiling.

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5.11.4 Fire Protection Systems

Automatic fire suppression is provided by a Halon 1301 system actuated by cross-zoned detectors; operation of the system alarms in the control room. Fire hose and portable fire extinguishers are available for manual fire suppression.

5.11.5 Adequacy of Fire Protection

Because of concerns for effectiveness and reliability, gaseous fire suppression systems alone are not acceptable protection for areas containing large quantities of electrical cables in which deep-seated fires could develop.

5.11.6 Modifications

The licensee has proposed to install a backup Halon 1301 agent supply that would allow a second manual discharge if automatic release of the primary supply is ineffective.

The licensee has proposed to provide alternate means to achieve safe shutdown from a location remote from the control room, regardless of any fire damage in the control room or cable spreading room. The licensee has proposed to provide at least a one-hour fire resistance above the cable spreading room floor. A three-hour resistance rated material will be applied to the metal plates in the ceiling to prevent the spread of fire to the control room. Cable spreading room fire suppression effectiveness is placed on the cable spreading room circulating fans; therefore the licensee has proposed to power the circulating fans in the cable spreading room from an essential power supply.

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

5.12 Switchgear Rooms

5.12.1 Safety-Related Equipment

The 4160 Volt and 480 Volt safety-related switchgear rooms are located in the control complex on elevations 108 feet and 124 feet, respectively. Redundant switchgear are housed in separate rooms within three-hour fire barriers. One of the 4160 Volt switchgear rooms contains power cables from both redundant diesel generators.

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5.12.2 Combustibles

The significant combustible in the switchgear rooms is electrical insulation on cable and in the switchgear enclosures. Power cables are contained in flexible metal conduit; control cables are placed in lightly loaded trays.

5.12.3 Consequences If No Fire Suppression

An unsuppressed fire in three of the switchgear rooms will not affect more than one safety-related division because of the separate rooms provided. In the 4160 Volt switchgear room containing both redundant power cables from the diesel generators, the room configuration, light fire loading, enclosure of power cables in flexible metal conduit, and enclosure of switchgear in metal cabinets will prevent involvement of both redundant cables in a fire.

5.12.4 Fire Protection Systems

Fire detection is provided by smoke detectors in each switchgear room. Portable fire extinguishers and hose stations are available for manual fire suppression.

5.12.5 Adequacy of Fire Protection

The existing physical conditions and protective features will preclude loss of redundant safe shutdown systems. To effectively combat all potential fires and minimize damage to safety-related systems, interior fire hose stations are available adjacent to the switchgear rooms.

5.12.6 Modifications

No modifications are recommended for these areas.

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

5.13 Battery Rooms

5.13.1 Safety-Related Equipment

Rooms containing redundant batteries, battery chargers and inverters are located on elevation 108 feet of the control complex. These systems supply DC power to safety-related systems, some of which are required for safe shutdown. All redundant systems are separated by three-hour fire barriers except that the inverter rooms contain power cables from both redundant diesel generators, and one battery charger room contains cable from the redundant battery charger room.

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5.13.2 Combustibles

The combustibles in these rooms consist of a small amount of electrical insulation on cables and inside equipment cabinets. Most of the electrical cable is in either rigid or flexible metal conduit; there is a small amount of open cable trays. The battery rooms contain batteries in plastic cases; hydrogen is generated during battery charging.

The station batteries at Crystal River 3 are of a type which has a very low hydrogen production rate when under charge. Section 8.2.2.6 of the Final Safety Analysis Report states in part, . . "under the condition that the battery rooms were completely sealed from outside air it was calculated that it would require 210 hours to produce sufficient hydrogen in the rooms to yield an explosive mixture (four percent by volume).

5.13.3 Consequences If No Fire Suppression

Because of the physical arrangement and light fire loading, an unsuppressed fire in any of these rooms would affect only one division of safety-related equipment.

5.13.4 Fire Protection Systems

Fire detection is provided by smoke detectors in each individual room, and portable fire extinguishers are provided for manual fire suppression.

5.13.5 Adequacy of Fire Protection

The existing fire loading and layout will preclude loss of redundant safe shutdown systems. To effectively combat all potential fires and minimize damage to safety-related systems, interior fire hose streams should be available to the area.

The battery room ventilation ducts for hydrogen removal are located several feet below the ceiling bays, creating an unnessary fire hazard. The ventilation system is not monitored for continuous operation.

5.13.6 Modifications

The licensee has proposed to relocate the battery room exhaust ducts near the ceiling and to provide local monitoring of ventilation flow for each battery room.

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

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5.14 Diesel Generator Rooms

5.14.1 Safety-Related Equipment

The two redundant diesel generators are housed in individual rooms separated by a three-hour fire barrier. The controls for each diesel generator are also housed in individual rooms that are separated from the diesel generators and from each other by three-hour fire barriers. One control room contains some electrical cables associated with the redundant diesel generator.

5.14.2 Combustibles

The significant combustibles in the diesel genera or rooms are diesel fuel and lubricating oil. The control rooms contain a small amount of electrical insulation on cables and in the electrical cabinets.

5.14.3 Consequences If No Fire Suppression

An unsuppressed fire in one diesel generator room will not affect the redundant unit because of the three-hour fire barriers provided. However, there is a potential for the spread of burning combustible liquids to the redundant system via the common floor drain system and under the fire doors.

The fire loading and physical separation in the control room containing electrical cable from the redundant diesel generator is such that a fire in the combustibles in the room will not affect both divisions.

5.14.4 Fire Protection Systems

The diesel generator rooms and the control rooms are protected by a preaction automatic sprinkler system actuated by rate-compensating heat detectors. In addition, the control rooms have smoke detectors that alarm in the plant control room. Portable fire extinguishers and interior fire hose are available for manual suppression.

5.14.5 Adequacy of Fire Protection

The pre-action sprinkler system provided will reduce fire damage to safety-related diesel generator systems. The detection-actuation system for the pre-action sprinkler system is capable of functioning automatically on loss of station and off-site power. The smoke detector in each control room is poorly positioned, which could result in slow detector response and delay of manual fire suppression. The design of the floor drain system and the lack of curbs at fire door openings could allow burning liquid to spread fire to the redundant diesel generator or control room. A leak in the diesel fuel system could go undetected with continued

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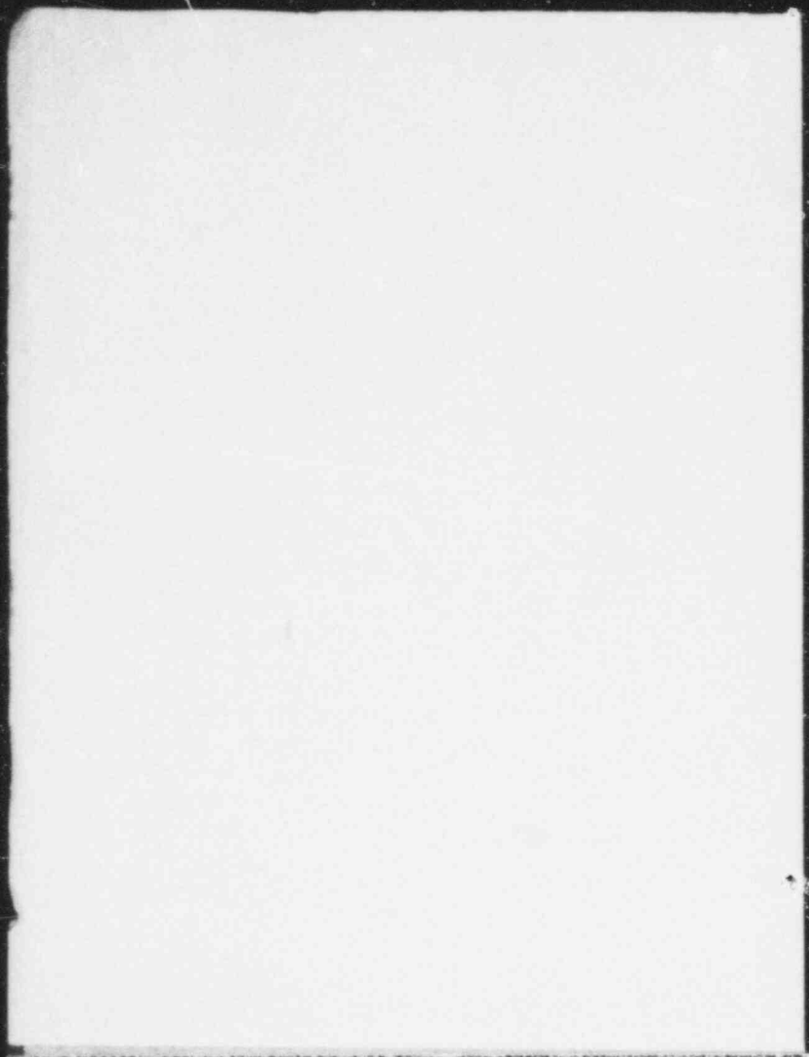

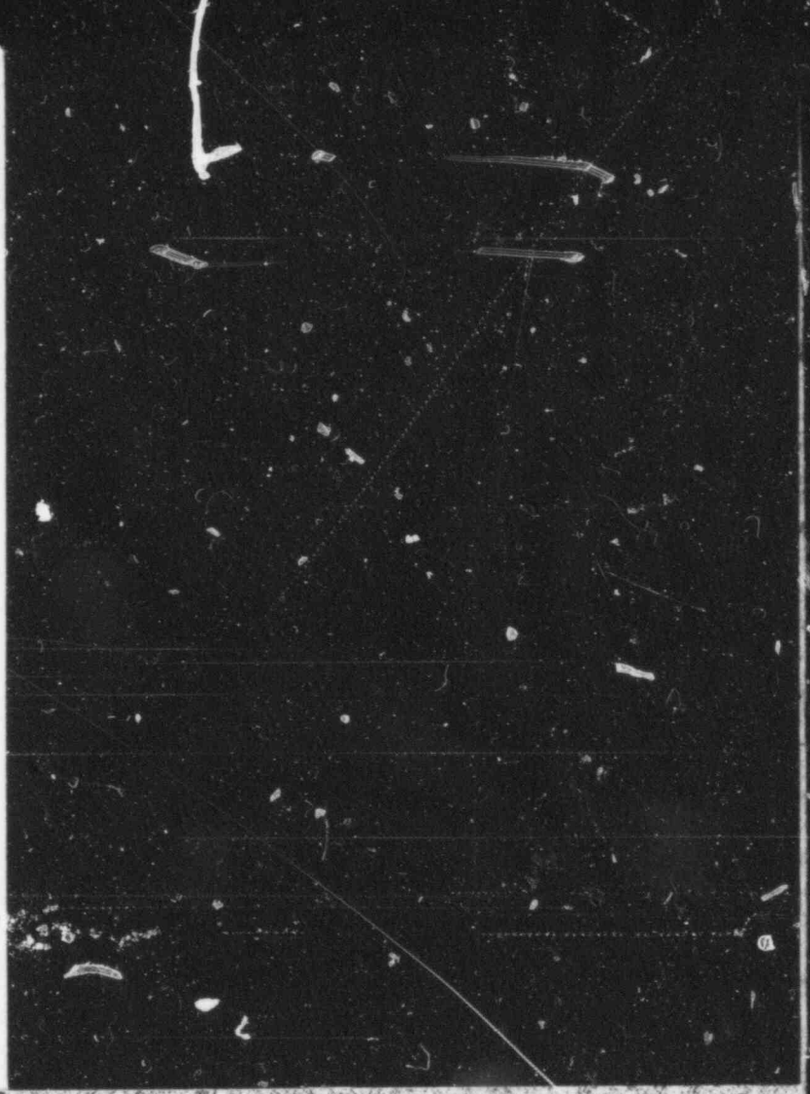

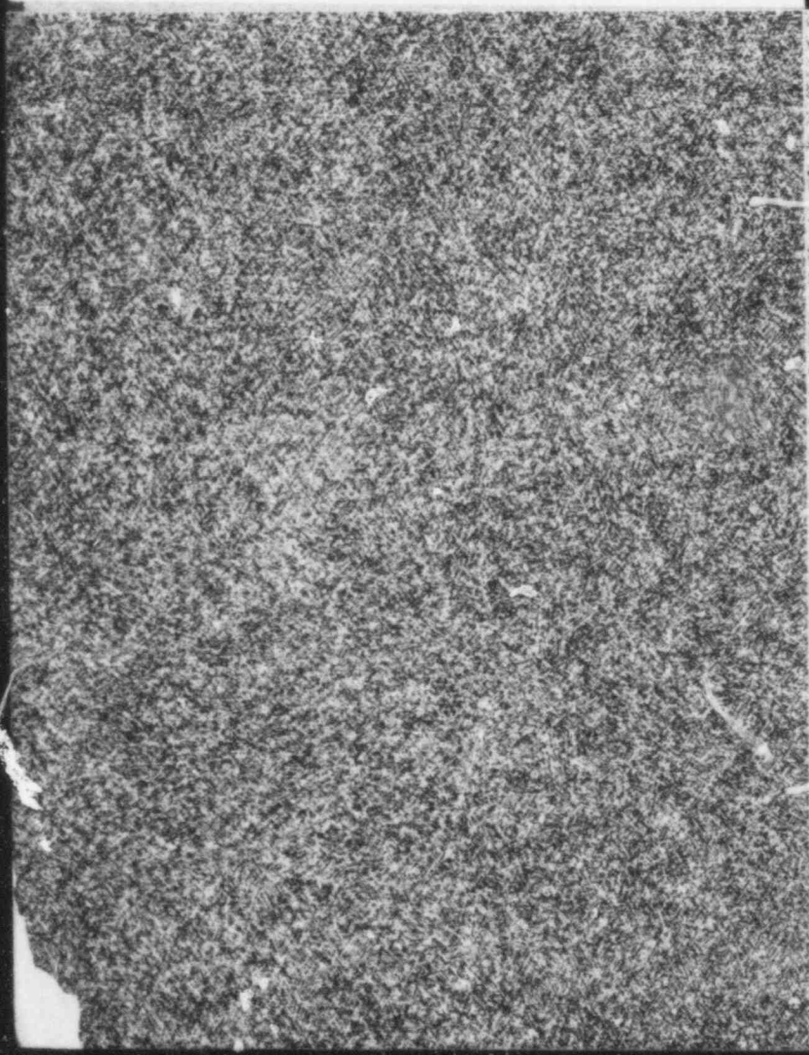

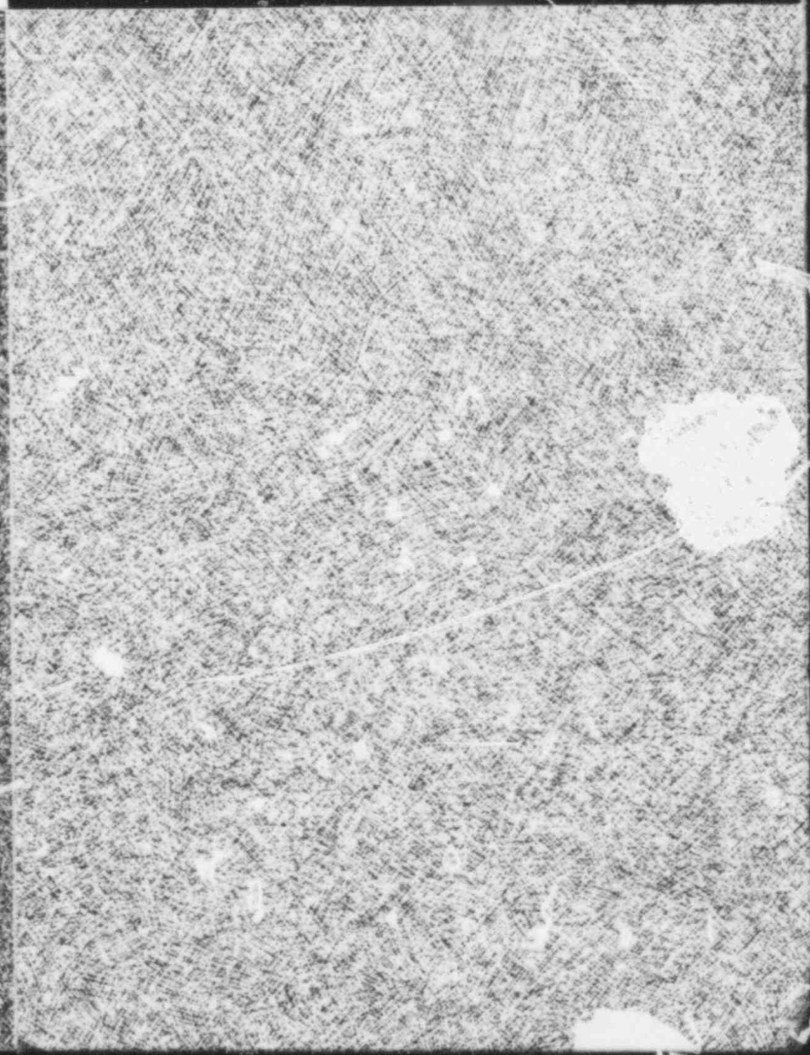

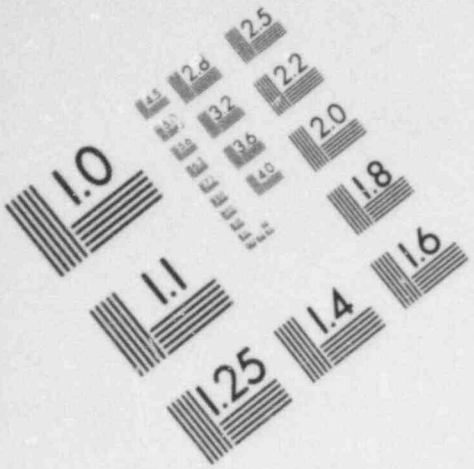

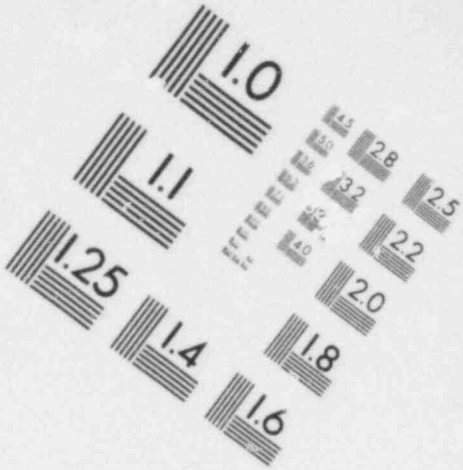

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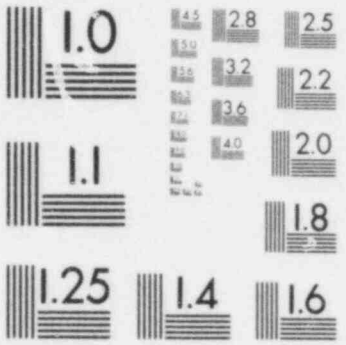

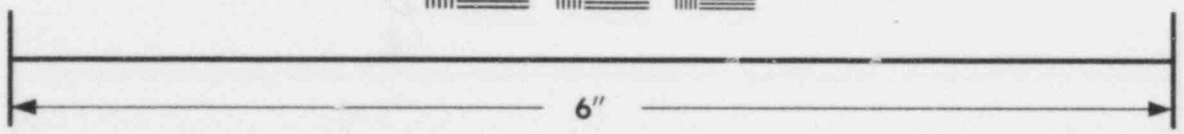

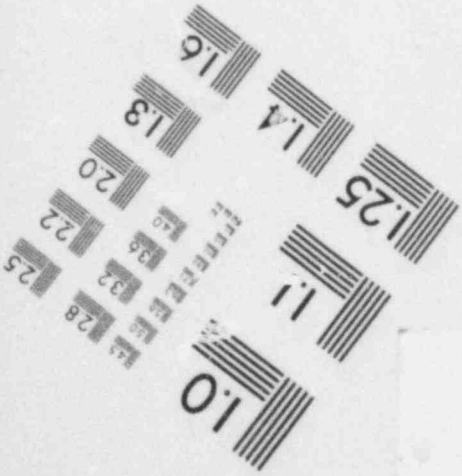

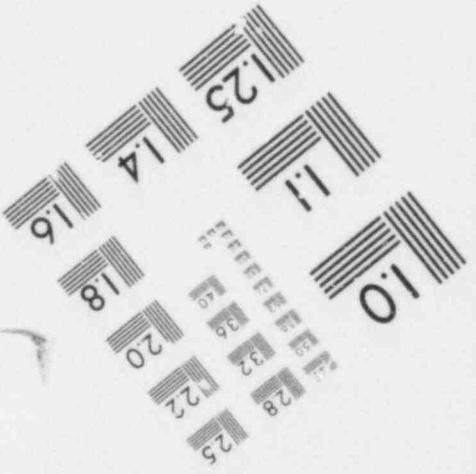

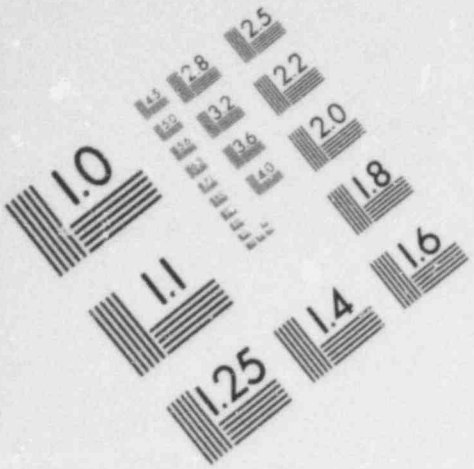

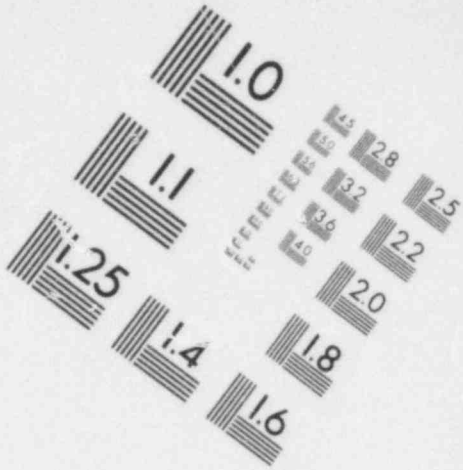

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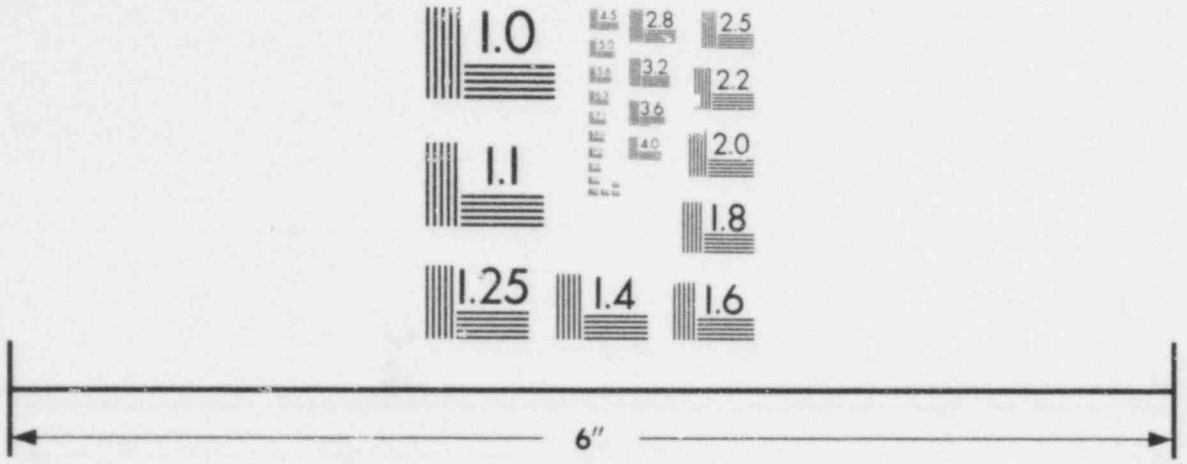

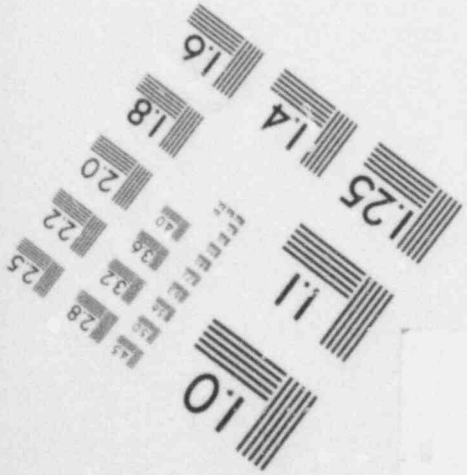

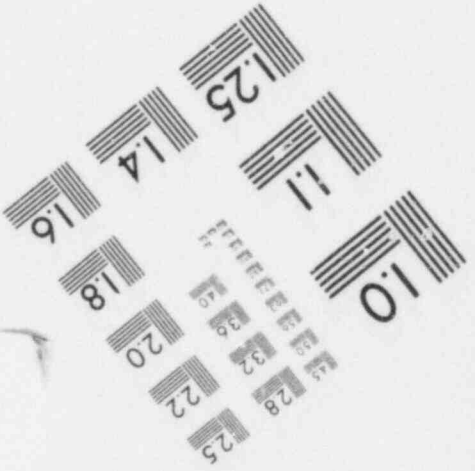

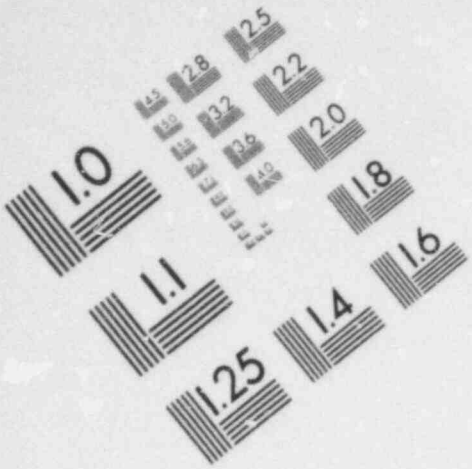

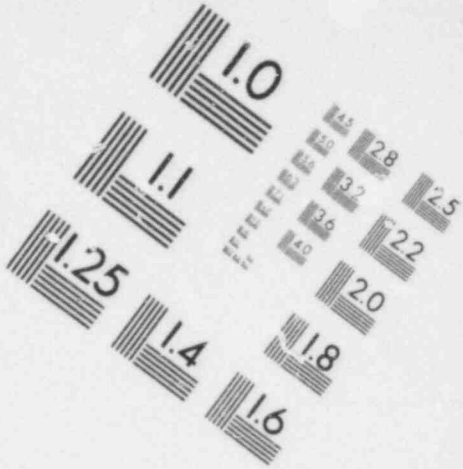

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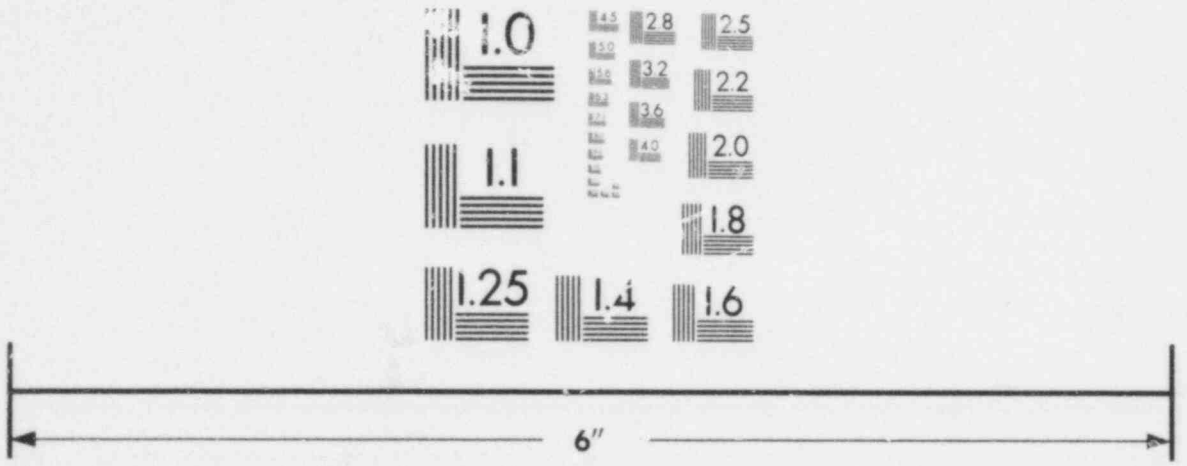

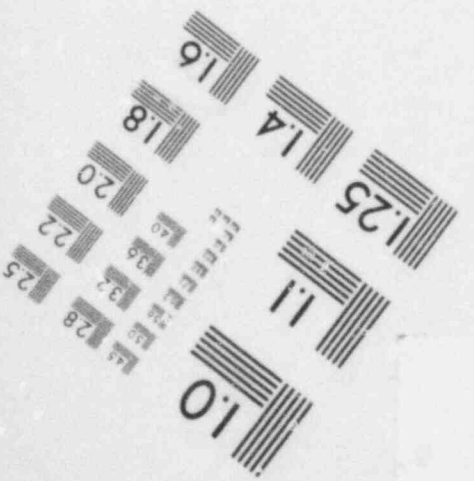

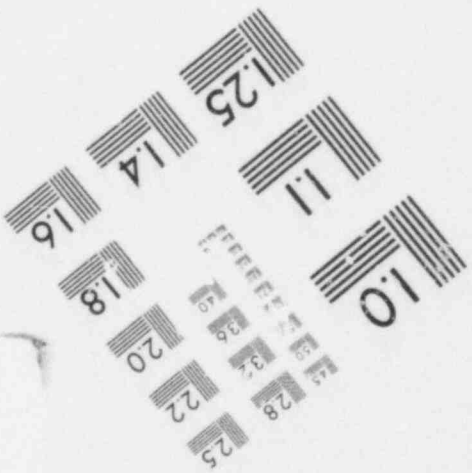

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operation of the fuel transfer pumps which have no running indication in the control room.

5.14.6 Modifications

The licensee has proposed to provide curbs at doorways in the diesel generator rooms, modify the floor drain system by the installation of weirs to eliminate this avenue of potential fire spread, relocate the control rooms' smoke detectors to improve response time, and provide a sump alarm to ensure that the control room personnel are alerted to any potential fuel leak.

We find that, subject to implementation of the above described modifications, the fire protection system satisfies the objective identified in Section 2.2 of this reported and is, therefore, acceptable.

5.15 Turbine Building

5.15.1 Safety-Related Equipment

There is no safety-related equipment or electrical cables located within the turbine building.

5.15.2 Combustibles

The significant combustibles in the turbine building include lubricating oil in the reservoir, purifier and piping systems for the main turbine generator, the main feedwater pumps, and the hydrogen seal oil system; hydrogen; electrical insulation on cable and in electrical equipment; and miscellaneous ordinary combustibles such as resins wood, paper and plastic which are mostly transient.

5.15.3 Consequences If No Fire Suppression

An unsuppressed fire in the turbine building could cause significant damage to nonsafety-related systems and structures. Safety-related systems will not be affected if the fire barrier separating the turbine building from safety-related areas maintains its integrity.

5.15.4 Fire Protection Systems

The heater bay is provided with smoke detectors. The two lower elevations of the turbine building are protected by automatic sprinklers. The turbine lube oil reservoir and purifier, the main feedwater pump oil reservoir, and the hydrogen seal oil unit are protected by automatic water spray systems. The main feedwater pumps and the turbine generator bearings are protected by an automatic carbon dioxide system. Interior fire hose stations and

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portable extinguishers are distributed throughout the turbine building for manual firefighting.

5.15.5 Adequacy of Fire Protection

The areas and equipment containing large quantities of combustible lubricating oil are protected by automatic sprinklers, water spray or carbon dioxide systems which are designed to control anticipated fires. Areas containing safety-related systems are separated from the turbine building by three-hour fire barriers that will stop the spread of fire should fixed protective systems or manual fire suppression efforts fail.

The licensee has stated that "the turbine building was designed and constructed as a free standing structure. It is joined to the control complex and the intermediate building only by mastic joint, therefore; the complete failure of the turbine building will not affect the control complex or the intermediate building."

5.15.6 Modifications

We find that the fire protection system for the turbine building satisfies the objective identified in Section 2.2 of this report and is, therefore, acceptable.

5.16 Yard Area

5.16.1 Safety-Related Equipment

Safety-related equipment in the yard area includes the condensate storage tank, the borated water storage tank and the underground fuel oil tanks for the emergency diesel generators.

5.16.2 Combustibles

The combustibles which were considered for their potential to exposure safety-related systems include oil-filled transformers, the underground turbine lube oil storage tank, and the underground diesel fuel oil tanks.

5.16.3 Consequences If No Fire Suppression

An unsuppressed fire in the yard area would not present a significant exposure to safety-related systems because of intervening distances or barriers.

5.16.4 Fire Protection Systems

The oil-filled transformers are protected by automatic water spray systems actuated by rate-compensation heat detectors. Yard fire hydrants and fire hose are available for manual fire suppression in the yard area.

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5.16.5 Adequacy of Fire Protection

Considering the yard layout, existing fire suppression systems provide acceptable protection for safe shutdown equipment. Several of the post indicator valves in the yard area were not protected from vehicular traffic.

5.16.6 Modifications

The licensee has proposed to provide traffic guards around post-indicator valves exposed to the vehicular traffic.

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

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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 [illegible] implementing procedures are provided by letters from the licensee dated June 22, 1977 as supplemented by letters dated July 11, 1977, December 19 1977, May 30, 1978, June 23, 1978 and letter of reponse dated January 26, 1979.

We have reviewed the administrative controls for fire protection and find that, this fire protection program, except as noted below, satisfies the objectives identified in Section 2.2 of this report and is, therefore, acceptable. We will report on the resolution of the fire brigade manpower requirement in a supplement to this Safety Evaluation.

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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. The licensee will propose a Technical Specification change to require that at least four individuals with fire protection training be on site at all times. The proposed Technical Specifications will include the requirement for a call-back program to assure that one or more offsite fire brigade members will be readily available in the event of a fire emergency. We find the change acceptable pending resolution of the question of minimum brigade size acceptable to the Commission. 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 of operation and surveillance requirements for these modifications.

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8.0 CONCLUSIONS

The licensee has performed a fire hazards analysis and has proposed certain modifications to improve the fire protection program. Additional modifications have been proposed by the licensee during the course of our review, which are based upon the fire hazards analysis and our onsite evaluation of the fire protection program. These proposed modifications are summarized in Section 3.0. In addition, we have concluded that the licensee should implement certain evaluations or improvements related to the fire protection program. These are summarized in Section 3.0. Significant steps are being taken to provide additional assurance that safe shutdown can be accomplished and that the plant can be maintained in a safe condition during and following potential fire situations. Upon implementation of the licensee's proposed modifications and satisfactory completion of remaining evaluations, we find that the objectives identified in Section 2.0 will be satisfied.

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

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

> "Fires occur rather frequently; however, fires involving equipment unavailability comparable to the Browns Ferry fire are quite infrequent (see Section 3.3 of [NUREG-0050]). The Review Group believes that steps already taken since March 1975 (see Section 3.3.2 of [NUREG-0050]) 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 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 events which further the likelihood of disabling fires and to improve assurance of rapid extinguishment of fires that occur. Consideration should be given also to features that would increase further the ability of nuclear facilities to withstand large fires without loss of important functions should such fires occur."

We recognize that the "Risk Assessment Review Group Report to the U. S. Nuclear Regulatory Commission" NUREG/CR-0400 (The Lewis Committee Report), states that the Review Group is unconvinced of the correctness of the

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WASH-1400 conclusion that fires contribute negligibly to the overall risk of nuclear plant operation. In the Commission's Policy Statement dated January 18, 1979, "NRC Statement on Risk-Assessment and the Reactor Safety Study Report (WASH-1400) in Light of the Risk-Assessment Review Group Report", the Commission indicated on page 3 that it "accepts the review Group Report's conclusion that absolute values of the risks presented by WASH-1400 should not be used uncritically either in the regulatory process or for public policy purposes and has taken and will continue to take steps to assure that any such use in the past will be corrected as appropriate. In particular, in light of the Review Group conclusions on accident probabilities, the Commission does not regard as reliable the Reactor Safety Study's numerical estimate of the overall risk of reactor accident."

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

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

We have concluded, based on the consideration discussed above, that: (1) because the amendments do not involve a significant increase in the probability or consequences or accidents previously considered and do not involve a significant decrease in a safety margin, the amendments do 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 these amendments will not be inimical to the common defense and security or the health and safety of the public.

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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 Evaluation-Crystal River 3 Nuclear Station, dated December 29, 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, therefore, is as follows:

1. Consultants' Comments: 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 systems 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 the 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 for nuclear plants.

2. 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.

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Massive changes will be required in most areas of the plant if effective permanent smoke removal systems are required, the design of which would also have to include consideration of radioactive releases. While portable fans and ducts may be effective for smoke control in many instances, there is concern that they will 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 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 of 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. The current fire service portable smoke removal units have a sufficiently high temperature capability to remove smoke when the hot gasses are cooled enough for fire brigade entry. The manual fire fighting consultants have made their evaluations of the fire capabilities of a number of plants and have recommended use of the portable smoke exhaust systems. We require the licensees to develop pre-fire 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 emergency breathing equipment, fire suppression equipment, fire barriers, and other protective 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 consultant(s).

3. Consultants' Comments: Minimize Fire Effects

SER Item 8.0 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

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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 terms "minimize" in the Context of its use in Appendix A to BTS 9.5-1 and GDC-3 where it means a general level of detection and suppression. This level of protection is afforded to all safety systems, not only where required to prevent loss of safe shutdown capability.

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APPENDIX A

Correspondence from the Nuclear Regulatory Commission to Florida Power Corporation

Letter of:

May 3, 1976	Transmittal of Standard Review Position 9.5-1
September 30, 1976	Transmittal of Appendix A to APCSB 9.5-1 and Supplemental Guidance
December 17, 1976	Transmittal of Standardized Technical Specifications and Errata Sheet
June 16, 1977	Transmittal of Sample Technical Specification
August 4, 1977	Transmittal of "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls and Quality Assurance"
November 29, 1977	Transmittal of Technical Specification
February 3, 1978	Transmittal of Amendment No. 13
March 23, 1978	Transmittal of missing pages to Amendment No. 13
June 5, 1978	Transmittal of "Manpower Requirements for Operating Reactors"
November 14, 1978	Transmittal of Fire Review Plan Questions

Correspondence from Florida Power Corporation to the Nuclear Regulatory Commission

Letter of:

October 26, 1976	Regarding Fire Protection Program Review
April 28, 1977	Regarding Fire Protection Program Reevaluation
June 22, 1977	Transmittal of "Fire Protection Program Review"
July 11, 1977	Transmittal of Technical Specification Change Request No. 4.

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December 19, 1977	Regarding objection to Section 6.2.2.f of the proposed interim Technical Specifications.
May 30, 1978	Regarding FPC response to NRC Guidelines on Fire Protection.
June 23, 1978	Regarding NRC guidance document "Manpower Requirements for Operating Reactors."
January 9, 1979	Transmittal of response to the Staff Site Visit positions and questions.
January 26, 1979	Transmittal of response to the Staff Site Visit positions and questions.
February 14, 1979	Transmittal of response to the Staff Site visit positions and questions.
February 27, 1979	Transmittal of response to the Staff Site Visit positions and questions.
April 5, 1979	Transmittal of response to the Staff Site Visit positions and questions.

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