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ASSOCIATED UNIVERSITIES, INC.

Department of Nuclear Energy

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March 27, 1980

Mr. Robert L. Ferguson  
Plant Systems Branch  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

RE: James A. FitzPatrick, Fire Protection Review, Items 3.1.8, 3.1.18,  
3.1.19, 3.2.1, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8, 3.2.9, and  
3.2.10.

Dear Bob:

Attached are all the James A. FitzPatrick fire protection review items for  
which we have received licensee information.

Respectfully yours,

Robert E. Hall, Group Leader  
Reactor Engineering Analysis

REH:EAM:sd  
attachment

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JAMES A. FITZPATRICK

Fire Protection Review

Item 3.1.8 - Ventilation Systems, Safety Related Pump Rooms SP-1 and SP-2

SER Section 3.1.8 indicates that the licensee will install physically separated supply ventilation systems with automatically actuated 3-hour rated dampers in safety related pump rooms SP-1 and SP-2.

By letter dated November 14, 1979 the licensee proposed to provide a separate source of ventilation from the east cable tunnel via the existing access doorways. The access door between the pump rooms and the door to the east cable tunnel will be held open with fusible links and electric releases. The 4 existing ventilation openings to the pump rooms will be fitted with 3-hour rated fire dampers equipped with 160°F fusible links and electric releases.

The electric releases for the 2 doors and the 4 dampers will be actuated automatically by heat or smoke detectors, or manually from a local control panel. The fusible links will serve as a backup for the electric releases.

We recommend that the staff accept the licensee's proposal.

Item 3.1.18 - Fire Detection and Signaling Systems

SER Section 3.1.18 indicates fire detection and signaling systems will be installed in the following areas:

1. Crescent Area
2. Reactor Building Elevations 312', 330', 326', 344', and 369'
3. Battery Charging Rooms
4. Battery Room Corridor
5. Safety Related Pump Rooms SP-1 and SP-2
6. Control Room HVAC Air Intake
7. Safety Related Control Room Cabinets

By letter dated September 5, 1979, the licensee proposed to install a total of 273 new area smoke detectors, 36 self-contained smoke detectors, and 6 ultraviolet flame detectors. Plans showing the proposed locations were included with the letter.

The licensee's submittal described the factors used in determining the location, spacing, and type of detectors to be installed. However, the submittal did not provide sufficient quantitative data for the staff to determine the acceptability of the method in all areas of the plant since it relied, necessarily, on considerable engineering judgement. NRC is in the process of developing acceptance criteria for fire detector installations, and we will address this issue when such criteria becomes available.

### Item 3.1.19 - Exposed Structural Steel

SER Section 3.1.19 indicates that the licensee will protect exposed structural steel against fire damage where failure of such steel would jeopardize safe shutdown.

By letter dated November 14, 1979 the licensee provided the results of an analysis performed to identify the structures, equipment, or components whose failure could cause a significant release of radioactivity, or which are vital to a safe shutdown of the plant and removal of the decay and sensible heat.

The licensee's analysis indicated that the fire resistance of the exposed steel construction in the control room area is not sufficient to prevent collapse in case of a major fire in this area. Also, the fire resistance of exposed structural steel supporting the barriers between redundant equipment areas in the diesel generator building and electrical bays is not sufficient to prevent loss of redundant equipment in case of a major fire. The licensee has proposed to provide the capability to shut down the plant independent of the cables and equipment in the control room, and to provide three-hour rated fire proofing for certain exposed structural steel in the diesel generator building and electrical switchgear bays.

The licensee's analysis appears to permit some exposed structural steel to remain in the electrical bays. We recommend that the staff require the licensee to verify that exposed structural steel supporting the concrete roof of each electrical bay is protected by three hour rated fire proofing.

We further recommend that the staff require the licensee to provide the design details of the capability to shut down the plant independent of the control room.

### Item 3.2.1 - Fire Hazard Analysis

SER Section 3.2.1 indicates that the licensee will perform an analysis for each fire area containing safety related cable raceways (cables/conduit) or components, to verify the effectiveness of the spatial separation, tray covers, and/or fire stops in preventing simultaneous damage to redundant safety systems from a possible exposure fire involving the fixed combustibles in the area and a reasonable amount of transient combustible materials which may be in the fire area for routine plant operations and maintenance. In addition to the damage resulting from elevated temperatures in the immediate vicinity of the fire, the analysis will consider the effects of:

- Smoke and heat propagation via open stairways, hatches, and unrated penetrations in barriers,
- Smoke and heat propagation via HVAC ducts not equipped with automatic-closing fire dampers.

By letter dated December 6, 1979, the licensee stated that the plant was reviewed to determine where fires within single fire areas could jeopardize the ability to safely shut down the plant. Some areas were found where fire spread through unprotected openings could jeopardize safe shut down capability. Recommendations for modification were made including enclosing spiral stairs, providing 3-hour fire dampers or other isolation in ductwork in critical locations and modification of cable penetrations pending the results of testing.

The licensee's response does not:

- Indicate which areas of the plant contain redundant divisions of safety related equipment or cables, the loss of which could degrade plant safety.
- Provide any design details for the proposed fire protection of conduits, cables, or cable trays.
- Provide design details for the proposed spray barrier and sleeve sealant on reactor building elevation 272 feet.
- Provide justification for using a removable "fire rated" cover on an open hatch on reactor building elevation 300 feet. It is possible that a fire could occur while the hatch cover is not in place. The removable hatch cover is comparable to a manually operated fire door.

We recommend that the staff request the licensee to provide the following:

- A description of each plant area containing redundant divisions of safety-related cables or equipment, the loss of which could degrade plant safety, and a description of the proposed modifications and the basis for their acceptability.
- Design details for the proposed protection of conduits, cables and cable trays.
- Design details for the proposed spray barrier and sleeve sealant on reactor building elevation 272 feet.
- Design details and justification for using a removable hatch cover on reactor building elevation 300 feet.
- Description of "other isolation" which may be provided in the ductwork between crescent area west and reactor building elevation 272 feet.

We will complete our evaluation following receipt of the requested information.

#### Item 3.2.3 - Fire Water Piping System

SER Section 3.2.3 indicates the licensee will perform an engineering study to determine the modifications required to preclude a single failure in the piping system from causing a loss of all fire suppression water to any safety-related fire zone.

By letter dated November 14, 1979, the licensee indicated that the fire protection water piping system will be modified by the addition of several sectionalizing valves and a fire department siamese connection. One of the existing yard hydrants will be replaced by a municipal-type hydrant with a 4-1/2 inch outlet, and a check valve will be removed from the warehouse piping system.

Our review confirms that these modifications will preclude a single failure in the piping system from causing the loss of all fire suppression water to any single safety-related fire zone. We recommend that this item be accepted by the staff.

#### Item 3.2.4 - Diesel Fire Pump Room Sprinkler Spacing

SER Section 3.2.4 indicates that the licensee will perform an engineering study to verify that the diesel fire pump room sprinkler head arrangement provides adequate coverage that protects the entire room.

By letter dated September 5, 1979, the licensee indicated that a ventilation exhaust fan near one of the existing 6 sprinkler heads could cause a "shadowed" area in sprinkler discharge. The licensee indicated they will correct this deficiency by installing one additional sprinkler. Shop drawings and revised hydraulic calculations will be submitted to the insurance underwriter for approval.

We recommend that the staff request the licensee to submit design details. We will complete our review of this item when this information has been submitted.

#### Item 3.2.5 - Fire Door Supervision

SER Section 3.2.5 indicates that the licensee will perform an engineering study to determine the modifications required to close and lock or electrically supervise the position of all fire doors and barriers that separate safety related areas from each other and from non safety related areas or areas containing large amounts of combustibles.

By letter dated November 14, 1979 the licensee indicated that there are presently 21 fire doors in the plant and that there are an additional 20 doors which will be supervised by a new Class A monitoring system, thereby complying with the staff position.

The licensee submittal did not describe the characteristics of a "Class A monitoring system." We recommend that the staff require the licensee to provide a brief operational description of this system.

#### Item 3.2.6 - Signaling Circuits Supervision

SER Section 3.2.6 indicates the licensee will perform an engineering study to determine the modifications required to supervise the fire protection systems signal initiating and alarm signal sounding circuits in accordance with Article 240, NFPA 72D.

By letter dated September 5, 1979 the licensee indicated the response to this item was in an attached report titled "Response to NRC Concern PF-19." However, it appears that the licensee may have misunderstood the nature of the concern. NRC Concern PF-19 (now identified as SER Section 3.1.18) required the licensee to install additional detectors in the plant. However, SER Section 3.2.6 concerns the supervision of electrical circuits between heat detectors or other devices in the plant and the fire alarm annunciator panels in the control room.

We recommend that the staff request the licensee to submit a report of the required engineering study of the modifications required to assure that signaling circuits in the plant will meet the requirements of Article 240 of NFPA 72D.

#### Item 3.2.7 - Fire Pump Performance

SER Section 3.2.7 indicates the licensee will conduct a test program to verify that the fire pumps meet the performance requirements outlined in NFPA 20.

By letter dated September 5, 1979 the licensee indicated that the fire pumps were tested and met the performance requirements outlined in NFPA 20. The testing was conducted by plant personnel and the tests were observed by a representative of the insurance underwriter as part of the underwriter's requirements to witness such tests on an annual basis.

We recommend that the staff accept the licensee's statement that the fire pumps met the performance requirements of NFPA 20 based on the licensee's statement.

#### Item 3.2.8 - Fire Pump Capacity

SER Section 3.2.8 indicates the licensee will perform an engineering study to verify that a single fire pump is capable of meeting the combined demand (flow and pressure) for the operation of any fixed water fire suppression system plus 1000 gpm for hose streams.

By letter dated September 5, 1979, the licensee identified three plant areas where a single fire pump was not capable of meeting the combined demand for the fixed water suppression system and 1000 gpm for manual hose streams.

The three plant areas include:

- The south end of turbine building elevation 272 feet
- The northwest corner of turbine building elevation 272 feet
- The south end of turbine building elevation 252 feet.

Although the pump capacity was 200 to 600 gpm less than the licensee's estimated total demand, the licensee concluded that the protection for each area was adequate without modification because:

- In the south end of turbine building elevation 272 feet, a synthetic hydraulic fluid with superior fire resistance is used, transient and fixed combustibles in the area are limited, and the only safety-related equipment in the area is part of the reactor protection system (which is fail-safe).
- In the northwest corner of turbine building elevation 272 feet, no safety-related equipment is in the area, and transient and fixed combustibles are very limited.
- In the south end of turbine building elevation 252 feet, no safety related equipment is in the area, and the only significant fixed or transient combustible is the sprinklered turbine lube oil storage room, which is separated from the remainder of the building by three hour rated barriers.

The licensee's April 29, 1977 Fire Hazard Analysis indicated that there was no safety-related equipment or cables in the south end of turbine building elevation 272 feet. The most recent submittal contradicts this statement.

The licensee's sprinkler system demand figures in the September 5, 1979 submittal do not correspond to the sprinkler system demand figures in the licensee's May 7, 1979 submittal.

The licensee's study appears to utilize the concept of "primary" (high discharge density over a small area) and "total" (lower discharge density over a larger area) sprinkler system demand. For instance, the demand for the south end of turbine building elevation 272 feet is specified as 0.3 gpm per square foot over 3,000 square feet, or 0.2 gpm per square foot over 6,450 square feet. With a reliable automatic supply system, the use of a "primary" demand is unnecessary. Revision of the licensee's estimates in this manner may decrease or eliminate the apparent inadequacy of the fire pumps.

Also, the basis for the discharge densities and design areas in the licensee's study is unclear. At a discharge density of 0.2 gpm per square foot, Section A-2-2.1.3 of NFPA 13-1978 recommends a design area of about 5,700 square feet for sprinkler protection of areas where combustible hydraulic fluids are used in limited amounts. Where moderate to substantial amounts of flammable or combustible liquids are used, the same design area would require a discharge density of about 0.285 gpm per square foot.

We recommend that the staff require the licensee to:

- Clarify the conflicting statements in the April 29, 1977 and September 5, 1979 submittals regarding safety-related equipment or cables in the south end of turbine building elevation 272 feet.
- Verify that the April 29, 1977 submittal is otherwise correct with respect to location of safety-related cables or equipment in the plant.
- Provide the basis for the discharge densities and design areas for the sprinkler systems in the south end of turbine building elevation 272 feet, northwest corner of turbine building elevation 272 feet, and south end of turbine building elevation 252 feet.
- Clarify the apparent discrepancies between the May 7, 1979 and September 5, 1979 submittals with regard to sprinkler discharge densities and design areas.

We will complete our evaluation of this section following receipt of the required information.

#### Item 3.2.9 - Testing of Carbon Dioxide Fire Suppression Systems

SER Section 3.2.9 indicates that the licensee will perform discharge tests of the carbon dioxide fire suppression systems installed in the safety related areas of the plant to demonstrate that a satisfactory concentration of carbon dioxide can be achieved and maintained for the design period in all parts of the protected areas if additional documentation cannot support or establish that the systems provide adequate protection.

By letter dated November 14, 1979 the licensee indicated that the completion date for the required discharge test had been changed to January 1980.

The licensee has not yet provided the required information. We will complete our analysis when the results from the required carbon dioxide fire suppression systems testing are submitted.

#### Item 3.2.10 - Crescent Area Fire Protection

SER Section 3.2.10 indicates that the licensee will perform engineering studies to determine (1) the modifications required to provide a 3-hour rated barrier between the Crescent area halves, and (2) the feasibility and desirability of converting the suppression system protecting the HPCI and RCIC turbine to automatically actuated systems.

By letter dated September 5, 1979, the licensee indicated that there is no physical location at which the provision of a fire barrier will achieve the degree of separation necessary to insure capability to safely shut down the reactor in event of an unmitigated fire in the crescent area.

The licensee proposed to erect fire rated enclosures around both the RCIC and HPCI turbine pumps to contain any oil fires in the HPCI and RCIC oil systems. The enclosures will sit on a concrete type curb wall with a retention volume equal to approximately 125 percent of the individual lube system. Suitable trapped drains will be provided to contain the oil and drain fire protection water. The present manually operated water spray systems shall be changed to automatic systems actuated by abnormal heat or smoke. The new enclosure will require a Category I ventilation system, either in the form of new fans or extensions of the existing supply and/or exhaust ductwork. All duct penetration will require fire dampers. The licensee concluded that postulated lube oil fires can be confined within the enclosures and the spread of fire to other safe shutdown systems can be prevented.

The licensee's submittal does not indicate the fire resistance rating of the ceiling of each enclosure, nor that of cable or pipe penetrations.

We recommend that the staff accept the licensee's proposed modifications, except that the walls and ceiling of each enclosure, and each penetration of an enclosure boundary should have a three hour fire resistance rating. We recommend that the staff require the licensee to submit the design details of the modification for review prior to implementation. The licensee was not able to address the concern of providing a 3-hour barrier between the east and west areas and thereby assuring availability of all the safety related equipment in one area. Therefore, we recommend that the staff require the licensee to demonstrate the ability to provide safe shutdown in case of a design base fire anywhere in the east or west crescent area.