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Department of Nuclear Energy

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March 31, 1980

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

RE: Quad Cities 1 and 2, Fire Protection Review Item 3.1.1, 3.1.5, and 3.1.6

Dear Bob:

Enclosed are the Brookhaven National Laboratory inputs for Item 3.1.1, Fire Detection Systems, Item 3.1.5, Water Suppression Systems, and Item 3.1.6, Foam Suppression System.

This completes the items for which we have adequate licensee input for Quad Cities 1 and 2.

Respectfully yours,

Robert E. Hall

Robert E. Hall, Group Leader
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QUAD CITIES 1 and 2

Fire Protection Review

Item 3.1.1 - Fire Detection Systems

The Quad Cities 1 and 2 SER under 3.1.1(1) requires the licensee to install an early warning fire detection system in the control room. On November 2, 1979 the licensee submitted a drawing made by Sargent and Lundy that pertains to this requirement. This drawing is inadequate to determine the acceptability of the proposed detection system. The location and type of detector cannot be determined by the drawing.

We recommend that the staff request that the licensee submit to the NRC a drawing with an elevated view showing the detector in relationship to suspended ceiling and walk-in control cabinets. The type of ceiling should also be indicated on the drawing. The type of detector is not indicated but we recommend that it be the smoke detector type since the principle hazard in this area is electrical cable insulation which could produce a smokey fire.

Item 3.1.5 - Water Suppression System

The Quad Cities 1 and 2 SER required the licensee to submit general design criteria and details for the following asterisked 3.1.5 Water Suppression System items.

1. The sprinkler systems in the Unit 1 and Unit 2 cable tunnels will be modified to prevent fire propagation between trays.

2. Water suppression systems will be provided in the Unit 1 and Unit 2 trackway areas.

3. An automatic water suppression system will be provided in the cable spreading room.

4. Automatic sprinkler protection will be provided over the oil storage locations in the turbine building and in the crib house.

The licensee under a cover letter dated November 2, 1979, submitted design drawings on the above mentioned items.

1. The Unit 1 cable tunnel sprinkler system is designed to prevent fire propagation between the cable trays. The system as indicated on the drawing dated September 25, 1979 is acceptable.

   The Unit 2 cable tunnel contains redundant divisions of safety related cable trays.

   The fire protection for this tunnel is designed such that a single sprinkler system i.e. from the outside stem and rising valve to the sprinkler heads out of service will not affect the protection for the redundant division of cable trays. However, the water supply for all the sprinkler systems protecting the tunnel are fed from a single 6 inch connection to

an existing 10 inch main. A break in the 6 inch main or in the 10 inch main will cause the loss of all automatic suppression in the tunnel; and, therefore, the present feed arrangement is unacceptable. The feed main supplying water to the sprinkler system protecting a single division of cable trays should be independent of the feed main supplying water to the sprinkler system protecting the opposite division of cable trays. The independence of feed should be designed such that no single impairment will cause the loss of water to systems protecting both divisions of cable trays. We will evaluate the acceptability of this item after the licensee submits plans for the recommended alternate feed.

2. The Unit 1 trackway will be protected by an extra hazard pipe sized pre-action system. The head location and piping appear adequate but the sprinkler heads in the open area of the trackway should be provided with shields in accordance with NFPA 13-1978, paragraph A3-18.6.

   "The shield will collect the heat so that the fusible link in the sprinkler head will actuate early in the fire development."

   The drawings for the Unit 1 trackway does not show the type, location, spacing and sequential operation mode for the detection system required to operate the deluge valve. These drawings should be forwarded to NRC for review with final acceptance of the system based on this review.

   The Unit 2 trackway is similar in design to the Unit 1 trackway. The comment on the lack of detection system drawing for Unit 1 is applicable to the Unit 2 trackway.

   We evaluate the final acceptability of this item after reviewing the detector system drawings that show operation of the deluge valves.

3. The fire protection for the cable spreading room consists of two wet pipe sprinkler systems. Each system protects approximately half of the area. The system provides both area and cable tray protection. The area's sprinklers are located at the ceiling while the cable tray sprinklers are located between the cable trays. Both systems are fed from a single water main.

   The staff has studied the plant's ability to safely shut down outside this area and will require the licensee to provide alternate shutdown from the room. Based on this requirement, the fire protection system as designed, is satisfactory. We recommend that the staff accept part 3 of Item 3.1.5.

4. Two areas (Area P and Area T) in the turbine room are protected by a deluge system in each area. The areas are used for the storage of drums of oil. The system is designed to a density of 0.3 gpm/sq. ft. over the entire area.

   The systems are acceptable as designed providing the control valve and manual actuator is outside the curbed area of the hazard.

As indicated in the licensee's letter dated September 25, 1979, the exposure for the oil storage area in the crib house will be reduced by the elimination of all 55 gallon drums of oil. Any oil stored in this area will be limited to a total of 25 gallons. The oil will be stored in 5 gallon safety cans and then inside a flammable liquid cabinet. Based upon the reduction of the fire hazard, automatic sprinklers need not be provided over the oil storage area.

This part of Item 3.1.5 is satisfactory and we recommend that the staff accept part 4 of Item 3.1.5.

Item 3.1.6 - Foam Suppression System

The Quad Cities 1 and 2 SER required the licensee to submit general design criteria and details for 3.1.6 Foam Suppression System. The specific item under this heading is "An automatic foam suppression system actuated by flame or infrared detectors will be provided for each MG set fluid coupling and its curbed area. The feed for the foam system will be independent of the feed to the sprinkler system protection for this area."

The licensee under cover letter dated November 2, 1979 forwarded to the writer design drawings, hydraulic calculations and engineering data sheet on the above mentioned item. The following is a review based on this submittal.

1. The engineering data sheet was reviewed and an error was found in the amount of foam necessary for system storage. The amount in storage should be 72 gallons for each system. See Calculations below.

   A. Theoretical calculations for determining foam necessary for storage is as follows:

      Area of coverage - 1500 sq. ft.
      Foam Density - .16 gpm/sq. ft.

      NFPA 16-1974-Paragraph 4022 - The design discharge rates for water or air foam solution shall provide densities of not less than 0.16 gallons per minute per square foot of protected area.

      Gpm of Solution - 240 gpm (1500 x .16)
      Foam Liquid Concentrate - 3%

      240 gpm x 3% = 7.2 gpm of foam concentrate
      7.2 gpm x 10 min. discharge time = 72 gallons of foam necessary in storage

      NFPA 16-1974-Paragraph 4023 - "The foam discharge shall continue for a period of 10 minutes at the design rate specified in 4022. Where the system has been designed to have delivery rate higher than specified in the foregoing, proportionate reduction in the discharge period may be made."

B. Hydraulic calculations for determining foam necessary for storage is as follows:

Gpm of solution - 276 gpm (from licensee's hydraulic calculations)

$$\frac{\text{Theoretical} \;\text{--->}\; 240}{\text{Actual} \;\text{--->}\; 276} = \frac{X}{10} \qquad X = 8.7 \text{ min. actual discharge time required.}$$

276 gpm x 3% = 8.28 gpm of foam concentrate

8.28 gpm x 8.7 min. discharge time = 72 gallons of necessary foam in storage.

2. The SER requires the licensee to install either flame or infrared detectors for system actuation. The present drawings indicate thermostat type detectors will be provided. We recommend that the staff request that the licensee install the detectors as called for in the SER.

3. In accordance with NFPA 16-1974 Paragraph 2111 the system control equipment should be relocated so that they will be accessible during a fire emergency in the protected area and where there will be no exposure from the protected area.

NFPA 16-1974-Paragraph 2111 - "Equipment items, such as storage tanks and proportioners for air foam concentrates; pumps for water and air foam concentrates; and control valves for water, concentrates, and air foam solution shall be installed where they will be accessible, especially during a fire emergency in the protected area and where there will be no exposure from the protected hazard."

4. The SER requires the foam systems and the area sprinkler systems to be on independent feeds so that a single impairment will not compromise both types of protection. The drawings submitted do not show the feed arrangements for the various systems. We recommend that the staff verify that the feed arrangements are independent.

5. A normally closed manual by-pass should be provided around the normally closed solenoid valve controlling foam concentrate flow from the tank to the deluge system. This arrangement will allow for total manual actuation for both the foam concentrate system and the water deluge system.

Final review of this system will be made after the above mentioned recommendations are documented by licensee submittals.