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April 12, 1982

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Station Units 1 and 2
Braidwood Station Units 1 and 2
Auxiliary Building Flooding
NRC Docket Nos. 50-454, 50-455
50-456 and 50-457

Reference (a) March 25, 1982 letter from
T.R. Tramm to H.R. Denton

Dear Mr. Denton:

This is to provide information regarding the auxiliary building flooding analyisis for Byron and Braidwood Stations. Prompt review of this information should close Outstanding Item 12 of the Byron SER.

Enclosed is a revised response to FSAR question 10.47. It includes additional information on water sources and safe shutdown equipment. This revised response will be incorporated into the Byron/Bridwood FSAR at the earliest opportunity.

Please direct questions regarding this material to this office.

One signed original and (15) copies of this letter are provided for your use.

Very truly yours,

T.R. Tramm

T.R. Tramm
Nuclear Licensing Administrator

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QUESTION 10.47

"Your response to Q10.30 has not provided an adequate analysis to demonstrate that drainage of leakage water away from safety-related components or systems is adequate for worst case flooding resulting from postulated pipe breaks or cracks in high or moderate energy piping near these safety-related components or systems. The analysis must show that drainage by natural routes such as stairwells or equipment or hatches by the non-seismic Category I drainage system under failed conditions is adequate to prevent the loss of function of safety-related components and systems. As an example, show that a crack in one essential service water pump room will not flood out the other redundant pump before operator action can be taken to isolate the leak assuming a failed non-safety grade sump alarm system. Worst case locations should be assumed for this example and for other safety-related systems listed in FSAR Table 3.6-1.

It is our position that unless drainage capability by natural or by failed non-seismic Category I drainage systems can be demonstrated, you should provide the following for all areas housing redundant safety-related equipment.

1. Leak detection sumps shall be equipped with redundant safety grade alarms which annunciate in the control room. Verify that if operator action is required on receipt of the alarm that flooding of redundant safety grade equipment will not occur within 30 minutes; or

2. Provide separate watertight rooms and independent drainage paths with leak detection sumps for each redundant safety-related component."

RESPONSE

A confirmatory analysis has been completed to insure that the Byron/ Braidwood design will accommodate flooding as a result of high and moderate energy line breaks with no adverse effects on the capability to safely shut the plant down. Design features such as enclosure of safety related equipment by structural walls, separation of redundant safety systems, and drainage into stairways and open areas prevent a loss of safe shutdown capability in the event of moderate or high energy line breaks in the auxiliary building.

The auxiliary building flooding study examined 114 separate areas in the auxiliary building. 20 of these areas were large general areas and the remaining 94 were considered subcompartments. Subcompartments are enclosed by structural walls and open into other areas only by doorways. The limiting high or moderate energy line break in each area was defined by surveying the lines in the area and determining the limiting failure. Pipe breaks and cracks were defined following the guidelines in Standard Review Plan Section 3.6.1. Through-wall cracks were postulated in Category II systems following the Standard Review Plan guidelines. This approach is justified because of the Byron/Braidwood design criteria for Category II piping systems in the auxiliary building. The Category II piping is both designed and supported to withstand seismic loads. The allowable stresses are the same as those used with equivalent Category I pipe. As a result, Category II systems are no more likely to be loaded beyond design than Category I systems. Maximum flood levels were defined for a break within an area and for breaks outside the area which might raise the flood level.

Fluids are considered to drain from subcompartments and general areas by way of doorways, stairwells, open hatches and floor drains. Doors are considered to be open or closed to maximize the flood levels. Non-watertight doors are assumed to have a 1/2 inch gap at the bottom. The floor drain system in the Byron/Braidwood plants is a Safety Category II system but is supported to withstand seismic loads throughout the auxiliary building. Credit is taken for the floor drain capacity since there is no potential failure mode for the auxiliary building drain pipes which would prevent drainage.

The auxiliary building is equipped with leak detection sumps which will detect any leakage above normal rates. Also, plant personnel regularly check the general conditions in the auxiliary building. As a result, it is assumed that any isolable break is isolated 30 minutes after the break occurrence. All systems which contain sufficient inventory to cause significant flooding can be isolated. After isolation, the analysis was continued until the levels stabilized to insure that maximum levels were calculated in areas away from the break. If isolation is not assumed, 34 areas would experience increasing flood levels after 30 minutes. All but two of these areas are on elevation 330 feet or 346 feet. In general, safe shutdown equipment is not located on these areas or is protected by watertight doors. The RHR pumps are not required for hot shutdown but are required for cold shutdown. The pumps are not protected by waterproof doors but are elevated to prevent flood damage. The two remaining areas are a surface condenser room on elevation 401 feet and a subcompartment on elevation 475 feet 6 inches. Neither of these areas contain safe shutdown equipment.

Of the 114 areas analyzed, 84 will not be subject to flooding greater than 4 inches deep. Electrical equipment is located at least 4 inches above the floor to eliminate flooding concerns. These areas, therefore, required no additional analysis.

The remaining 30 areas could experience water levels greater than 4 inches. Of these, 17 would not flood above 12 inches and 13 were predicted to flood above 12 inches. These 30 areas are primarily located in the lower levels of the auxiliary building. These areas are individually discussed in the following paragraphs.

The auxiliary building basement is at elevation 330 feet. All rooms and areas on this elevation can be flooded to at least a depth of 12 inches. As a result, these areas have been designed to accommodate flooding. The floor drain sump and equipment drain pump rooms for Units 1 and 2 have been fitted with watertight doors. These rooms can be filled without affecting safe shutdown equipment. The essential service water valve pits, if flooded, would result in failure of the motor operated valves. The as-is position can be considered the safe position because the essential service water systems are redundant and separated by structural walls. The general area contains the essential service water pumps and strainers. The doorways and penetrations leading into this area are watertight and the structural walls are adequate to withstand the forces of flooding in adjacent areas. In the event of a limiting crack of a 36 inch essential service water line within the area, a maximum flood level of 12 inches is predicted. In general, this will not disable the essential service water pumps. Even if the system in the area is affected, there will be no impact on the redundant system which is separated by a structural wall.

On the 346 feet level, flooding above the 4 inch level is predicted in four general areas and ten subcompartments. A crack in a 48 inch essential service water line is predicted in the Unit 1 and 2 general floor areas which contain the blowdown condenser pumps, nitrogen storage area and various tanks and motor control centers. None of the equipment in this area is safe shutdown equipment. Two general piping areas which contain the auxiliary building collection sump pumps are located adjacent to the containments. The area adjacent to Unit 1 is predicted to flood to 12 inches after a 20 inch essential service water line failure. The area adjacent to Unit 2 is predicted to flood to 48 inches after a 48 inch essential service water line failure. Neither of these areas contains safe shutdown equipment.

The subcompartments predicted to flood are the two RHR pump rooms, the two containment spray pump rooms and the valve operating area on each unit. Upon failure of a 3 inch chemical and volume control system line, a flood level of 10 inches in the valve operating area could be expected. No safe shutdown equipment is in this area.

The residual heat removal pump rooms and containment spray pump rooms are all interconnected and all contain safe shutdown equipment. The floor of these rooms is at elevation 343 feet, 3 feet below the general area. The containment spray pumps are used only during accident conditions and, therefore, are not required under normal conditions as defined in the Standard Review Plan. However, the containment spray pumps are elevated to prevent flooding from disabling the pump. The RHR pumps are used during normal shutdown but are not required (except in LOCA conditions) to bring the plant to a safe hot shutdown condition. In a normal shutdown, the RHR system will be used when the reactor pressure is below about 400 psig to cool the reactor. At this time, a 16 inch RHR system line in the RHR pump room or a 24 inch Safety Injection System (RHR suction) line in the containment spray pump room will be pressurized. A failure of these lines would cause flooding up to the level of the 346 feet general area. The subcompartments in question are located at elevation 343 feet so a flood of about 3 feet could be postulated. The RHR pumps, like the containment spray pumps, are elevated well above the predicted flood level. This also protects the pumps from flooding in the event a pipe in the general area fails and floods these subcompartments. The only equipment which would be damaged by this flooding is the cubicle coolers. This would cause a gradual increase in the room operating temperatures, but would not impair the ability to safely shut down the plant.

On the 364 feet level, three subcompartments per unit could be flooded. A failure of an 18 inch non-essential service water line in the blowdown condenser room could result in a 40 inch flood level. A failure of a 12 inch component cooling line in either residual heat exchanger room (A or B), would result in a flood level of approximately 100 inches. There is no safety related equipment in the blowdown condenser room. Flooding of a residual heat exchanger room would not affect the redundant train.

On the 383 feet level, a crack in the 6 inch diesel oil piping in either Unit 2 diesel oil storage tank room would result in a flood level of less than 6 inches. This would not affect the other tank or the plant safe shutdown capability. A crack in the 20 inch non-essential service water line in either Unit 1 or 2 auxiliary feedwater diesel driven pump room would result in a 6 inch flood level. This would have no effect on the diesel driven auxiliary feedwater pumps or the redundant motor driven pumps.

On the 401 feet level, a failure of a 6 inch chilled water line would result in a 5 inch flood level in the boric acid transfer pump room. No pump damage is expected and no safe shutdown equipment will be affected. Non-essential service water line failures could flood two of the radwaste surface condenser rooms to levels of 10 and 36 inches repectively. No safe shutdown equipment is affected.

At elevation 475 feet, 6 inches, a failure of a 4 inch fire protection line could result in up to 24 inches of water in cable spreading area E or K. No damage is expected to the cables from a flood. All cables with safety functions have redundant cables located in another cable spreading area separated by structural walls. A 14 inch non-essential service water line located in a room containing ventilation equipment and the chilled water expansion tank could result in a 21 inch flood level. No safe shutdown equipment is in this area.

As a result of this study, it is concluded that flooding will not adversely affect the capability to safely shut down the plant. The architectural design of the plant, the drain systems, the redundancy and separation of safety systems and the installation of watertight closures insure the plant safety.