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October 14, 1988

Mr. Thomas E. Murley, Director
Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC. 20555

Subject: Byron Stations Units 1 and 2
Braidwood Stations Units 1 and 2
Request for Additional Information Response
NRC Docket Nos. 50-454/455 and 50-456/457

Dear Mr. Murley:

The NRC staff telephonically requested additional information on September 2, 1988, concerning the natural circulation capability comparison between the Byron and Braidwood Stations and the Diablo Canyon Station. Further clarification of the requested information took place telephonically on September 28, 1988. Enclosed with this letter is Commonwealth Edison's response to the NRC questions.

Please direct any further questions regarding this matter to this office.

Very truly yours,

R. A. Chrzanowski
Nuclear Licensing Administrator

RAC/klj
cc: Byron Resident Inspector
Braidwood Resident Inspector
L.N. Olshan - NRR
S. Sands - NRR
Region III Office

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ATTACHMENT

Byron and Braidwood Station Responses to the Request for Additional Information Regarding Natural Circulation Cooldown

1. What is the effect of RCP and motor inertia?

   In comparison to Diablo Canyon, effect is similar. Diablo has a 6000 HP motor compared to Byron/Braidwood's 7000 HP. Motor inertia would therefore be similar, if not slightly higher due to the larger size motor. Effect of pump would be similar since Model 93A is used.

2. What are quantitative values for thermal driving head?

   An analysis would need to be performed to determine these values. However, with respect to Diablo Canyon, thermal driving head would be similar per comparison presented in questions 4 and 5 listed below.

3. Are these units with a T-cold upper-head?

   Yes. Although not specifically stated, this is inferred in the first paragraph of Q212.154-3. It should be noted that in comparison, Diablo Canyon is a T-hot upper head.

4. Is resistance per loop for Diablo Canyon consistent with other plants?

   Table Q212.154-1 "Comparison of Hydraulic Resistance Coefficients" presents a comparison between Diablo Canyon and Byron/Braidwood for normal flow conditions. The flow ratio between them is equal to approximately 1.0033 indicating that the total resistance coefficients between the plants is insignificant. Per request of the NRC, the values reported for Diablo Canyon were verified with Westinghouse as being accurate.

5. Flow resistance with Diablo is based on NORMAL flow. At lower flows-coefficient of friction may increase. A statement is needed to justify comparison at normal flow when NC flows are much lower.

   At lower flows, coefficient of friction may in fact increase, both for Diablo Canyon and Byron/Braidwood. Page 2 of Q212.154 states "...It is expected that the relative effect of the (hydraulic) coefficients (Table Q212.154-1) would be the same under natural circulation conditions such that the natural circulation loop flow rate for Byron/Braidwood would be within 2% of Diablo Canyon.

6. Page 2 of response states flow is dependent on decay heat. Is this consistent with other Westinghouse statements i.e., independent of decay heat?

   Per Q.212.154-2, loop flow circulation is dependent on decay heat. More specifics are necessary as to the source of the other Westinghouse statements to the contrary.

7. What is cooldown rate with 3 and 4 steam generators?

   Using Natural Cooldown Circulation Procedure 1/2 BEP ES-0.2, a cooldown rate monitored at the RCS cold legs of less than 50F/hr. is required to assure no void formation in the upper head, to the point where the RHR system could be employed for further cooldown without void formations.

   As indicated on Q212.154-2, an evaluation has been performed at Byron/Braidwood to demonstrate cooling can be provided via two steam generators. Therefore, the capacity of the atmospheric relief valves is determined to be adequate.

8. What time to RHR cut in temperature?

   RHR cut in temperature (350°F, 400 psi) can be achieved in approximately 9 to 10.5 hours. (Table Q212.154-4/5)

9. How much aux feed is needed for cooldown with 3 or 4 steam generators?

   For Braidwood, a back-up source of water is available from the Essential Service (SX) Water System System with it's source being the Essential Service Cooling Pond. For Byron, the SX system source is the essential service cooling tower. Both are Safety Category 1.

   In addition the refueling water storage tanks are available for a 'bleed and feed' type of cooldown. These tanks are approximately 500,000 gallons and are safety category 1.

   Per telecon with NRC, B&L study of Diablo Canyon indicates 360,000 gallon of feedwater would be required there. The capacity of Byron/Braidwood Safety Category 1 systems exceeds this amount. Other non-safety systems could also be made available. By Tech Spec requirements, a minimum amount of 200,000 gallons of make-up water is required to be available for aux feed in the 500,000 gallon capacity condensate storage tanks.

10. How long for boration?

    Calculated results for the feasibility of reaching cold shutdown without letdown are given in Table Q212.154-4/5. This shows the resulting boron concentration as a function of time and temperature. The CVCS aux spray is reliant on non-safety instrument air. Assuming loss of this air, and if efforts are unsuccessful in operating valves using portable bottles, the pressurizer PORV's could be used. Per FSAR 9.3.4.1.1b, the amount of boron available exceeds that amount required to borate the RCS to cold shutdown concentration.

11. How is it determined that upper head is sub-cooled prior to depressurization?

    Byron Procedure 1/2 BEP ES 0.2 page 19 of 19 (Braidwood similar) discusses determination of sub-cooling using RCS pressure. Additionally, it should be noted that upper head sub-cooling can be accomplished without the use of CRDM fans.

12. Page 9 of response - Are personnel trained to handle portable gas cylinders?

    No specific training is required for operation of portable gas cylinders. However, this is an accepted maintenance and testing activity for non-routine operation of select valves.

13. What is the assurance that PRT will not rupture?

    The PRT is designed to absorb a discharge of steam equivalent to 110% of the full power pressurizer steam volume without rupture. Although the volume of steam released during depressurization from a hot standby to a cold shutdown condition during natural circulation is not necessarily less than this, the rate of release is significantly lower and can be controlled to ensure that the integrity of the PRT is maintained.

14. What is the volume of the upper head?

    821.9 cu. ft.

15. Is there a reactor vessel spray nozzle between downcomer and upper head? If so, will it's spray area provide better cooling effect in upper head?

With RCP's running, 2/3% of flow from the cold legs is diverted up through holes drilled in the upper (head) flange assemblies. The temperature of the flow which enters the head via this path corresponds to the cold leg value. Table Q.212.154-2 indicates that the effective hydraulic resistance to flow in Byron/Braidwood is slightly less than Diablo Canyon. Assuming that a pressure differential was similar for both plants, Byron/Braidwood head flow rate would be 112% of Diablo Canyon. It's also assumed this flow rate comparison would be similar at natural circulation consistent with response to Question 5. Since Byron and Braidwood are T-cold upper-head, upper head will be cooler at initiation of natural circulation since Diablo is a T-Hot Plant.

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