May 27, 1997

50-270

Mr. W. W. Foster, Chairman
B&WOG Steering Committee
P.O. Box 10935
Lynchburg, VA 24506-0935

SUBJECT: REQUEST FOR INFORMATION RELATIVE TO THE HIGH PRESSURE INJECTION/MAKEUP LINE CRACK FOUND AT OCONEE UNIT-2

Dear Mr. Foster,

On April 22, 1997, plant operators at Oconee Unit-2 began a reactor shutdown because of an unidentified reactor coolant system boundary leak rate greater than 1 gallon per minute. Oconee personnel later identified the leak to be from a crack in the high pressure injection/reactor coolant makeup line (HPI/MU) at the nozzle/thermal sleeve area. On May 1 and 6, 1997, the NRC held conference calls with representatives of the Babcock and Wilcox Owners Group (B&WOG) and Framatome Technologies, Inc. to discuss the details of the crack and the potential generic safety implications for other B&W plants. On May 9, 1997, the NRC sent a request for information on this event to you.

The purpose of this letter is to amend the May 9, 1997, information request based on additional information obtained in discussions with representatives of Framatome Technologies, Inc. The NRC requests that you provide an interim response to the attached amended questions by May 29, 1997, and that you provide a final response when analysis of the event is complete. This action was discussed with Mr. J. J. Kelly of Framatome Technologies in a conference call May 15, 1997. Your response should be addressed to the NRC Document Control Desk and should reference B&WOG Project No. 693.

As part of our longer-term followup of this issue, the staff requests the results of the computational fluid dynamics analysis currently in progress, and long-term stress analysis that may be required.

If you have any questions on this matter, please contact me by phone, 301/415-2829 or by email, jlb4@nrc.gov.

Sincerely,

Original Signed By:
Joseph L. Birmingham, Project Manager
Generic Issues and Environmental
Projects Branch
Office of Nuclear Reactor Regulation

Project No. 693
Enclosure: Amended List of Questions On
HPI/MU Line Crack
cc w/encl: See next page

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NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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REQUEST FOR INFORMATION
BABCOCK and WILCOX OWNERS GROUP
CRACKING IN HIGH PRESSURE INJECTION/MAKE UP (HPI/MU) LINES

1. Nozzle/Thermal Sleeve Design and Configuration

   a. Provide a complete description of the safe end/thermal sleeves nozzle assemblies in each HPI or HPI/MU nozzle, including the warming lines, where applicable. Include fully dimensioned drawings as necessary. Identify installation characteristics (contact rolled, doubled rolled, etc.)

   b. Identify the materials used in the fabrication of the nozzle, safe end, piping, and pipe/safe-end weld. Identify whether the nozzle, safe end, and piping are wrought or cast.

   c. Describe any HPI or HPI/MU thermal sleeve upgrades, replacements, modifications. Indicate when changes were made and reasons for the changes. Indicate if repairs or modifications recommended by B&W Document No. 77-1140611-00 were implemented.

   d. Provide detailed schematic or isometric drawings of the HPI and HPI/MU systems within the containment.

   e. Provide HPI and MU/HPI system P&ID drawings. Identify warming or flow control valve bypass lines that provide "warming" flow.

   f. For each HPI nozzle and HPI/MU nozzle, provide the results of the detailed stress analysis performed pursuant to the recommendations of B&W Document No. 77-1140611-00. Identify expected usable lifetimes.

2. System Operation

   a. Describe the method of operation of the HPI/MU system. Include flows, warming (bypass flow) valves. Include periodic tests and their flows. Describe how operation comports with recommendations of B&W Document No. 77-1140611-00, including the bases for any deviation from these recommendations.

   b. Describe cycling frequencies for HPI/MU line(s) during startup/shutdown and normal operation.

   c. Provide cycles of inadvertent initiation of HPI. Identify design cycles.

   d. Discuss the differences or similarities between the event at Crystal River 3 in 1982 and that at Oconee Unit 2 in 1997 with regard to the HPI/MU nozzle degradation mechanism, and failure modes. Discuss the analysis performed at the facility in response to the Crystal River 3 event in 1982 and provide results of that

analysis. Also, describe changes in operation implemented in response to the Crystal River 3 event in 1982, and changes in operation implemented in response to the Oconee 2 event.

e. Provide any thermocouple data regarding temperature profiles in the HPI and HPI/MU lines.

f. Provide an update of the "Matrix of Facts" submitted on May 5, 1997, regarding thermal sleeve design and recent inspections in B&W plants.

3. Inservice Inspection Program

a. Provide a description of the inspection program established for the facility as a result of the Safe-End Task Force effort after the 1982 Crystal River 3 event. Indicate whether or not it conforms to B&W Document No. 77-1140611-00 and the bases for any deviation therefrom. Identify documents submitted to NRC regarding implementation of this program at the facility. Indicate if the conduct of the examinations deviated from the original program/commitments described in the plant specific procedures.

b. Provide a history of all examinations (volumetric, surface and visual) of the HPI nozzle, safe-end and pipe/safe-end weld and adjacent piping and of the radiographic or visual examination of the thermal sleeves in each unit. Specify type, date and results. Specify if the examination records have been re-reviewed in response to the Oconee Unit 2 event, and identify any changes in the original findings.

c. Identify the method used to perform the volumetric examination, the scope of the examination, the qualification procedure for determin-ing whether cracks exist in the inspected material, and the results of the inspection. Describe any mockups that were used to qualify the UT inspection methods, including how representative the geometry and materials of the joint are represented by the mockup and the type of reflector e.g., EDM notch, fatigue crack, etc., were used.

d. Compare the materials in the calibration block to the materials in the HPI line.

e. Provide the bases supporting the frequency of inspection of Ultrasonic Testing, Radiographic Testing and Volumetric Testing, of the welds in each unit.

f. If, as a result of the Oconee Unit 2 event the facility program has changed, provide the revised Augmented Inspection Program of HPI/MU nozzles. Include examination type, frequency and acceptance criteria based on findings of inspection results from Oconee.

g. State whether the inspection programs established by licensees in

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Enclosure

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f. If, as a result of the Oconee Unit 2 event the facility program has changed, provide the revised Augmented Inspection Program of HPI/MU nozzles. Include examination type, frequency and acceptance criteria based on findings of inspection results from Oconee.

g. State whether the inspection programs established by licensees in response to the Safe End Task Force recommendations and Generic Letter 85-20 were specified in plant procedures as mandatory inspections.

4. Fracture Analysis

a. Provide a fracture analysis to determine the critical flaw size required to fracture the HPI/MU piping under normal loads during either HPI injection or make-up conditions.

b. Determine the sensitivity of the complex flaw geometry, i.e., 360° internal part through crack and through wall cracking on the critical flaw size.

c. Based on the root cause of the cracking experienced at Oconee -2 in April 1997, provide an assessment of the time: (a) to initiate a crack, (b) to propagate a crack through the pipe wall from the largest crack size that could be missed by UT and RT examinations.

5. Other Configurations

Identify other similar configurations, e.g., rolled-in thermal sleeves in areas of large coolant temperature differences, of piping existing in safety-related systems in the plant. Show that they are not susceptible to cracking from the same mechanism identified in the root cause investigation.

6. Safety Implications

a. Describe how the failure of one or more HPI lines in a unit is analyzed, and describe the analyzed consequences.

b. Describe the limiting single failure and what equipment is relied on to mitigate the potential accident.

c. Review the Probabilistic Risk Assessment for each plant to assess the risk significance of this event. Provide the results of the assessment, and state the actions that would be taken to reduce the potential risk.

7. Compensatory Actions

a. Describe what actions have been taken to prepare the operators for a potential HPI pipe break for each operating unit.

b. Describe the plant program for leakage monitoring and acceptance criteria. Indicate if any restrictions or administrative controls have been implemented in response to the Oconee 2 event.