May 15, 2003

Mr. James Mallay
Director, Regulatory Affairs
Framatome ANP
3315 Old Forest Road
Lynchburg, VA 24501

SUBJECT: REVIEW OF TOPICAL REPORT BAW-2374, "RISK-INFORMED ASSESSMENT OF ONCE-THROUGH STEAM GENERATOR TUBE THERMAL LOADS DUE TO BREAKS IN REACTOR COOLANT SYSTEM UPPER HOT LEG LARGE BORE PIPING" (TAC NO. MB8187)

Dear Mr. Mallay:

I am responding to the letter of March 13, 2003, in which William McCollum, on behalf of the Babcock and Wilcox Owners Group (B&WOG), withdrew Topical Report BAW-2374, Revision 1, from review by the NRC staff. The subject letter also summarized the actions that the B&WOG plans to take to resolve the issues pertaining to hot leg breaks as discussed at the February 6, 2003, meeting between representatives of the NRC and the B&WOG.

The NRC staff agrees with many of the statements made in your letter and its attachment. We have delineated other statements that require clarification and have provided our responses to them as a means of clarifying these outstanding matters. These responses are contained in the enclosure to this letter.

If you have any further questions, please contact Brian Benney at (301) 415-3764.

Sincerely,

/RA/

Herbert N. Berkow, Director
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 693

Enclosure: Staff Clarifications and Responses

cc w/encl: See next page

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cc:

Mr. Howard C. Crawford
AmerGen Energy Company
Route 441 South
P.O. Box 480
Middletown, PA 17057-0480

Mr. David J. Firth
Manager, B&W Owners Group Services
Framatome ANP
3315 Old Forest Road
Lynchburg, VA 24501

Mr. W. R. McCollum, Chairman
B&WOG Executive Committee
Duke Energy Corporation
526 South Church Street
Charlotte, NC 28201-1006

NRC STAFF CLARIFICATIONS AND RESPONSES
TOPICAL REPORT BAW-2374, "RISK-INFORMED ASSESSMENT OF ONCE-THROUGH STEAM GENERATOR TUBE THERMAL LOADS DUE TO BREAKS IN REACTOR COOLANT SYSTEM UPPER HOT LEG LARGE BORE PIPING"

1. March 13, 2003, Letter Statement: "The B&WOG plans to develop and submit a new topical report that will provide the information the NRC determined is required as the basis for plant-specific approvals. Individual plant descriptions will be provided either as appendices to this new report or as separate documents that reference the report. The B&WOG plans to submit this new information to the NRC by June 2004."

   Staff Response: Submission of a new topical report for review would be an approach that is acceptable to the staff. Since the previous revisions have been withdrawn, the report must contain any relevant information contained in the previous revisions.

2. Attachment Statement: "A new topical report will be developed by the B&WOG based on BAW-2374, Revision 1 and the detailed comments generated by the NRC from its review of this report. The purpose of the topical report is to evaluate the integrity of the SG tubes and tube repair products in the context of demonstrating the successful termination of an assumed large, hot leg break. Such a break is not a limiting event for ECCS (emergency core cooling system) design, but it may challenge the integrity of degraded steam generator (SG) tubes because of thermal stresses induced from the injection of cold ECCS into the reactor coolant system. The topical report will address the integrity of the SG tubes, any loss of ECCS fluid into the secondary system, isolation of the secondary to limit any loss of ECCS fluid, and demonstration of adequate long term cooling."

   Staff Response: Our understanding is that tube integrity is maintained for a surge line break and a break in the pipe that connects the top of the hot leg and the upper reactor vessel head at Davis-Besse. Based on this assertion, the breaks of concern that must be addressed to meet Section 50.46 of Title 10 of the *Code of Federal Regulations* (10 CFR) are the sizes and locations in the range between those breaks and the large break at the top of the hot leg. The regulatory intent can be met by using a suitably justified bounding break since the existing design basis loss-of-coolant accident (LOCA) analyses continue to bound the blowdown-refill-reflood aspects of the LOCA and the purpose of the new analyses is to evaluate extremely low likelihood, longer-term behavior.

3. Attachment Statement: "Regulatory Basis. The regulatory basis for proceeding with a realistic evaluation of the effects of this postulated LOCA on the SG tubes and any subsequent loss of ECCS injection is the application of risk-informed insights to the consequences of the event. Specifically, since the risk significance of the event has been demonstrated to be very small, design basis assumptions (such as single failures associated with secondary side isolation) are not warranted because they provide negligible safety benefit. Therefore the consequences of a large, upper hot leg break that induces elevated thermal loads on the SG tubes may be appropriately evaluated using realistic assumptions to demonstrate compliance with the pertinent regulations, such as the dose criteria in 10CFR100 and the long term cooling criterion in 10CFR50.46."

Staff Response: The letter's interpretation of the single failure requirements and use of realistic assumptions to meet regulatory requirements is misleading. The single failure requirement will be addressed with consideration given to the 10 CFR Part 50, Appendix A, Criterion 35 requirement for suitable redundancy and the intent of the regulations. Establishing a combination of extremely low probability of needing main steam isolation valve (MSIV) closure and available steam line closure capability downstream of MSIVs will provide suitable redundancy for the regulatory intent to be met by not assuming MSIV failure. A similar approach to steam line closure capability may be acceptable for plants not equipped with MSIVs. We note that probabilistic aspects of the likelihood of the accident and of risk will be important and, where acceptable, the probabilistic information contained in BAW-2374, Revision 1 will be appropriate.

There is no change in the existing design basis LOCA analysis methodology with respect to showing compliance with 10 CFR 50.46 and 10 CFR Part 100 for the previously accepted analyses. With respect to possible consequential failure of SG tubes following initiation of a LOCA, we have determined that the behavior may be assessed by using an acceptably justified, bounding approach that is based upon realistic analyses.

4. Attachment Statement: "Break Size. A limiting hot leg break size will be identified for each of the two plant designs under consideration (lowered loop and raised loop). The limiting break size will be selected by maximizing the amount of ECCS injection lost through any failed SG tubes by evaluating a small number of candidate break sizes. The engineering evaluation used to determine the limiting break size will consider estimated tube loads, representative pressure differences between the RCS (reactor coolant system) and secondary, and an estimated (or assumed) number of failed tubes due to elevated thermal loads. The limiting break size will not be developed by performing an actual break spectrum analysis. Nor will a detailed thermal-mechanical structural analysis be conducted to determine precise tube loads. Instead, the limiting break size and tube loads will be approximated based on prior analyses. The tube load will be estimated based on the calculated tube-to-shell temperature difference. The limiting break size and the method to be used to confirm adequate long term cooling will be determined by August 2003."

   Staff Response: The letter indicates a limiting break size will be selected by maximizing the amount of ECCS injection lost through any failed SG tubes by evaluating a small number of candidate break sizes. Although we agree with the concept of using a realistically-based upper bound break for evaluation of secondary side response, including feedback into ECCS behavior, acceptable justification for the selection will be necessary.

5. Attachment Statement: "SG Mechanical Loads. Based on the demonstration that the assumed event is adequately terminated (that is, long term cooling is established), the design basis for the SG mechanical loads will continue to be based on the limiting break in attached piping (to the hot leg)."

   Staff Response: Acceptable justification must be provided.

6. Attachment Statement: "Secondary Isolation. The evaluation of secondary isolation will be based on the success of any automatic actions (with no failures assumed and realistic delay times) and on successful operator actions, which will be based on applicable emergency operating procedures, but with realistic delay times and operator action times. This analysis will be used to determine the amount of ECCS fluid that is lost as a function of time after SG tube failure. If secondary isolation occurs prior to the time of SG tube failure, even a limited break analysis may not be necessary."

   Staff Response: We addressed the single failure criterion consideration in Item 3, above. With respect to emergency operating procedures and emergency operating procedures guidelines, we would not object to changes accomplished for the purpose of addressing BAW-2374 concerns if warranted as a result of B&WOG/licensee investigations. However, such changes should probably not be made unless there were essentially no impact on other aspects of the procedures; an approach consistent with the low likelihood of the BAW-2374 LOCAs.

7. Attachment Statement: "Net Positive Suction Head (NPSH) in the Sump. The adequacy of long term cooling relies on the maintenance of sufficient NPSH in the sump to ensure operability of the ECCS pumps during recirculation. The calculation of NPSH will be based on a best estimate approach using realistic assumptions, including the amount of ECCS fluid lost due to failed SG tubes, containment pressure, operator actions, and ECCS pump performance."

   Staff Response: A bounding case should be developed.

8. Attachment Statement: "Steam Line Integrity. A best estimate evaluation of steam line integrity will be performed to ensure that the weight of any potential water entering the steam lines is within the static load limit. Existing analyses are expected to be used."

   Staff Response: A reasonable bounding approach should be used and water hammer should be addressed. Realistic analyses may be used.

9. Attachment Statement: "Offsite Dose. Any release of radioactivity and the resultant dose, under the provisions of 10CFR100 (or the alternate source term provided in 10CFR50.67), will be estimated using realistic assumptions for fuel damage, ECCS performance, and other assumptions consistent with the above discussion."

   Staff Response: We believe the letter is referencing the release due to potential SG tube failure that would be added to the existing predictions of design basis release for hot leg LOCAs. If this is correct, then this approach is acceptable when accompanied by acceptable justification.