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T. M. Novak, Chief, Reactor Systems Branch, TR

REVIEW OF RESPONSES TO REQUEST FOR ADDITIONAL INFORMATION ON B&W AIMS
ANALYSIS AND MODEL (ENR-10099 & ENR-10099-P)

The responses to requests for additional information furnished by B&W on May 2, 1975 for ENR-10099, and May 23, 1975 for ENR-10099-P have been reviewed and found to be incomplete in some areas, and non-responsive in others. As a result, the enclosures to this memo request additional information for clarification of some responses, and reiterate the original request in more specific terms for areas not responded to.

In addition to the above, the enclosures also contain requests for additional information concerning the two reports arising from our continuing review of the B&W AIMS analysis and model.

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Enclosure:
Additional Information Request

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ENCLOSURE 1

ADDITIONAL INFORMATION REQUESTED
FOR REVIEW OF BAF-100-9

A. RESPONSES TO INITIAL LIST OF QUESTIONS

1. Response to Question 210.2 (Item 4)

Long term heat removal using auxiliary feedwater flow to the steam generators with primary flow furnished by the primary loop pumps, or by natural circulation, is indicated as the long term core heat removal process. Describe the analyses performed to confirm the adequacy of natural circulation in the event offsite power is not available after an ATWS, particularly in the transition between end of pump coastdown and development of full natural circulation flow.

2. Response to Question 240.18

In the loss-of-feedwater ATWS, primary coolant flow is said in this response to be held constant without further identification concerning the density of the flowing coolant. As this coolant is undergoing appreciable temperature change, provide data for the coolant mass flow corresponding to the average coolant temperatures shown in the topical report for this ATWS.

3. Response to Question 240.19

Data presented on Table 240.19-1 of this response shows a reduction in peak system pressure of 172 psi, for the 177 FA LOOP-ATWS using a more rapid flow coastdown (Figure 240.19-1) than was used in the analysis for the topical report where the 205 FA coastdown curve was used. Data also shown on this table for the 145 FA LOOP-ATWS in which a slower coastdown was used (Figure 240.19-1) than in the 205 FA plant curve

shows a peak pressure reduction of 136 psi. Discuss the reasons for the apparent divergence in sensitivity to flow coastdown between these two plant designs.

B. CONTINUING REVIEW OF BAW-10099

1. Provide a block diagram of the model or models used in the CADD3 program as the basis for the computed results shown in this report. Core and steam generator axial nodding are of particular interest, as well as fuel and clad radial nodding.
2. Provide the fuel to clad gap dimension and the gap conductivity values used in CADD3 for the ATWS analyses presented in the topical report. Identify the bases for selection of these values.
3. Provide computed average fuel temperature for the LOPW and LOOP ATWS transients for the 177 FA plant.
4. Provide computed mass flow through the steam generator pressure relief valves, and secondary water mass and distribution in the subcooled, nucleate boiling, film boiling, and superheat regions for the LOPW and LOOP ATWS transients for the 177 FA plant.
5. Identify the pressurizer model used in CADD3 for the ATWS analysis topical report.

ENCLOSURE 2

ADDITIONAL INFORMATION REQUIRED

FOR REVIEW OF B&W-10098-P

A. RESPONSES TO INITIAL LIST OF QUESTIONS

1. Response to Questions 1 & 2

Justification for the use of models giving higher heat flow rates in the fuel and gap in CADDs than would be obtained with more appropriate and detailed models has not been furnished. The claim for conservatism in resulting system pressure calculations has not been supported by sensitivity studies as the claimed conservatism will be dependent on moderator temperature feedback reactivity. Provide a sensitivity study using nominal fuel and gap heat flow characteristics early in core life with the same fuel and moderator temperature reactivity coefficients used in the topical report analysis for the 177 FA plant LOFW-ATWS.

2. Response to Questions 3 & 4

From the response to these questions, it is concluded that only the W-3 and the B&W-2 correlations are used in ATWS studies to determine INB ratios. If this conclusion is correct, identify the criteria used for selecting the correlations to be used during the progress of an ATWS, and discuss the experimental or analytical justification for use of the B&W-2 correlation for pressures well above the 2450 psia limit in the range of validity for this correlation.

3. Response to Question 5

Justification of the time step size criteria used to ensure computational stability and accuracy has not been furnished in this response. The CADDS report indicates a programmed time step control to ensure computational stability, and a probably smaller time step requirement to yield the desired degree of accuracy. If stability and accuracy criteria have not been identified in the report, or in this response to Question 5, unless the 5% power level change time step limitation is interpreted as such. Provide further information on these time step criteria, if used, and on the criteria by which solution convergence is determined, as well as the degree of accuracy desired in solutions of the equations.

4. Response to Question 6

The rationale or justification for using the weighting factors 1, 2, and 3 in Equations 3-8 to 3-11 has not been presented in this response. Further discussions of the trapezoidal rule used in the solution of these equations is required as well as on node size selection based on $\Delta z/z$. Describe the source for the spatial density variables in these equations.

5. Response to Question 7

Provide the criterion or method used for selecting the parameters C_1 and C_2 in determining XQ^{N+1} .

6. Response to Question 8

From the discussion presented in this response, it is assumed that the correlation used for h was the Forslund and Rohsenow reference. If so, discuss the assumption made with respect to $V_v - V_l$, and droplet size.

B. CONTINUING REVIEW OF BUM-10098-P

1. Pg 2-10, Par. 2.4.3

Stable film boiling heat transfer is determined in CADDS by Quinn's modified Sieder-Tate correlation, or Groeneveld's correlation; however, the criterion for selecting one or the other correlation has not been indicated. Provide this criterion.

2. Pg. 3-7, Equation 3-17

Describe the condition to be satisfied in Equation 3-13 on page 3-5 that determines completion of the iterative calculations for ϕ predicted.

3. Page 3-10, Equation 3-27

Discuss the use of the moderator temperature and density reactivity feedback simultaneously as implied by this equation, and discuss the basis for the axial and radial weighting coefficients, a_j and F_m , relative to neutron flux profiles, axial and radial.

4. Page 4-11

In determining heat transfer above DNB in the steam generator secondary, the Miropolsky correlation for film boiling, or the McDonough-Milich-King correlation for transition boiling is used depending on the correlation producing the highest heat flux. Justify the use of this criterion for determining heat transfer in ATWS analyses.

5. Provide a comparison of the CADDIS computer program output with available data obtained from plant startup transient tests. (Documentation of informal response 240.24 to above question to be included with responses for BAW 10098-P).