UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

November 26, 1990

Mr. Robert Borsum
Babcock & Wilcox Owners Group
1700 Rockville Pike
Suite 525
Rockville, Maryland 20852

Dear Mr. Borsum:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON WESTINGHOUSE OWNERS GROUP (WOG) GENERIC ANALYSIS OF SURGE LINE STRATIFICATION (TAC NO. M40583)

REFERENCE: 1. Westinghouse Owners Group report, "Pressurizer Surge Line Thermal Stratification Generic Detailed Analysis Program, MUHP-1091 Summary Report", WCAP-12639, June, 1990.

The staff of the Mechanical Engineering Branch (MEB) has completed a preliminary review of the WOG report which provides a summary of the program on generic detailed analysis of pressurizer surge line thermal stratification (Reference 1). This program was conducted by the WOG to evaluate stresses, fatigue and deflections of the surge line under thermal stratification effects for 43 Westinghouse plants. Combined with plant-specific programs to be performed by the individual licensees, the WOG report is intended to partially address Action 1.d requested in the NRC Bulletin 88-11.

As a result of the review, MEB has developed a list of comments and a request for information. These comments and questions on Westinghouse Report WCAP-12639 are provided in the Enclosure. The enclosure may also form the basis of an agenda for a meeting in the near future.

If there are any questions regarding this letter please contact me on (301) 492-1426.

Sincerely,

James J. Raleigh

James J. Raleigh, Project Engineer
Project Directorate I-2
Division of Reactor Project - I/II
Office of Nuclear Reactor Regulation

Enclosure:
Comments and Questions on
WCAP-12639

Comments and Questions on Westinghouse Report WCAP-12639

Executive Summary

1. The generic detailed analysis demonstrated acceptable ASME Section III Equation (12) stress and fatigue usage for 15 out of 43 plants. Please identify the 15 plants which were shown acceptable, the 28 plants which have not yet been shown acceptable, and the 12 plants which were qualified by plant specific analysis. For each plant, provide the calculated equation (12) stress and the fatigue usage factor based on the most current analysis. Explain why the previous justification for continued operation still applies to those plants which were not qualified by the generic analysis. Provide a description and schedule for completion of the plant specific analyses to be perfqrmed.

2. The generic detailed analysis does not support the conclusions of the existing JCO for four plants. Identify these plants and provide additional justification for continued operation.

3. What specific instructions (in addition to WCAP-12639) are being provided to individual Licensees to demonstrate applicability of the generic analysis to their plant, update their analysis and perform additional evaluations if needed. Provide examples.

4. Will all Licensees be required to update their analysis of record for the surge line? How will differences in the Code of Record be reconciled?

3.0 Interpretation of Monitoring Data

1. Provide additional information on the correlation of measured pipe OD temperature to fluid temperature distribution. How closely does the measured ΔT at the pipe OD match the fluid ΔT inside the pipe? To what degree of accuracy can the measurements predict the vertical fluid temperature distribution including the hot-to-cold interface depth. How are the uncertainties accounted for in the stress analysis? Provide examples.

2. Describe the basis for selection of the five hot-to-cold interface levels shown in Figure 3-4 to define axial stratification profiles along the length of a particular surge line. Were the selection criteria confirmed by measurements?

4.0 Update of Design Transients

1. To what extent was plant monitoring data used to confirm the normal and upset stratification transient data presented in Table 4-1?

2. Considering the relatively low ΔTs for the normal and upset transients listed in Table 4-1 (compared to the heatup/cooldown transients in Table 4-2), did any of the events significantly contribute to fatigue usage? Could a ΔT cutoff be defined below which the thermal stresses are less than the endurance limit?

3. The distribution of system ΔT ranges presented in Section 4.5 was based on a review of historical records from 10 plants. While the data may be representative for the sample of ten plants, it may not be representative for a single plant within the group. For example, certain plants within the sample may have had consistently higher ΔT ranges than others because of differences in operating practices. Provide additional justification to demonstrate that the system ΔT distribution is representative and conservative for any plant in the WOG program.

4. Was the detailed data reduction described in Section 4.6 and summarized in Tables 4-3 through 4-6 performed for each of the ten plants? Did the bounding distribution use this type of information from all ten plants for each mode of operation?

5. Please explain how data from different modes of operation was factored into the development of Table 4-2 data. Were different ΔT values used for each mode?

6. Section 4.6 states that a cooldown contains less than half of the cycles of a heatup and therefore the number of cycles for heatups were multiplied by 1.5 to reflect both heatup and cooldown. Were the temperature ranges of the cooldown cycles shown to be bounded by the temperature ranges of the heatup cycles?

7. Identify the plant which indicated significantly higher stratification cycles at the nozzle as stated in Section 4.6. What geometric effect was judged to cause this?

8. Identify the plants with significantly higher cycles associated with performing venting operations during heatup as stated in Section 4.6.

9. Table 4-2 shows fewer total nozzle transients in the nozzle than in the pipe. This is attributed to turbulent mixing which occurs at the nozzle when the reactor coolant pump is operating. However, even when the pump is operating, stratification does occur in the pipe and the global bending will induce nozzle stresses. How are these stresses accounted for?

10. Are striping transients associated only with heatup and cooldown? If so, explain why striping does not occur during normal or upset transients.

5.0 Plant Structural Grouping for Global Piping System Analysis

1. Please identify each plant associated with the plant numbers in Table 5-1.

2. Describe the criteria used to define the enveloping support/restraint configuration within a subgroup. Provide examples to illustrate.

6.0 Global Piping Analysis

1. How will the potential for exceeding snubber and spring hanger travel ranges be checked? What specific information and instructions will WOG provide to the individual licensees?

2. The analysis of a representative surge line with enveloped supports will not provide displacements and support loads that can be used for design purposes. How will the individual plants be able to verify support adequacy and potential interferences with whip restraints or other adjacent structures?

3. Do the temperatures presented in Table 6-1 represent fluid or metal temperatures? Are fluid and metal temperatures assumed to be equal in this analysis?

4. Identify the plants listed in Table 6-2.

7.0 Local Thermal Stress and Unit Load Analysis

1. Provide a brief description of the heat transfer analysis performed to determine local thermal stresses in the piping and hot leg nozzles. Were only steady state conditions considered? Considering the variations in fluid velocities and temperatures, how were conservative values of film coefficients arrived at?

9.0 ASME Fatigue Analysis

1. The ASME Code, Section III, 1986 Edition was used in the analysis. Since all surge lines were originally designed to earlier Code editions or to other piping codes, will a code reconciliation be performed for each plant?

2. Provide a description of the "transfer function method," an example of its application, and a copy of Reference 3.

3. How will the assumed envelope of OBE moments be verified?

4. If the thermal striping stress intensity and peak stress range was calculated from a 2-D finite element analysis using the model shown in Figure 9-1, please clarify why and how 1-D heat transfer analysis stresses from the computer program "STRFAT2" were used.

5. The paper by Fujimoto, et al., "Experimental Study of Striping at the Interface of Thermal Stratification" suggests that the surface film coefficient in the interface region may be as much as seven times the nominal value. What impact would this have on the results?

6. Describe the methodology and significant assumptions used in developing Figure 9-2. Was a flow rate of 90 gpm assumed? Would the curve change significantly at different flow rates?

7. Provide the basis for the assumed OBE moments summarized in the table in Section 9.3.1.

8. Please clarify the requirements for equation 13 qualifications. It appears that the 15 plants which were shown acceptable for equation 12 and maximum usage factor must still be checked for meeting equation 13 as part of the plant specific evaluation. Moments of the hot leg nozzle must be compared to the allowable moments in Table 9-5. Are all other components of the surge line qualified to equation 13?

9. Are the additional plant specific evaluations for the 28 plants that have not been qualified to equation 12 or fatigue usage being performed as part of the WOG program? How will these results be reported and what is the schedule for completion?

10.0 Plant Specific Applicability Criteria

1. Please explain how the permanent plant temperature sensor mounted in the surge line (TE 450) can be used to determine maximum fluid ΔT.

2. Is each plant required to perform a plant specific global piping analysis? What specific instructions will WOG provide to each utility?

3. Section 10.4 refers to moments tabulated in section 9.2.1. Shouldn't it refer to the table in section 9.3.1?

4. The pressurizer nozzle evaluation is outside of the scope of the WOG program. Have any preliminary evaluations been performed to ensure that the pressurizer nozzle is not a concern?

5. Will the results of the plant specific detailed analyses for those plants not shown acceptable under the generic analysis be reported in a future WOG report?