July 1, 1991

Docket Nos. 50-390
and 50-391

Mr. Dan A. Nauman
Senior Vice President, Nuclear Power
6N 38A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

Dear Mr. Nauman:

SUBJECT: WATTS BAR NUCLEAR PLANT - STRUCTURAL AND GEOSCIENCES ISSUES, SSER 6 OUTSTANDING ISSUE 19(j) (TAC 79717 AND 80346)

Our Structural and Geosciences Branch has completed review of Enclosure 5 of your letter dated May 8, 1991. Your letter provided response to concerns we described in my letter dated January 4, 1991.

We find that additional information is needed (see enclosure) to fully address the structural and geosciences issues, which are tracked by Outstanding Issue 19 (j) in SSER 6. Please respond within 45 days of receipt of this letter. This requirement affects 9 or fewer respondents and, therefore, is not subject to Office of Management and Budget review under P.L. 96-511.

Sincerely,

Original signed by

Peter S. Tam, Senior Project Manager
Project Directorate II-4
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc w/enclosure:
See next page

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Enclosure

Request for Additional Information

WATTS BAR OUTSTANDING ISSUE 19 (j)

1. Provide examples where ductility ratio has been applied for an inelastic thermal deflection calculation of beams, frames, and columns which demonstrate their satisfactory use in the following areas:

   a) Any industry standard for structural design currently in use (e.g. chemical or transportation industries) and
   b) Theoretical discussion with verification by experimental data (include pertinent references)

   It is essential to include simultaneous application of a dead load together with a thermal load in the above examples. Discuss also how repeated load (i.e. SSE) is considered in the example.

2. Provide a sample calculation of a structure subjected to thermal as well as other loads such as dead, live and SSE. The calculation should utilize the "ductility" concept as proposed in the FSAR Amendment 64. This calculation should deal with a representative structural member in Watts Bar with relatively high stresses from the above loadings including thermal. Please provide justifications for any assumptions in generating the calculation result with an explicit demonstration that 1) effect of assumption in the final result is negligible or 2) physical data indicates that such assumption is valid. Also, discuss how the temperature causing thermal stress was arrived at and how transient nonuniform nature of temperature distribution on structural steel and concrete is considered.

   Justification of ductility factor should be provided and it should be based on a discussion where experimental data plays a predominant role rather than theoretical discussion. The above example calculation should include explicitly how energy balance and inelastic evaluation are performed. One should consider repeated nature of SSE loads and its effect on the structure in inelastic region. (see question 1)

3. In your May 8, 1991 response, it was stated that "For regions associated with the formation of a plastic hinge mechanism the maximum acceptable ductility ratio is 3.0 for inelastic analysis". Discuss how the above statement is related to Table 3.8E-2 of FSAR, i.e., the proposed displacement ratio. Also, provide a specific numerical example where plastic hinge is included in the beam evaluation.

4. Provide specific values for ε_u and ε_y for Watts Bar structural steel as a function of temperatures. Also, provide a basis for such values.

5. Use one of the load combination (i.e. item 8 of page 3.8E-6) to demonstrate how different loadings and stresses are combined. When stresses are combined rather than loads, one should address the following:

   When the resultant stresses are within elastic limits the orders of combination, whether it is stress or load, would make no difference. However, the load combination item 8 of page 3.8E-6 allows the stresses to be in an inelastic region. In this case, the order would make a definite difference. Provide justification why stress combination is correct by mean of physical data as well as theoretical analysis.

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