October 11, 199

Mr. Oliver D. Kingsley, Jr.
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Chief Nuclear Officer
Tennessee Valley Authority
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Dear Mr. Kingsley:

SUBJECT: WATTS BAR NUCLEAR PLANT - STAFF POSITION AND REQUEST FOR ADDITIONAL INFORMATION ON FSAR CHAPTER 3, AS REVISED BY AMENDMENT 79 (TAC NOS. M88488 AND M88489)

The staff reviewed FSAR Chapter 3, "Design of Structures, Components, Equipment, and Systems," as revised by Amendment 79, and requested additional information by a letter dated May 3, 1994. TVA responded by letter dated August 18, 1994. The staff reviewed that response, and determined that even more information is needed as described in the enclosure. The enclosure also states the staff's position on those issues.

An acceptable target date for your response will be discussed with your site licensing staff in the next licensing status meeting.

This requirement affects nine 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

Docket Nos. 50-390 and 50-391

Enclosure: Request for Additional Information

cc w/enclosure: See next page

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other than personnel access doors in the crane wall. For instance, same increase was proposed for equipment hatches in Section 3.8.3 and various items in Sections 3.8.4, "Other Seismic Category I Structures," and 3.8.6, "Category I(L) Cranes."

The applicant stated that since the personnel locks and hatches were initially designed with a large margin for normal nonseismic loads (0.5Fy) and normal loads are usually limited to self dead weight, load combinations involving OBE were considered to be upset load. This is the reason why E and E' are considered to be same. Another reason for the proposed increase provided by the applicant is that assessment of load for the door is more accurate than usual because of the nature of dead loads where no added loads from other sources, such as live loads and pipe attachment loads, are applied, implying that a lesser safety factor may be used. The staff found that the applicant's reasoning is not acceptable, since any conservative design should accommodate OBE without increasing allowable stresses, thus, effectively reducing the design margin. Moreover, the applicant's argument does not apply to the crane design (Tables 3.8.6-1 and 3.8.6-2).

It is the staff's position that the allowable stress limit for the Category I structures be equal to 0.67Fy when the load combination includes OBE, live and dead loads. The staff's position is not a new one and it is reflected in Standard Review Plan, Section 3.8.

Question 5.d

Note 3 in Table 3.8.3-3 stated that "the value given for allowable stress is the maximum value permitted, assuming that buckling does not control. The critical buckling stress shall be used in place of Fy when buckling controls." However, no corresponding allowable buckling stresses are provided in the table. In response to the staff's request for additional information, the applicant stated that "For door structural and mechanical parts, compression loads are either nonexistent or negligible. Also, any element experiencing a compression load would normally have a very low slenderness ratio approaching unity. However, should a situation call for evaluation of compressive loads where slenderness ratio is greater than 1, the allowable stress must be adjusted to the provisions given in the AISC specification. This clarification will be reflected in the forthcoming amendment." The staff found that the applicant's stated approach to the resolution is acceptable, pending submittal of that amendment.

calculation package during the onsite inspection. However, inclusion of the details of the approximation in the calculation package alone is not sufficient for a staff acceptance of the method, particularly when onsite inspection is performed on a sampling basis. The staff believes that the approximation of the nonlinear model to that of a linear system representing the NSSS is an important issue, especially from the NSSS design point of view which has to be articulated as a part of FSAR Amendment 79. This type of information should be highlighted.

The inspection report stated on page 12 that the team reviewed TVA calculations which document the seismic analysis method and results of the ICS, and found them acceptable. However, the scope of the review was clearly stated in page 11 as discussed above. Moreover, the conclusion of the report excluded the NSSS because the object of the inspection was earthquake design of civil structures, not the NSSS while the interface of the two was within the scope of the review.

The staff, therefore, concludes that the applicant's response is not sufficient. To be acceptable, the applicant should include more detailed discussion of the combined ICS and NSSS models as an appendix to the Watts Bar FSAR. As a minimum, the additional information should include:

1. Geometry and sketches of the model,

2. Engineering data, such as, mass, spring, damping, size and location of the gaps, location of one-way hangers,

3. Description of modelling of gap and one-way hanger and validation of such model,

4. Detailed description of four linearized NSSS support stiffnesses and a discussion of how such supports adequately represent the nonlinear system being evaluated,

5. Discussion of governing equation of motion and the validation of numerical integration algorism including stability and error estimate as discussed in "Analysis of Numerical Methods", E. Isaacson and H. B. Keller, 1966.

6. Validation of overall model and

7. Summary of the calculated stresses of the critical members both in concrete structure and piping and supports, corresponding allowable stresses and references from which the allowable stresses are quoted.

Question 5.c

Note 2 of FSAR Table 3.8.3-3 provided the definition of Earthquake E as the operating basis earthquake (OBE) or safe shutdown earthquake (SSE) loads, whichever is greater. Corresponding allowable stress was assigned as 0.9Fy, where Fy denotes material yield stress. This effectively raises the allowable stresses for OBE by 50%. This is contrary to the staff's position. The applicant also proposed a similar increase in allowable stresses for items

STAFF POSITION AND REQUEST FOR ADDITIONAL INFORMATION

FSAR CHAPTER 3

WATTS BAR, UNITS 1 AND 2

DOCKET NOS. 50-390 AND 50-391

The staff reviewed FSAR Chapter 3, as revised by Amendment 79, and requested additional information by a letter dated May 3, 1994. TVA subsequently responded by letter dated August 18, 1994. The staff reviewed that response, and determined that additional information is still needed as described below. The question numbers below refer to the numbers used in the May 3, 1994 letter:

Question 4

In Amendment 79, the applicant discussed a methodology that ties nuclear steam supply system (NSSS) stiffness to interior concrete structures (ICS), making a single structural model for seismic response evaluation. The applicant stated that the NSSS model is nonlinear because of a gap and a one- directional support from pipe hangers. The applicant further stated that the nonlinear model is linearlized by some type of bounding parametric study. The staff requested additional information on the bounding study and the basis for adopting such a method. The applicant stated in the response that this aspect of the study had been reviewed and approved previously by the staff as a part of Seismic Analysis Corrective Action Program (refer to Chapter 1 for this program) and also stated that the staff's conclusion was documented in Inspection Report 50-390, 50-391/89-21.

The staff reviewed Inspection Report 50-390, 391/89-21 and the Civil Calculation Program audit report dated October 10, 1990. The staff found that there are some discussions with regard to ICS-NSSS interface. It is stated in the Inspection Report 50-390, 50-391/89-21, page 11, that "Westinghouse, the Watts Bar Nuclear (WBN) NSSS supplier, furnished the NSSS model for WBN Unit 2. It is represented by a mass matrix and associated stiffness matrix. To be coupled to the Unit 1 ICS in the analysis, the Unit 2 NSSS model was first converted to its mirror image in Unit 1. Conversion of the coordinate and degree-of freedom system was then performed for the purpose of interface with the ICS stick model at the NSSS support locations. Appropriateness of the conversion is demonstrated in TVA calculation B26 890427, which shows the converted NSSS model duplicates the frequencies and mode shape of the Westinghouse model. The team found the NSSS model conversion adequate."

From the above, it is clear that the inspection report discussed specifically the aspect of the NSSS model conversion. Nowhere in the report did the inspector discuss the approximation of the nonlinear NSSS model to an equivalent linear model and associated bounding calculations. The report did not indicate the staff's approval of the adequacy of the approximation. The approximation of the NSSS model is only described for the first time in FSAR Amendment 79. The applicant indicated that such discussion is provided in a

ENCLOSURE