## TENNESSEE VALLEY AUTHORITY

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# JAN 31 1991

U.S. Nuclear Regulatory Commission ATTN: Document Control Desk Washington, D.C. 20555

Gentlemen:

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PDR

In the Matter of the Application of Tennessee Valley Authority

Docket Nos. 50-390 50-391

WATTS BAR NUCLEAR PLANT (WBN) - UNITS 1 AND 2 - REVISED RESPONSE TO NRC REQUEST FOR INFORMATION ON OFFICE OF INSPECTION AND ENFORCEMENT (OIE) BULLETIN 79-02.

- Letter from Elinor G. Adensam to H. G. Parris, June 28, 1985, References: 1. Flexibility Requirement in Pipe Support Base Plate Design Using Concrete Expansion Anchors at the Watts Bar Nuclear Plant, Units 1 and 2
  - 2. TVA Civil Engineering Branch (CEB) Report No. (84-05)-NRC OIE Bulletin 79-02 - Pipe Support Baseplate Designs Using Concrete Expansion Anchors - Final Report - Revision 2, December 10, 1984
  - Letter from J. A. Domer to Elinor Adensam, August 22, 1985, 3. TVA response to NRC Request for additional information (RAI) on Baseplate Flexibility

NRC (Reference 1) requested additional information relative to TVA's proposed baseplate design criteria. These criteria were originally submitted for NRC review in TVA's response to NRC OIE Bulletin 79-02 (Reference 2).

TVA provided this required additional information via Reference 3 in August of 1985.

Since that time, both design and programmatic changes have taken place for Bulletin 79-02. Design methods have been modified in the areas of flexible baseplate analysis, anchor stiffness, prying, and rigid baseplate analysis. Programmatically, the bulletin provisions were incorporated into the Hanger Analysis and Update Program (HAAUP) reanalysis of piping and supports.

NRC, during a recent audit of WBN FSAR Amendment 64, November 5-9, 1990, questioned whether TVA's original response (Reference 3) remains valid given implementation of the Corrective Action Program (CAP) for the HAAUP.

Due to the changes described above, TVA agrees to revise its Bulletin 79-02 report to detail the design methods used for baseplate and anchorage analysis. This report revision will be completed by July 15, 1991.

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Additionally, since the Reference 1 NRC questions relate to specific aspects of a report which will be superseded and to design methods that have been modified, the following general responses are provided for the identified areas of concern:

FLEXIBLE BASEPLATE ANALYSIS

QUESTION 1a

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In section B, page 24 [Reference 2], the method used for analyzing baseplates with four bolts subjected to a uniaxial bending moment appears to be applied to both rigid and flexible base plates. Justification for this approach should be presented by comparison with BASEPLATE II calculations. Clarification is also needed when this approach is used for combined bending plus axial loads.

#### Question 1b

In the same section and page, clarification is needed on the basis for distributing anchor loads by inverse proportion for plates loaded primarily in tension, where the baseplate is apparently considered rigid. In addition, the rigidity requirement should be stated as conforming to IEB 79-02.

#### Response

The methods for calculating anchor loads by flexible baseplate analysis methods were revised by Design Standard Change Notice (DSCN)-CEB-89-04 to Civil Design Standard DS-Cl.7.1. This revision, based on expansion anchor stiffness of 400 kips/inch, assures that the anchor loads from the earlier hand calculations will exceed the loads determined by BASEPLATE II finite element analysis. This change notice also deleted the use of the inverse proportion method mentioned in question lb.

ANCHOR STIFFNESS AND PRYING

#### Question 2

Appendix C of Section B [Reference 2] states a set of anchor stiffnesses to use with the computer program BASEPLATE II. However, in the response by TVA to Black and Veatch (B&V) inquiry of January 13, 1984, it was stated that the stiffness properties of the anchor bolts are nonlinear and are input into the program in the form of a curve. The specified basis for these stiffnesses or stiffness curves has not been located in the report and should be provided.

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### Question 5

1.

Indicate the minimum required distance from the bolt centerline to the edge of the plate. Show that this minimizes or eliminates any prying effects.

#### Response

An anchor stiffness of 400 kips/inch is now defined for finite element analyses of baseplates. DSCN CEB-89-01 to Design Standard DS-C1.7.1 implemented the change. The change was made to provide stiffnesses which are closer to the upper-bound values from static tests.

The use of the higher anchor stiffnesses given above will result in prying for some loading conditions for relatively thin baseplates. The method for hand calculation for flexible baseplates was modified to assure that the prying force was included in the anchor load where appropriate. The change was included in DSCN CEB-89-04. For BASEPLATE II analyses, prying effects are automatically included as these forces develop.

## RIGID BASEPLATE ANALYSIS

Question 3

In Section D [Reference 2], "Justification of the 4t Criterion," the information required under item 2 (Question 2) above is also needed here, since the justification is based on the stiffness of the anchor bolts. The applicant's results show that for plates under pure axial loading the rigid plate approach (8 bolts) underestimates the maximum anchor load from 5 to 13 percent. Therefore, 4t does not appear conservative under primarily axial tension. The effect of combined bending and axial load should also be addressed.

#### Question 4

The correspondence or relation of the material properties in the program CASDBAP and BASEPLATE II should be provided. Justification is also required for using 0.334 in cross-sectional area for a 3/4-inch bolt. Indicate if the minimum distance from the bolt centerline to the plate edge as shown is the minimum which was used in all analyses using the 4t criterion.

#### Response

The rigid baseplate analysis programs CASDBAP and BAP222 were not used for the pipe support reevaluation effort at WBN. Baseplates were analyzed using the BASEPLATE II finite element program or hand calculations based on flexible baseplate methods. U.S. Nuclear Regulatory Commission

If there are any questions, please telephone P. L. Pace at (615) 365-1824.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

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Enclosure

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ENCLOSURE

# List of Commitments

TVA will revise its Bulletin 79-02 report to detail the design methods used for baseplate and anchorage analysis. This report revision will be completed by July 15, 1991.