TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

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April 2, 1984

U.S. Nuclear Regulatory Commission
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 - NRC-OIE REGION II INSPECTION REPORT 50-390/84-05, 50-391/84-05 - RESPONSE TO VIOLATIONS

The subject inspection report cited TVA with two Severity Level IV Violations (390,391/84-05-03 and 390,391/84-05-04) in accordance with 10 CFR 2.201. Enclosed is our response to the subject violations.

If you have any questions, please get in touch with R. H. Shell at FTS 858-2688.

To the best of my knowledge, I declare the statements contained herein are complete and true.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Licensing

Enclosure
cc (Enclosure):
Mr. Richard C. DeYoung, Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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1100 Circle 75 Parkway, Suite 1500
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ENCLOSURE

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
NRC-OIE REGION II INSPECTION REPORT
50-390/84-05 AND 50-391/84-05
RESPONSE TO VIOLATIONS

SEVERITY LEVEL IV VIOLATION - 390,391/84-05-03

10 CFR 50, Appendix B, Criterion V, as implemented by Watts Bar FSAR Section 17, paragraph 17.1A.5 requires that activities affecting quality be prescribed by documented procedures and drawings and be accomplished in accordance with these procedures and drawings.

Watts Bar Civil Design Standard DS-C1.7.1, paragraph 5.0 states...that the contact surface between the plate and the concrete remains a plane provided the plate projects no more than four plate thicknesses from the attached member and the baseplate (i.e., rigid plate analysis). Otherwise the effect of the baseplate and anchor deformations shall be considered.

Contrary to the above, between January 17-20, 1984, activities affecting quality were not being accomplished in accordance with documented procedures in that the pipe support group had not implemented the above documented requirements.

Response

1. Admission or Denial of the Alleged Violation

   TVA admits the violation occurred as stated.

2. The Reasons for the Violation

   One of the requirements of NRC Bulletin 79-02 is that plate flexibility be considered if the plate is not sufficiently rigid to justify the assumption of rigid plate analysis. In 1982, a memorandum was issued which instructed TVA designers to use rigid plate analysis methods for the completion of this work for WBN. This position was based on previous designs and is acceptable provided the plates are sufficiently rigid. However, the memorandum was generally interpreted by designers to allow use of rigid plate methods without evaluation of plate rigidity. This interpretation resulted in many baseplates being designed using rigid plate assumptions when the effects of baseplate and anchor deformations should have been considered.

In 1983, Civil Design Standard DS-C6.1 was revised (new number DS-C1.7.1). Section 5.1 of the standard gives limitations on use of rigid plate analysis methods which must be applied unless documented justification is submitted for other limitations. Designers for WBN interpreted the 1982 memorandum mentioned above to provide the required justification. However, the memorandum did not state any limitations, and did not provide the justification required by DS-C1.7.1.

3. Corrective Steps Taken and Results Achieved

The corrective action is being handled as part of the resolution to NCR WBN WBP 8402 (WBRD-50-390,391/84-06). The corrective action consists primarily of a random sampling program which will determine if the failure to consider flexibility resulted in a significant number of anchors with reduced factors of safety. A total of 300 supports are being evaluated of which approximately 95 percent have been completed. The baseplates are analyzed using flexible plate analysis unless the plate meets the rigidity requirements of DS-C1.7.1.

Specific corrective action will be developed after completion of the evaluation of the baseplate sample. The results of the sampling program and the specific corrective action will be included in the final report for WBN WBP 8402.

4. Corrective Steps Taken to Avoid Further Noncompliance

The memorandum which was used by designers for justification of rigid plate analysis has been revised. The revised memorandum now refers designers to DS-C1.7.1.

DS-C1.7.1 was revised to clarify the limitations on rigid plate analysis.

A training course was held to assure that designers understand the baseplate analysis requirements of DS-C1.7.1.

5. Date When Full Compliance Will Be Achieved

All corrective action and action required to prevent recurrence stated above and in NCR WBN WBP 8402 will be completed by April 16, 1984.

SEVERITY LEVEL IV VIOLATION - 390,391/84-05-04

10 CFR 50, Appendix B, Criterion V, as implemented by Watts Bar FSAR Section 17, paragraph 17.1A.5, requires that activities affecting quality be prescribed by documented procedures and drawings and be accomplished in accordance with these procedures and drawings.

Watts Bar Engineering Procedure EN DES-EP 3.03, and Civil Design Standards DS-C1.7.1 and DS-C6.1, provide procedures and acceptance criteria for pipe support and baseplate design calculations.

Contrary to the above, between January 17-20, 1984, activities affecting quality were not being accomplished in accordance with documented procedures and drawings in that a review of four pipe support calculations, including baseplates and anchor bolts, revealed the following deviations from the documented requirements:

a. Calculations for supports 47A450-3-76 R1, 47A450-3-75 R1, and 17A586-1-12 R2, contained incorrect or incomplete calculations.

b. Calculations for supports 47A450-3-76 R1, 47A450-3-75 R1, and 1-038-39 R0 did not contain the required designer and checker identification on all pages of each calculation.

Response

Support reference numbers:

1. 47A450-3-75 R1
2. 47A450-3-76 R1
3. 1-038-39 R0 (identified in inspection report as 1-038-39)
4. 17A586-1-12 R2

1. Admission or Denial of the Alleged Violation

TVA admits that the violation occurred as stated except for the cited items relating to the evaluation of anchors for combined tension and shear loading as discussed below:

The inspection report indicates that the anchors for supports 1 and 4 were overstressed because the combined effect of tension and shear had not been evaluated. The apparent overstressed anchors were identified by an independent calculation performed by the inspector using a straight line interaction formula.

TVA Civil Design Standard DS-C1.7.1 also uses a straight line tension-shear interaction formula (see section 5.3). However, C1.7.1 allows shear loads to be distributed to anchors in inverse proportion to the tensile load in the anchor. This method of distributing shear to anchors is less conservative than the method used by the inspector in his calculations. However, the DS-C1.7.1 method more closely models the behavior of bearing-type anchorage connections and this behavior has been observed in anchorage testing. Some of the supports were designed using DS-C6.1 which also distributed the shear in inverse proportion to the tensile load. DS-C6.1 was superseded by DS-C1.7.1 in 1983.

For support 1, the tension-shear interaction was evaluated in the last calculation on sheet 2 of the superheat calculation package. This calculation is in accordance with the previously mentioned provisions of C1.7.1. For support 4, the designer noted that shear was acceptable by judgment. This judgment was correct for that condition because one bolt in the support had no tension load. Since the shear capacity of that bolt exceeded the applied shear, evaluation of the maximum stressed tensile anchor was not required.

2. Reasons for the Violation

a. Incorrect Baseplate Steel Stress Calculation

The calculated steel stress for support 2 was incorrect because the pressure distribution at the baseplate concrete interface was incorrectly obtained from the computer output. The designer apparently did not understand the parameters printed by the baseplate analysis program (BAP222) which define the pressure distribution under the plate.

b. Failure to follow EN DES-EP 3.03, "Design Calculations"

The calculations for supports 1, 2, and 3 contained some sheets which were not signed by the designer and checker. The sheets which were not signed and dated were printed output from a general use structural analysis program. The unsigned sheet for support 4 was a hand-drawn sketch of the stick model used to develop the computer model. EN DES-EP 3.03 requires signatures on each sheet.

For supports 1 and 2, the deviation from the requirements of EN DES-EP 3.03 occurred primarily because of a misinterpretation of the requirements as they relate to computer output which is included in the calculation package. Computer output which is separate from the calculation package is not generally signed on every sheet.

For support 3, the deviation was an oversight by the checker. However, the checker did initial the sheet giving the computer input obtained from the stick model.

EN DES-EP 3.03 also gives format and content requirements for calculations. Supports 1 and 2 did not meet all of those requirements. However, the designer did have section headings such as "BAP Model" and "SAGS Output." The designer may have considered these titles to meet the intent of EN DES-EP 3.03, figure 4, "Typical Content."

The deviation resulted from inadequate knowledge and understanding of EN DES-EP 3.03.

3. Corrective Steps Taken and Results Achieved

a. Incorrect Baseplate Steel Stress Calculation

The calculations for support 2 will be corrected. No change in baseplate thickness will be required since the corrected plate stress will still be less than the allowable. No further corrective action will be taken because it is highly unlikely that this error was repeated. This judgment stems from the fact that the type situation in question, with uniform bearing pressure, occurs only in the few supports which see only compressive loads and it also involved misinterpretation of the computer analysis output on this support by the designer. TVA believes this type of error would, in most cases, be caught by the problem checker. Also, as noted below, the action required to prevent recurrence of this problem was taken in 1980.

b. Failure to Follow Engineering Procedure EN DES-EP 3.03

The procedural deficiencies relating to EN DES-EP 3.03 did not result in any unacceptable supports. Calculations for other supports designed during the same time period may exhibit similar deficiencies. Since the calculations for supports 1 and 2 were performed in 1980 under EN DES-EP 3.03 R4, some discrepancies with the current revision 6 would be expected.

A detailed evaluation will not be performed since safety of the supports is not involved and action to prevent recurrence has been implemented for several years. (Item 4 below.)

4. Corrective Steps Taken to Avoid Further Noncompliance

a. Incorrect Baseplate Steel Stress Calculation

On October 6, 1980, the computer program BAP222 was revised. The revision included the calculation of the magnitude and location of the resultant compressive force at the baseplate-concrete interface. Although this revision would not prevent the error, it would significantly reduce the likelihood of the error being repeated. Also, in 1983, another program was implemented for Watts Bar which reads the output file from the BAP222 baseplate analysis program and uses that data to calculate plate stresses. The use of this program (PLTDL42) would prevent a recurrence of the deficiency. No further action to prevent recurrence will be performed.

b. Failure to Follow Engineering Procedure 3.03

Inadequate knowledge and understanding of procedures has been previously identified as a problem. In the time since the deficient calculations were made in 1980, TVA has upgraded its engineering procedure training program. Documented training sessions are now required to assure that all personnel are aware of the engineering procedures which affect their work. The effectiveness of this training was evidenced by quality and accuracy displayed in the recently performed calculations reviewed by the inspector. No further action to prevent recurrence will be performed.

5. Date When Full Compliance Will Be Achieved

All corrective action will be complete by May 17, 1984. All action to prevent recurrence has been completed.