UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

Report Nos.: 50-259/85-21, 50-260/85-21, and 50-296/85-21

Licensee: Tennessee Valley Authority
500A Chestnut Street
Chattanooga, TN 37401

Docket Nos.: 50-259, 50-260 and 50-296 License Nos.: DPR-33, DPR-52, and DPR-68

Facility Name: Browns Ferry 1, 2, and 3

Inspection Conducted: April 1-4, 1985

Inspector: W J Ross /for 4/19/85
W. C. Liu Date Signed

Approved by: W J Ross /for 4/19/85
J. J. Blake, Section Chief Date Signed
Engineering Branch
Division of Reactor Safety

SUMMARY

Scope: This routine, unannounced inspection entailed 26 inspector-hours on site in the areas of seismic analysis for as-built safety-related piping systems (IE Bulletin 79-14), and pipe support baseplate designs using concrete expansion anchor bolts (IE Bulletin 79-02).

Results: One violation was identified - Inadequate Design Calculations On Pipe Support HPCI R-86, R2.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*G. Jones, Plant Manager
*R. Guthrie, Design Service/Nuclear Power
*J. Marshall, Jr., Civil Design Project Engineer, DETS
*D. Mims, Engineering Group Supervisor
*B. Morris, Compliance
*R. Lewis, Senior Shift Manager
J. Beason, Civil Engineer, Office of Engineering
R. Baird, Civil Engineer, Office of Engineering

Other licensee employees contacted included engineers, security force members, and office personnel.

NRC Resident Inspectors

*G. Paulk, Senior Resident Inspector
*C. Patterson, Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on April, 4, 1985, with those persons indicated in paragraph above. The inspector described the areas inspected and discussed in detail the inspection findings listed below. No dissenting comments were received from the licensee.

(Open) Violation 296/85-21-01, Inadequate Design Calculations on Pipe Support HPCI R-86, R2, paragraph 5.b.

(Open) Unresolved Item 259, 260, 296/85-21-02, Shear Force Distribution for IEB 79-02 Design Calculations, paragraph 6.b.

(Open) Unresolved Item 259, 260, 296/85-21-03, Frequency/Deflection Criteria Used For Pipe Support Analysis, paragraph 5.c.

(Open) Inspector Followup Item 259/85-21-04, Design Calculation for Support No. CS R-11, paragraph 5.b.

The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspector during this inspection.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Unresolved Items

Unresolved items are matters about which more information is required to determine whether they are acceptable or may involve violations or deviations. Two new unresolved items identified during this inspection are discussed in paragraphs 5 and 6.

5. Seismic Analysis for As-Built Safety-Related Piping Systems (IE Bulletin 79-14).

a. Program Status

The inspector held discussions with licensee representatives with regard to the implementation of the IEB 79-14 and 79-02 programs. It was noted that the schedule for engineering design verification had been revised as follows:

Unit No.	Completion Date	Scheduled Outage
1	March, 1987	6/87 - 3/88
2	September, 1986	11/86 - 6/87
3	December, 1987	2/88 - 10/88

Discussions held with licensee representatives revealed that Browns Ferry pipe support group was responsible for implementation of both the IEB 79-14, pipe support design, and IEB 79-02, baseplate and anchor bolts analysis. Based on the current information, there are approximately 5500 pipe supports involved in the program; piping stress analysis is about 50% complete; pipe support design is 40% complete. However, no single piping system was finally issued.

b. Design Calculations

The inspector reviewed portions of the following design calculation packages in the areas of the IEB 79-14 and 79-02 programs:

Support No.	Piping System	BFN Unit No.
CS R-11, Rev. 3	Core spray	1
CS R-21, Rev. 2	Core spray	1
HPCI R-27, Rev. 1	High pressure coolant injection (HPCI)	2
RHR R-18, Rev. 1	Residual Heat Removal (RHR)	2
RHR R-90, Rev. 1	RHR	2
*HPCI R-86, Rev. 2	HPCI	3

*Discrepancies identified during the review.

The above design calculations with respect to pipe support design and baseplate/anchor bolts analysis were reviewed for conformance to analysis criteria, applicable code, NRC requirements, and the licensee commitments. In addition, these calculations were evaluated during the review for thoroughness, clarity, consistency, and accuracy. In general, the calculations appeared to be adequate in terms of using design input, assumptions, references, equations and tables, with the exception of the following two supports:

(1) Support No. HPCI R-86, Rev. 2, in the Unit 3 high pressure coolant injection system was examined. It was noted that portions of the design calculations had not been performed in accordance with licensee commitments and the NRC requirements.

- Sheet 2 of the calculation specified a 5/16-inch fillet weld to one-inch plate. The as-installed plate was 1½-inch thick. The 5/16-inch weld which was subject to 12,000 pound load was simply evaluated by engineering judgement. No weld calculations were included in any part of the support calculation to justify the weld sizes.

- Sheet 3 specified a 3/4-inch plate for qualification, actual calculation was based on 1½-inch thick. Cross sectional area of the plate showed A = 8 square inches, actual cross sectional area should be 12 square inches.

- Sheet 5 showed two W6 x 15.5 structural members, one vertical and one sloped, these two members had been removed, there were no notes to indicate that these members were either void or supersed-ed. Furthermore, weld calculation for the two attachment plates, 1½" x 8" x 8", as shown on the as-built drawing could not be identified from the calculation package.

- Sheet 6 specified plate size 1½" x 12" x 1'-2" with 3/4" diameter bolt. There were no notes to indicate that the plate had been revised to 1½" x 15" x 1'-3", and bolt size had been changed to 1¼" diameter. As-built drawing showed a ¼-inch all around weld for the strut connection to the horizontal steel beam. But no weld calculations were performed.

- Sheets 10 thru 13 showed Support No. R-90 and support detail assembly. There were no notes to identify that the R-90 and the support assembly were void or superseded.

TVA's Engineering procedure 3.03, Design Calculations, paragraph 2.3 states that all design calculations shall be checked for

adequacy by a qualified person. The checker must be able to provide independent review; paragraph 4.5 states that any configuration change given by an as-constructed drawing must be reconciled with the associated calculations. Calculations are often worked during development to preserve history, with corner-to-corner diagonal lines and words such as "void", or "superseded". The preparers must ensure that each sheet is identifiable with the document, that the status of each sheet is clear, and that the document has continuity. Figure 11 of the procedure provides example revisions to calculation sheets that should be implemented by all design personnel.

The improper design analyses performed in the aforementioned support calculations are violations of 10 CFR 50, Appendix B, Criterion III, and is identified as Violation 296/85-21-01, Inadequate design calculations on pipe support HPCI R-86, R2.

(2) Support No. CS R-11, Rev. 3, in the Unit 1 core spray system was reviewed. It was noted that the baseplate had two structural attachments. Each attachment had three forces and three moments. The baseplate had a thickness of 3/8-inch and was analyzed by hand calculations. Sheet 2 of the calculation was revised on March 9, 1983, but was not signed by the checker. The inspector held discussions with the licensee representative with respect to the baseplate analysis. It was determined that the baseplate will be reanalyzed by the computer applications to ensure that the plate stress and the anchor bolt loads are to be within the allowables. Pending further review of the design calculation. This matter is identified as Inspector Followup Item 259/85-21-04, Design Calculations for Support No. CS R-11.

c. Design Consideration

Browns Ferry Design Criteria No. BFN-50-D707, Rev. 2, Analysis of as-built piping systems, was partially reviewed with respect to pipe support design requirements. It was noted that the frequency/deflection criteria for the pipe support design were not addressed in the document. The inspector held discussions with licensee representatives in the areas of piping stress analysis and pipe support design. It was found that the pipe support group was not instructed to verify whether the supports were able to meet the rigid requirements when the piping stress engineer modeled the supports as rigid in the stress analysis. The designing of rigid pipe supports without verifying frequency/deflection requirements had created inconsistencies between the pipe support designs and the piping stress analyses, pending further evaluations with regard to the above concerns, this matter is identified as Unresolved Item 259, 260, 296/85-21-03, Frequency/deflection criteria used for pipe support analysis.

Within the areas inspected, one violation was identified.

6. Pipe Support Baseplate Designs Using Concrete Expansion Anchor Bolts (IE Bulletin 79-02)

a. Factor of Safety

The inspector reviewed six pipe supports in the areas of the baseplate and anchor bolt calculations. It was noted that the factor of safety of anchor bolts used in the calculations met the IEB 79-02 requirements.

b. Tension Shear Interaction

Civil design standard DS-C1.7.1, Rev. 2, General Anchorage to concrete, was partially reviewed, paragraph 5.3 states that the shear capacity of the individual anchors is inversely proportional to the tensile load in the anchor. The inspector held discussions with licensee representatives with regard to the above concern. It was found that Browns Ferry pipe support group had performed design calculations in accordance with the aforementioned instructions in that the shear force could be reduced to zero when the anchor bolt tensile load approached the allowable value. As a result, the verification of anchor bolt tension-shear interaction had become meaningless in terms of impractical shear force distribution to the anchor bolts, pending further evaluations with respect to the aforementioned concern, this matter is identified as Unresolved Item 259, 260, 296/85-21-02, shear force distribution for IEB 79-02 design calculations.

Within the areas inspected, no violations or deviations were identified.