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

Report Nos.: 50-259/93-29, 50-260/93-29, and 50-296/93-29

Licensee: Tennessee Valley Authority
6N 38A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

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: August 16-20, 1993

Inspector: Rich C. Chou
R. Chou

9-15-93
Date Signed

Accompanying Personnel: J. Blake

Approved by: Candle Julion for
J. Blake, Chief
Materials and Process Section
Engineering Branch
Division of Reactor Safety

9/15/93
Date Signed

SUMMARY

Scope:

This routine, announced inspection was conducted in the areas of previous open items concerning safety related pipe supports.

Results:

In the areas inspected, violations or deviations were not identified.

One open item remained open. One inspector followup item about base plate flexibility information was closed. The remaining open item was about an audit program used by Bechtel Power Corporation for the pipe support walkdown verification and the gap problem between the base plate and concrete. The licensee stated they will review their responses and take adequate actions to resolve the problems. One new concern was expressed to the licensee about Bechtel's use of Engineering Error Reports (EER) for the evaluation of the engineering design errors found by their employees since there was only one EER documented for 1993 from the combination of Mechanical, Civil, and Plant System Design Groups.

REPORT DETAILS

1. Persons Contacted

R. Baird, Civil Engineer
*M. Bajestani, Technical Support Manager
*R. R. Baron, Nuclear Assurance & License Manager
*J. H. Beasley, Quality Assurance (QA) Supervisor
*J. W. Davenport, Site Licensing Engineer
*J. E. Maddox, Engineering Manager
*L. Madison, Recovery Engineer - Civil
*R. J. Molt, Operation Superintendent
*P. D. Osborne, Acting Lead Civil Engineer
*J. A. Scalice, Plant Manager
*J. E. Wallace, Site Licensing Engineer
*R. D. Wells, Compliance Licensing Manager
*O. J. Zeringue, Vice President

Other licensee employees contacted during this inspection included craftsmen, engineers, mechanics, technicians, and administrative personnel.

Other Organizations

Bechtel Power Corporation
*D. W. Strohman, Quality Assurance Manager - on site

NRC Resident Inspectors
*C. Patterson, Senior Resident Inspector
*J. Munday, Resident Inspector
*R. Musser, Resident Inspector
*G. Schnebli, Resident Inspector

2. Actions on Previous Inspection Findings (92701)

A. (Open) Concern about Gap Problem between the Base Plate and the Concrete Surface

This concern was documented in Inspection Report 50-259, 260, 296/91-34. The concern was about the TVA acceptance criteria for the gap between a base plate and the concrete surface stated in the General Engineering Specification G-32, "Bolt Anchors Set In Hardened Concrete." Per paragraph 4.6.1.2 of this specification, the gap can be as large as 3/16" all around the edge of the base plate, even in the center of the base plate, since it does not have any limitation on the minimum contact area between the base plate and the concrete surface. A base plate which can be lifted up without contacting the concrete is an inadequate condition and is unacceptable due to the rigidity reductions in the support. The support in this condition could become flexible in contrast to the rigid condition assumed in the piping stress calculation. To prove that the 3/16" gap can exist all around the edge of the base plate and still meet the rigidity requirements for the support assumed in the piping stress calculation, the licensee

generated calculation No. CSG-92-CA01. The computer model shown in page 9, figure 2 of the calculation assumed that a base plate has a ¼" gap at the outer edge of one side gradually reduced to 0" at the compression flange of the attachment for the bending movement and the rest of base plate has contact between the base plate and the concrete surface. This case will have about 67% contact area which is a great contrast to just a tiny spot of contact area in the entire base plate and the concrete surface. Since this assumption in the model was not the worst case as specified in specification G-32, the model is not valid to support the specification. The licensee's engineer stated that in his opinion, the model was a worst case. But the inspector evaluated and found that it was not the worst case. The licensee stated they will use one of two methods to resolve the gap problems: 1) Produce a real worst case model with finite element analysis as stated in the specification to substantiate the worst condition in the specifications; 2) Revise the specification and set the limitation of maximum area of the gap or of minimum area of contact to be allowed without repair and to be acceptable with the proved analysis. The licensee agreed to review this problem and take an adequate action to resolve this problem.

B. (Open) Unresolved Item 50-296/92-07-01, Large Bore Walkdown Inspection and Document Checking Problems

During numerous NRC walkdown verification inspections in the field for the piping systems for TVA BFN, IE Bulletins 79-02/79-14 program, major discrepancies for the pipe supports between the as-built drawings or documents and field conditions were found to be very high in a rate about 30% - 40%, when considering whole pipe supports as a unit. The discrepancies included missing welds, missing nuts, insufficient weld sizes and lengths, smaller anchor bolts and base plate sizes, wrong member sizes and lengths, wrong weld symbols, anchor bolt spacing violation, etc.

Bechtel Power Corporation performed the field walkdown for the 79-02/79-14 program and used a 95/95 audit program to verify the accuracy and acceptance of the information collected or verified. The Bechtel walkdown program involves three stages to complete; these are field walkdown, sanity check, and 95/95 audit. Bechtel compiles all the walkdown sheets and assigns each sheet a unique number; the walkdown sheets include the drawings, sketches, or inspection and information sheets. The computer is used to randomly select walkdown sheets and half of the attributes in each sheet are selected. The QA Audit personnel perform a complete recheck on the attributes selected in each sheet. Bechtel claimed that the overall trend was 98.8 percent for 95/95 Program Results based on Quality Trend Analysis Program, Bechtel Job 21042, dated December 20, 1991. However, the inspector found thru the review of Bechtel 95/95 audit packages that approximately 55 percent of the attribute recheck was data information and 45 percent was drawing isometric recheck. The program lumps all the data sheets,

drawings, sketches, and isometrics together. The inspector considered that it was improper to consider attributes such as date, unit, etc. in the data sheets and attributes such as weld cracks, missing welds, missing members, etc. in the drawings or sketches to carry the same weight in the sampling. The attributes are not uniform or homogeneous. The licensee was requested to evaluate the impact of non-homogeneous attributes and agreed to review the Bechtel 95/95 program.

The inspector discussed the problem with the licensee engineers and QA specialists and reviewed "Walkdown Program Assessment, Monitoring Report OBF-R-92-3069", dated August 4, 1992, performed by the licensee QA group. This report contained background, evaluation, action plan, results, conclusions, and corrective action. To fully assess the adequacy of the pipe support errors found by TVA QA, Bechtel QA, and NRC, the licensee took four steps:

- TVA hired a technical expert in statistics from SYNERGY Consulting Services Corporation to independently review the 95/95 approach as defined in Bechtel calculation N3-PA-009.

- TVA performed an independent verification of 65 pipe supports to determine the extent of the errors identified with walkdown packages.

- Engineering reviewed the results of previous independent inspections of pipe supports by TVA QA, Bechtel QA, and NRC and reviewed the results of the independent walkdown.

- TVA and Bechtel QA with assistance from engineering and the walkdown group reviewed the errors found to determine the cause and the solution.

The statistics expert, purely from the statistics methods and sampling concluded that the 95/95 method is acceptable and can be used to audit or verify the walkdown data. The 95/95 program will achieve its expected results of 95/95 if sampling size can be increased. The current sampling size only achieved 95/92 results. In the Status Report, Review of the Browns Ferry HAAUP Walkdown Data Quality Sampling and Field Verification by SYNERGY Consulting Services Corporation to TVA, it stated that the Browns Ferry field verification process is consistent with industry practice and the Browns Ferry field verification principles agreed with principles established through the Watts Bar QA Records CAP which has been approved by the NRC. As the inspector noticed, this type of verification process was not an industry practice and no other utilities used it. Even the Watts Bar "HAAUP" did not use this process for the pipe support walkdown verification but used a standard verification program as used by the industry. The standard verification program is to randomly select a certain percentage of pipe supports, to inspect the whole support, and to

evaluate the failure rate considering a whole support as a unit; not to divide the support into several hundred attributes. The licensee presented a letter dated June 9, 1992 from NRC on the subject of Watts Bar Unit 1 - QA Records Corrective Actions Program with a supplemental safety evaluation report. In the letter, NRC clearly indicated the sampling program was acceptable for the QA Records Review after the sample size was revised. It did not indicate this sampling method could be used for HAAUP.

TVA performed 100% field inspection on 65 additional supports that were included in the walkdown program to fulfill the action plan, step 2, as stated above. Per Finding Identification Report No. BFFIR 920088, dated July 23, 1992, 17 out of 65 supports were found to have significant deficiencies not recorded by Bechtel walkdown personnel such as cracked weld, bent rod, plate thickness incorrect, undersized weld, incorrect bolt size, missing weld, loose nuts, insufficient weld lengths, nut not contacting clamp, oversize flame cut hole, missing cotter pin, etc. The failure rate was about 26% for 17 out of 65 supports failed.

Therefore, there is a significant difference between using a whole support as a unit and dividing a support into sheets and subdividing into the small attributes or elements. When the unimportant data elements are lumped into the important component or hardware elements, data elements will cover the importance of the component elements. The licensee agreed to reevaluate the Bechtel 95/95 program. This item remains open.

C. (Closed) Inspector Followup Item 50-259, 260, 296/93-26-03, Review of Supporting Calculation and IE Bulletin Response for Base Plate Flexibility.

This item was a request for a base plate formula supporting calculations. The computing formula used to determine the maximum anchor bolt tension was specified in TVA Civil Design Standard DS-C1.7.1, Section 5.1.1. The formula uses anchor bolts as tension axis and the intersection (the first contact) of base plate and concrete as compression axis. The bending arm distance between compression axis and tension axis is defined as 2 times base plate thickness plus the distance from the compression edge of attachment to the tension bolts. This formula or the bending arm distance was established and verified by the supporting calculation CSG-85-002, Rev. 0, dated July 31, 1985. This calculation compared the maximum bolt tension computed by hand by using the above formula to the maximum bolt tension obtained by using CDC Base Plate II Finite Element Analysis. However, the input and output of finite element analysis was not contained in calculation No. CSG-85-002. The inspector requested the computer analysis and the licensee response to IE Bulletin 79-02 for review. TVA stated that the response to IE Bulletin 79-02 did not include the consideration of base plate flexibility to be required. But TVA changed their position later and incorporated a

formula and prying factor in Civil Design Standard DS-C1.7.1, Section 5.1.1 to account for the base plate flexibility.

The inspection reviewed the CDC finite element analysis input and output. The output was verified to the information contained in Calculation No. CSG-85-002, Rev.0. The figures were matched. The calculation No. CSG-85-002 was reviewed and determined to be acceptable. All the maximum bolt tensions calculated by using the formula were higher than or equal to the maximum bolt tension printed by computer analysis. Therefore, the formula for the anchor bolt tension calculation is conservative with the considerations of base plate flexibility and prying action and is acceptable.

This item is considered closed.

3. Evaluation of Engineering Design Error Reporting Process

During the review of previous open items and related pipe support calculations, the inspector noticed that some of the calculations were revised frequently based on the Field Design Change Notice (FDCN) or the impact of other supports. The inspectors discussed this problem with the licensee's engineers to see if any engineering design error reporting process is open to the employees to report design errors or deficiencies.

TVA has a non-conformance report process open for employees with any deficiencies found in the plant. For the engineering design error reporting process, TVA has Site Standard Practice SSP-3.4, "Corrective Action Program". This program has been in effect for several years for documenting and resolving deficiencies identified in effect for several years. This program contains two reporting processes: Problem Evaluation Reports (PERs) for a lower tier and suspected deficiency condition and Significant Corrective Actions Reports (SCARs) for a higher tier and significant conditions which require immediate action.

TVA design employees generally use PERs for reporting the deficiencies. Per Paragraph 2.1 of SSP-3.4, it states that the procedure applies to onsite TVA and contractor organizations and offsite TVA organizations in support of site activities, when such organizations are involved in identifying, documenting, evaluating, approving, dispositioning, correcting, revising, tracking, trending, controlling, reporting to management, or closing adverse conditions.

Bechtel is a major design or consulting firm for Browns Ferry Units 2 and 3. TVA defines the Bechtel office in Athens, Alabama, (which is about 40 miles from site) to be a onsite extension for contractors. TVA QA stated that the PER process has been used by Bechtel on, off, and on again. Per inspector request, TVA QA PER sponsor printed a report to which contained a list of PER's reported by TVA and Bechtel employees for 1993. Only a few cases were reported by Bechtel in the design area.

Per TVA QA personnel, Bechtel uses a parallel reporting process, Engineering Error Report (EER), for the review and/or recording and processing of technical errors found in completed Bechtel design documents on Browns Ferry Nuclear Plant. EER is contained in Bechtel procedure EDPI-4.65.01, "Processing of Errors Found in Completed Design Documents." Bechtel QA generated a report for the documented EERs from Mechanical, Civil, and Plant Design Groups for 1992 and 1993. Only a few cases were documented for the design calculation deficiencies for 1992. Only one case (one week before this inspection) was documented for 1993.

After the inspector reviewed EDPI-4.65.01 and their attachments, the inspector feels that there is a deficiency in the procedure since the employee or originator needs to convince the group supervisor of the problem in order to have the EER even generated and get a tracking number. That is possibly why only a few EERs were generated for 1992 and 1993.

The inspector expressed concern to the licensee because of the apparent inadequate processes contained in EDPI-4.65.01 for EER and the fact that EER's have not been used properly. The licensee agreed to review the Bechtel EER processes and its impact. This Inspector Followup Item 50-296/93-29-01, "Review of Bechtel's EER process" will be reviewed during a future inspection.

4. Exit Interview

The inspection scope and results were summarized on August 20, 1993 with those persons indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results listed below. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

(Closed) Inspector Followup Item 50-259, 260, 296/93-26-03, Review of Supporting Calculation and IE Bulletin Response for Base Plate Flexibility (paragraph 3).

(Open) Inspector Followup Item 50-296/93-29-01, Review of Bechtel's EER Process.