

UNITED STATES NUCLEAR REGULATORY COMMISSION REGION II 101 MARIETTA STREET, N.W., SUITE 2900 ATLANTA, GEORGIA 30323-0199

Report Nos.: 50-390/94-67 and 50-391/94-67

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

Docket Nos.: 50-390 and 50-391 Facility Name: Watts Bar Nuclear Plant Units 1 and 2 Inspection Conducted: September 26-30, 1994

Date Signed

Inspector: J. J. Lenaban Approved by: E. Fredrickson, Chief Ρ. Watts Bar Construction Branch **Division of Reactor Projects**

SUMMARY

Scope:

This routine, announced inspection was conducted in the areas of licensee and contractor employee concerns programs pertaining to engineering and design, and review of design evaluations of deficiencies identified in structural steel connections.

Results:

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

Employee concerns are being adequately resolved. The licensee's design methodology to resolve the structural deficiencies is conservative.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *J. Adair, Lead Civil Engineer, Nuclear Engineering
- *M. Alexander, Site Representative, TVA Concerns Resolution Staff
- *W. Elliot, Engineering Manager
- R. James, Civil Engineer, Nuclear Engineering
- *P. Pace, Compliance-Licensing Manager

*J. Scalice, Vice-President, Site Operations

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

Other Organizations

E. Odar, Manager, Civil Engineering, EBASCO

NRC Resident Inspectors

M. Glasman, Resident Inspector *K. VanDoorn, Senior Resident Inspector, Operations *G. Walton, Senior Resident Inspector, Construction

*Attended exit interview

2. TVA Employee Concerns Program

During previous NRC inspections, the licensee's employee concerns program was examined by NRC Region II. These inspections included a review of implementing procedures, employee concerns files, and the concerns resolution backlog. During the current inspection, the inspector reviewed the log of employee concerns filed since January, 1990, and selected for review those involving engineer/design issues or concrete expansion anchor installation concerns. The following concern files were reviewed:

> 90-WB-077-F3 90-WB-370-F1 90-WB-493-F2 90-WB-607-F1 91-WB-H54-F1 94-WB-130-F1

The inspector determined that the licensee's action to investigate the concerns, and followup on corrective action was adequate. The concerns were resolved in a timely manner. In cases where the concerns were substantiated, nonconformances were initiated when the concern involved violation of licensee's procedures or hardware deficiencies. The concerns involving concrete expansion anchor installation practices

resulted in extensive reinspection of the installed anchors, and in some cases, initiation of pull testing (tensile testing) of the installed anchors to confirm anchor design capacities. The inspector concluded the employee concerns had been properly evaluated and resolved.

Violations or deviations were not identified.

3. EBASCO Employee Concerns Program

EBASCO Services, Inc, provides contract design engineering services for Watts Bar. The inspector examined the log of employee concerns filed under EBASCO since January, 1990. The majority of the concerns involved administrative issues and were not nuclear, safety-related. The inspector reviewed the following concerns which involved engineering design issues:

> 06-92-01 08-92-02 05-93-01 05-93-02 06-93-02 06-93-03 10-93-01

The inspector determined that the concerns had been properly evaluated and resolved in a timely manner.

Violation or deviations were not identified.

4. Miscellaneous and Structural Steel - Review of Design of Structural Steel Connections (37550 and 48051)

Since 1985, numerous deficiencies in construction of structural steel platforms have been identified at the Watts Bar site. The deficiencies were identified through followup on employee concerns, various licensee inspection programs, licensee design re-evaluation/review programs, and NRC inspections. Examples of the deficiencies included: undersized structural steel welds, incorrect bolt torque values, use of incorrect type of bolts, incorrect copes in structural steel beams, flame cut holes, incorrect installation of bolts in slotted holes, and numerous design deficiencies.

The inspector randomly selected three deficiencies and reviewed the licensee's design calculations to resolve these issues. The deficiencies involved incorrect copes in structural beams, flame cut holes in structural steel beams, and installation of bolts in slotted holes without use of washers.

The inspector reviewed procedures which control the design of structural steel connections. Acceptance criteria utilized by the inspector appear in the final Safety Analysis Report, Sections 3.7 and 3.8. Documents examined were as follows:

- TVA General Engineering Specification G-89, Requirements for Structural and Miscellaneous Steel, Revision 3
- Design Criteria WB-DC-20-21, Miscellaneous Steel Components for Category I Structures, Revision 6
- Civil Design Guide DG-C1.6.4, Structural Steel, Design of Structural Connections, Revision 4

The inspector reviewed the calculations listed below which addressed deficiencies in beam copes and bolted connection. Calculation reviewed were:

- Calculation WCG-1-684, Design Instruction for Structural Adequacy Evaluation of Steel Platforms, Revision 2. This calculation provides the generic criteria for evaluation of deficiencies identified on structural steel platforms.
- Calculation WCG-1-1363, Acceptance Rejections Criteria for Flame Cut Bolt Holes, Revision 1. This calculation established generic criteria for evaluation of flame cut holes in structural steel connections.
- Calculation WCG-1-1341, Assessment of Square Cuts and Copes for Platforms
- Calculation WCG-1-1372, Platform Single Cope Evaluations
- Calculation WCG-1-1373, Platform Double Cope Evaluations
 - Calculation WCG-1-866, Evaluation for Auxiliary Building Platforms, Elevations 724, 727, and 728, Drawing 48N1210-6, and -14
- Calculation WCG-1-876, Evaluation for Auxiliary Building Platform Elevation 799.63, Drawing 48N1210-10
- Calculation WCB-1876, Evaluation for Auxiliary Building Platform, Elevation 747, Drawing 48N1210-7
 - Calculation WCG-1-260, Qualification of Long Slotted Holes for Use Without Plate Washers

Calculation WCG-1-1341 documents the results of walkdowns to identify beams on structural steel platform with excessive copes and notches. The calculation evaluated the worst case conditions and established bounding conditions for beams with single and double copes which required further evaluation. The single and double copes were evaluated, for each bounding case, in calculation numbers WCG-1-1372 and -1373, respectively. The analytical methods included use of stress intensity factor equations, as established in the literature for control of fracture and fatigue in structures. The results of the calculations showed that the beams with copes and square notches were acceptable for the applied loadings. No repairs or reinforcement of beams was required due to the presence of notches or copes.

Calculation WCG-1-260 is a summary of the methods used to qualify connections with slotted holes. The calculation states that auxiliary building platforms shown on the 48N 1210 drawing series were bolted with A 325 bolts in friction connections. Each connection with a slotted hole was reviewed by the licensee to determine if the design load was greater that 50 percent of the allowable load. Connections with slotted holes with design loads exceeding 50 percent of the allowable load required plate washers. The inspector reviewed calculation numbers WCG-1-865, 866 and 876 to determine design loads on connections with slotted holes. The inspector also reviewed the analytic method for treatment of the slotted holes in the finite element models. In calculation number WCB-1-876, steel members with slotted joints were modeled with the axial forces released. In calculation numbers WCG-1-865 and 866, the beams with slotted joints were modeled as simply supported, that is, the axial forces were not released at these connections. The justification for not releasing the axial forces was stated in Section 11.0 of the calculations and was based on the fact that for connections using high strength A-325 bolts torqued to minimum AISC bolt tension requirements, the assembly will function as a friction connection, and the axial force will not be released. The inspector concurred with the treatment of beams with slotted joints as friction connections in accordance with AISC criteria. An alternate method would be assuming that the axial forces are released, as was done in calculation WCG-1-876, since this method may result in more conservative design values, depending on platform geometry. Based on review of the design calculations, the inspector concluded that the licensee's evaluation of the above deficiencies was adequate. Required repairs were incorporated into work plans.

Violations or deviations were not identified.

5. Exit Interview

The inspection scope and results were summarized on September 30, 1994, with those persons indicated in paragraph 1. The inspector described the areas inspected and discussed in detail the inspection results. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.