

TENNESSEE VALLEY AUTHORITY

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AUG 11 1987

WBRD-50-390/86-65  
WBRD-50-391/86-58

10 CFR 50.55(e)

U.S. Nuclear Regulatory Commission  
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Gentlemen:

WATTS BAR NUCLEAR PLANT (WBN) - UNITS 1 AND 2 - INADEQUATE AS-CONSTRUCTED WELD CONNECTIONS FOR CONTROL BUILDING STRUCTURAL FRAMING - WBRD-50-390/86-65, WBRD-50-391/86-58 - FINAL REPORT

The subject deficiency was initially reported to NRC-Region II Inspector Morris Branch on October 20, 1986, in accordance with 10 CFR 50.55(e) as SCR WBN CEB 8689. Steve Elrod was notified on January 16, 1987, that TVA considers this deficiency to represent a significant breakdown in the quality assurance program for this area of structural steel design and erection. Our first and second interim reports were submitted on November 19, 1986 and February 18, 1987, respectively. Enclosed is our final report.

If there are any questions, please telephone R. D. Schulz at (615) 365-8527.

Very truly yours,

TENNESSEE VALLEY AUTHORITY



R. Gridley, Director  
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Enclosure  
cc: See page 2

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ENCLOSURE  
WATTS BAR NUCLEAR PLANT UNITS 1 AND 2  
INADEQUATE AS-CONSTRUCTED WELD CONNECTIONS FOR CONTROL BUILDING  
CABLE TRAY SUPPORT  
10 CFR 50.55(e)  
WBRD 50-390/86-65 AND WBRD 50-391/86-58  
SCR WBN CEB 8689  
FINAL REPORT

DESCRIPTION OF DEFICIENCY

During the review of Weld Deviation Reports (WDRs) for the Watts Bar Nuclear Plant (WBN) weld program, calculations were made to check the adequacy of the as-constructed welded connections for mainframing and bracing due to cable tray support loads in the Control Building (elevation 741.0). Several of these connections proved to have stresses above design criteria allowables due to undersize, underlength, and missing welds.

These conditions were identified during inspections associated with the WBN Weld Sample Program. Welds found to deviate from the inspection criteria were described on WDRs. The WDRs were submitted to the design organization for evaluation of the welded connections to determine if they were suitable for service. This condition involves 10 WDRs that, after evaluation, based on the original design calculations, were deemed to be unsuitable for service (i.e., the stresses in the welded connections exceeded design criteria allowables). Three WDRs are for mainframing connections and seven WDRs are for bracing connections in mainframing that were provided for cable tray support loadings. After evaluation of 1,369 structural related WDRs (including revisions of the 876 original WDRs), the 10 WDRs described for elevation 741.0 were the only ones deemed unsuitable for service.

The mainframing connection deficiencies stem from a lack of procedural control for erection and inspection of structural steel during the timeframe that the work was performed. The bracing connection deficiencies stem from a lack of clear specification of weld requirements which led to misinterpretation of design detail by construction and inspection personnel.

TVA has determined that in this specific area of structural steel design and erection, a significant breakdown in the Quality Assurance program has occurred.

SAFETY IMPLICATIONS

The mainframing for the access platform of 741.0 elevation also carries cable tray support loads. This framing, in conjunction with other structural members, provides a method of supporting and transferring both vertical and horizontal seismic loads from cable tray supports to the floor. If some of the members were to fail, the load could redistribute to other members of the structure and have no adverse structural effects. However, if the loads did not redistribute during a Safe Shutdown Earthquake (SSE), several members could potentially fail. Failure of the main structural framing and bracing could possibly cause subsequent failure of the cable tray supports and jeopardize the ability of class 1E cables to perform their safety function.

TVA has evaluated the specific safety implications of this deficiency by performing a reanalysis of the floor structure using the latest design criteria (WB-DC-20-9). This reanalysis assumed that the deficient connections failed, forcing loads to redistribute to other structural members. Evaluation of the floor framing system indicated that the ultimate strength of the steel members and connections was not exceeded and, therefore, no members were in danger of failing to perform their design function. Had it remained undetected and uncorrected, this deficiency would not have adversely affected the safe operation of the plant.

#### CORRECTIVE ACTION

A refined model utilizing the actual cable tray spans, (original model used maximum span throughout) and the latest WBN design criteria was created to establish the reactions at the connections. Evaluating the original ten WDRs, utilizing the reactions from the refined computer model, revealed that seven WDRs were suitable for service and three were unsuitable for service (i.e., design allowables were exceeded). However, all ten connections are being repaired.

On elevation 741.0 of the Control Building, TVA is performing a walkdown (Walkdown Procedure - 16) to inspect, evaluate (Special Engineering Procedure - 87-01), and document all field-welded connections, and redesign configurations not meeting design criteria allowables. Although no other connections have been identified as not meeting design criteria allowables, a drawing search of structural and miscellaneous steel drawings was conducted to determine if other welded connections having unclear weld specifications existed. Seventy-two similarly configured welded connections were found; 64 on elevation 729.0, 6 on elevation 755.0, and 2 on elevation 776 of the Auxiliary Building. These have been included in the boundary for evaluations. The total number of connections evaluated is 1,098. All as-built connections will agree with design output documents. TVA will complete the field modifications by unit 1 fuel loading.

The following actions were initiated for reasons other than response to the identified deficiency but will prevent recurrence of similar deficiencies: Quality Control Procedure, QCP 2.04, "Fabrication, Erection and Inspection of Structural and Miscellaneous Steel," was issued in August 1975 (after the construction of the mainframing) to control the installation of structural and supplemental steel. Also, the Records Accountability Program has been initiated since the fabrication of the deficient welds. This program requires the responsible engineer to assign specific inspection test requirements for each structural feature. The current Nuclear Engineering Procedure (NEP) 5.2, Review, provides methods to ensure that designs are reviewed for suitability and compatibility with other designs.

To provide additional assurance that welding activities are performed to specification, measures in the welding inspection area have been taken to monitor the performance of welding inspectors. A system was instituted under which randomly selected and previously accepted inspections are reinspected by peer inspectors for adequacy. In addition, TVA has implemented a level III Quality Control (QC) Welding Inspection Program for structural welding to

monitor the performance of QC inspection activities on a sampling basis to ensure that structural welding inspections are being performed to established requirements and acceptance criteria are met. This will improve our program for ongoing inspections. Also, site management has been notified, by memorandum, of the causes and significance of this deficiency and have been instructed to make appropriate structural steel designers, construction engineers, and quality control personnel aware of the same.