TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

February 25, 1982

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WBRD-50-390/81-01
WBRD-50-391/81-01

Mr. James P. O'Reilly, Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Region II - Suite 3100
101 Marietta Street
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 - FILLET WELD MISSPECIFICATION - WBRD-50-390/81-01 AND WBRD-50-391/81-01 - FINAL REPORT

This deficiency was initially discovered on Bellefonte Nuclear Plant and was reported to the NRC on November 7, 1980, as NCR BLN BLP 8007. Subsequent investigation revealed that this deficiency was applicable to all TVA plants. The deficiency was reported to NRC-OIE Inspector R. W. Wright on December 10, 1980, in accordance with 10 CFR 50.55(e) for Watts Bar as NCR's WBN SWP 8008 and WBN 2807R. Interim reports were submitted on January 9, April 8, June 8, July 16, and October 22, 1981. Enclosed is our final report. The submittal date of this report was discussed with R. V. Crlenjak on February 8, 1982.

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

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Regulation and Safety

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

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ENCLOSURE

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
FILLET WELD MISSPECIFICATION
WBRD-50-390/81-01, WBRD-50-391/81-01
10 CFR 50.55(e)
FINAL REPORT

Description of Condition

Our investigation has identified violations of the 135-degree-maximum, 60-degree-minimum angle permitted for intersecting members of prequalified fillet-welded skewed tee joints. This requirement is imposed by the American Institute of Steel Construction (AISC) specification and the American Welding Society (AWS) D1.1 structural welding code.

This condition was found to exist in miscellaneous category I steel features and for category I mechanical and electrical component supports. The category I building structures are not involved in the nonconformance since none of these structures are steel framed. Further investigation has also identified this condition in engineered pipe supports in the intake and essential raw cooling water pumping stations and in gates, cranes, locks, doors, hatches, and other miscellaneous mechanical features in both TVA and vendor designs.

This violation occurred because designers were unaware of the requirements of the AWS structural welding code governing angularity limits and weld symbols for fillet welded skewed T-joints.

Safety Implications

Only nine of the analyzed cases were determined overstressed. Those were in joints in cable tray supports which could have resulted in failure of cable trays should the supports fail. This situation could have resulted in a degradation of the safe operation of the plant.

Corrective Action

1. All drawings of the steel civil features have been reviewed for presence of the nonconforming geometry. These features include cable tray supports, conduit supports, platforms, pipe-rupture protective devices, monorails, and tank and equipment supports. These structures are located in the auxiliary, control, reactor, diesel generator, and Carbon Dioxide storage buildings and the ERCW pumping station. For all civil structures, all nonconforming joints were subjected to a detailed structural analysis. This analysis was conservative in that it either neglected the load-carrying capacity of the fillet weld in the acute and obtuse angle portions of all joints, or only considered a portion of the weld throat as structurally effective. Except for the 14 joints discussed in the following paragraph, all joints were found to be stressed within allowable values.

   Fourteen joints in cable tray supports were found to have welds inadequate in size when subjected to forces calculated in the original design. The support systems were originally designed

using damping values permitted by the FSAR for welded structures. However, since these support systems consist of both welded and bolted connections and recent testing has shown that the cables in the trays significantly increase damping, the support systems were reanalyzed using damping values of 4 percent for the Operating Basis Earthquake (OBE) and 5 percent for the Design Basis Earthquake (DBE). These values are between the FSAR values for welded structures and for bolted structures. Five of the 14 joints were found to be stressed within allowable limits while 9 were found to be overstresed. The overstressed joints were redesigned and the drawings were issued requiring the joints to be strengthened by increasing the size of the welds in the nonskewed portion of the joints. Rewelding of these joints will be complete by fuel loading.

2. TVA has reviewed engineered support drawings for all piping sizes and all typical mechanical support drawings. The systems reviewed are as follows:

A. Reactor coolant	G. Component cooling
B. Residual heat removal	H. Main feedwater
C. Safety injection	I. Upper head injection
D. Chemical and volume control	J. Containment spray
E. Auxiliary feedwater	K. Steam generator blowdown
F. Main steam	L. Essential raw cooling water

All engineered pipe supports and all typical mechanical supports except for two which had not been used for construction were subjected to a detailed structural analysis using the procedure discussed in paragraph 1 above. None of the welds checked were overstressed. Design drawings for the two unused supports were voided.

3. TVA has completed identification and evaluation of nonconforming weld joints occurring on all TVA and vendor drawings involving gates, cranes, locks, doors, hatches, screens, bulkhead, seals, and platforms. Evaluation methods and criteria were as discussed above for other civil and mechanical features. All were found to be structurally adequate.

4. All Westinghouse supplied and/or designed RCS equipment supports, ice condenser, refueling equipment, fuel-handling equipment cranes, etc., skewed T-joint fillet welds have either been qualified by analysis and/or testing, or are considered nonload carrying welds.

5. Engineers and designers have been alerted to the AISC/AWS requirements for limiting angles for skewed T-joints.

6. General Construction Specification G-29C has been revised to clarify construction requirements for skewed T-joints.

7. Information will be provided to all engineers and designers further emphasizing the AISC/AWS requirements for fillet welded skewed T-joints. We anticipate issuing this information by March 1, 1982.