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

May 14, 1981

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U.S. NUCLEAR REGULATORY COMMISSION

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 - BREAKDOWN IN DRAVO QA PROGRAM - NCR 1-80 - FINAL REPORT

The subject deficiency was initially reported to NRC-OIE Inspector M. Thomas on March 28, 1980, in accordance with 10 CFR 50.55(e). Interim reports were provided on April 28, June 19, September 30, and November 24, 1980. Enclosed is our final report.

If you have any questions, please get in touch with D. L. Lambert at FTS 857-2581.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Regulation and Safety

Enclosure
cc: Mr. Victor Stello, 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
BREAKDOWN IN DRAVO QA PROGRAM
10 CFR 50.55(e)
NCR 1-80
FINAL REPORT

Description of Condition

During preparation for baseline inservice inspection (ISI), it was discovered that a number of welds on safety-related subassemblies, manufactured by Dravo Corporation (Dravo) of Marietta, Ohio, appeared to have extra weld material near the TVA field welds. These unidentified welds were later determined to be weld buildups performed by Dravo for the purpose of obtaining proper dimensional tolerances for subsequent alignment and counterbore so as to comply with ASME code fit-up requirements. These additional welds were not documented in accordance with the QA requirements and a nonconformance report (NCR) was issued (NCR W-4-P). This NCR was determined to be not reportable under 10 CFR 50.55(e) since it was thought that the documentation problem was an isolated instance and that the documentation could be obtained.

A further investigation revealed that there is a lack of documentation or insufficient documentation of the weld buildups on a large number of ASME Class 1, 2, and 3 pipe ends. These undocumented welds are on subassemblies manufactured by Dravo as part of the principle piping contract for Watts Bar Nuclear Plant. Both shop (Dravo) and field (TVA) girth weld areas are involved.

Subsequently, NCR 1-80 was written and determined to be reportable under 10 CFR 50.55(e).

Safety Implications

No defects in welding or hardware have been found. It has been determined that the only deficiency is the lack of proper QA documentation. Therefore, had this deficiency gone undetected, this condition would not have affected adversely the safety of operations of the plant.

Corrective Action

The following course of action was taken to ensure the acceptability of all weld buildups.

Documentation Search - Dravo conducted an extensive in-house search of their records in order to reconstruct all previously undocumented data. This information, which was reviewed and approved by Hartford Steam Boiler Company, Dravo's Authorized Nuclear Inspector (ANI), was submitted to TVA in the form of corrected sketches. The sketches were subsequently incorporated into the existing data packages. This involved 70 sketches.

Code Case - A request for a code case was initiated by Stone and Webster and supported by TVA in order to define the requirements for making and examining weld buildups. This code case, N-292, was approved by ASME Council on January 5, 1981.

Using the code case, which clarifies the code intent, the required nondestructive examination (NDE) for weld buildups is as follows:

Code Class	NDE Requirement(s)
1	Radiography and Surface Examination
2	Radiography
3	Surface Examination

Film Review - In order to demonstrate the integrity of all Class 1 and 2 weld buildups, TVA and Dravo have reviewed the radiographic (RT) film of all shop and field welds. This film is of sufficient width to include any possible buildup area and was reread in accordance with a Dravo procedure, E2879-RT-1, approved by TVA and Dravo's ANI. The purpose of this review was to determine if there were rejectable defects in the areas of possible weld buildup.

This review involved approximately 4,000 shop and 2,000 field welds of which a minimum of 10 percent were also reviewed by TVA's ANI (Hartford Steam Boiler Company). No rejectable defects were found.

NDE Surface Examination - Where required, Class 1 and 3 girth welds were surfaced examined a sufficient distance from the edge of the welds to include any possible outside diameter (od) buildups. Both Dravo and Dravo's ANI have certified that this was the case for Dravo's shop welds. TVA's procedure for surface examination ensures that this is also true for TVA field welds.

Design Calculations - Since it is not known if all inside diameter (id) buildups on Class 1 and 3 piping were surface examined and/or documented, analytical methods were used to further verify the integrity of the pipe. This is especially significant for Class 3 piping since RT is not required for the girth welds. These analytical methods were also extended to include Class 2 piping, since surface examination of girth welds was not a code requirement.

As a measure of conservatism, TVA applied so called "penalty factors" (essentially joint efficiency factors) of 0.95, 0.90, and 0.85 as multipliers to the design allowable stress intensity of Class 1, 2, and 3 piping, respectively. These factors, which are not defined in the code, are considered to be equivalent to the longitudinal weld joint efficiency factors that the code assigns to longitudinal butt weld joints in Section VIII and Section III, Class 3. Subsequent design calculations proved that in several cases, the manufacturer's minimum tolerance wall thickness was less than the calculated minimum thickness.

Where this occurred, additional refinements to the design calculations using actual values of tensile strength (obtained from the Certified Material Test Reports) resulted in the elimination of many of these pipe ends from further consideration. The remaining pipe ends were associated with the Main Steam and RHR Class 2 piping systems.

For these remaining Class 2 pipe ends with questionable wall thicknesses, actual wall thickness measurements were made by ultrasonic techniques using a Kraut-Kramer DM1B meter. Using the minimum measured thicknesses, it was determined that the minimum required wall thickness was met in all but 57 main steam pipe ends.

By exceeding the code case requirements, that is, by successfully performing od surface examination of the above mentioned Class 2 pipe ends, it was justified that the penalty factor could be increased an additional 5 percent. Once again, minimum wall calculations were made, using a "penalty factor" of 0.95 and the actual tensile strengths. These values were compared to the actual measured minimum walls. This process eliminated all but 14 main steam pipe ends.

All Class 2 main steam piping requires ISI of the butt welds. Because the joints associated with the remaining pipe ends require an additional NDE (i.e., ultrasonic-straight beam and 45° angle beam with USL-38), there was again justification in increasing the value of the "penalty factor" an additional 5 percent.

Final design calculations, using a "penalty factor" of unity and actual tensile strengths revealed that all the remaining 14 pipe ends have acceptable design minimum wall thicknesses.

Thus, all the piping involved has been systematically shown to exhibit analytically acceptable wall thicknesses at the areas of possible weld buildup.

Conclusion

Although the lack of documentation on weld buildups was a result of a failure by Dravo to implement an existing QA procedure, certain facts should be outlined:

1. Dravo's QA program was audited and approved by TVA and NRC as well as the ASME. In addition, certain aspects of the program were periodically reviewed by Dravo's ANI.

2. As a matter of standard operating procedures, it was Dravo's practice to use filler metals issued under a controlled program for all work, whether nuclear or nonnuclear, to prevent the inadvertent use of improper material on any contract.

3. TVA approved weld procedures were used and there is no reason to believe that undocumented welds were made in a different manner than documented welds.

4. All welding was performed by qualified welders.

As a result of these facts, plus the comprehensive analysis of the systems as discussed, TVA considers the fabrication acceptable and the systems to conform to the structural integrity requirements of the code.

In order to reduce the chance that undocumented weld buildups will occur on future TVA piping contracts, the vendor will be required to issue a specific weld buildup shop procedure. This has been done for TVA's remaining outstanding contract for the fabrication of safety-related piping subassemblies for Yellow Creek Nuclear Plant.