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AUG 18 1989

WBRD-50-390/84-17
WBRD-50-391/84-17

10 CFR 50.55(e)

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of the Application of)
Tennessee Valley Authority)

Docket Nos. 50-390
50-391

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2 - DEFICIENT WELDS FOR HANGER LUGS ON AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) CODE PIPING - WBRD-50-390/84-17 AND WBRD-50-391/84-17 - SECOND REVISED FINAL REPORT

The subject deficiency was initially reported to NRC Region II Inspector Steve Elrod on January 27, 1987, in accordance with 10 CFR 50.55(e) as Significant Condition Report (SCR) W-518-P for Unit 1. SCR WBN 7192 was initiated to document the potential for this deficiency for Unit 2. A similar deficiency was reported previously (WBRD-50-390/84-17 and 391/84-17) but was downgraded to nonreportable in our May 18, 1984 report. Because of the similarity to the previous deficiency, TVA reopened this item on January 27, 1987, rather than reporting this as a new deficiency. A revised final report was issued May 15, 1989, to reflect the revisions found in the WBN Phase II Welding Report.

Verification of the completion package for the revised final report identified that 8 of the 20 Unit 1 Class 1 lugs were visually accepted during construction after backgouging and the balance of 12 were ultrasonically evaluated and found acceptable. This second revised report is being submitted to document the verified inspections. This is in contrast to previous reports which indicated all Class 1 lugs were ultrasonically tested. The WBN Phase II Welding Report and corrective action program plan for welding will also be revised to reflect the actual inspections. The enclosure provides our second revised final report. No new commitments are made in this report.

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

Very truly yours,

TENNESSEE VALLEY AUTHORITY

M. J. Ray for

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Enclosure
cc: See page 2

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ENCLOSURE

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
DEFICIENT WELDS FOR HANGER LUGS ON ASME CODE PIPING
SCR W-518-P, SCR WBN 7192, NCR WBN 5559
WBRD-50-390/84-17, WBRD-50-391/84-17
10 CFR 50.55(e)

SECOND REVISED FINAL REPORT

DESCRIPTION OF DEFICIENCY

During rework activities on unit 1 supports on the Essential Raw Cooling Water (ERCW) System, it was discovered that welds joining the piping shear lugs to the pipe were not complete penetration in conformance with the design drawings which specify full penetration welds. In addition, the welds on some of the shear lugs did not extend the entire length of the lug. Discrepancies were also found with the specified root gap on a small number of the known discrepant welds. On unit 1, weld deviation reports have been written which identify other full penetration shear lug welds in various other systems that have a lack of the specified full penetration. This nonconformance was reported under Significant Condition Report (SCR) W-518-P for unit 1. SCR WBN 7192 was written for unit 2 to facilitate evaluation for generic nonconformances.

In March of 1984, Nonconformance Report (NCR) WBN 5559 was initiated to address a generic problem of a lack of full penetration on shear lug welds due to the welds not being backgouged after the initial weld pass. The May 18, 1984, final report dispositioned the nonconformance as use-as-is. TVA has since discovered errors in this disposition for American Society of Mechanical Engineers (ASME), Section III, class 2 and class 3 pipe; and thus, the use-as-is disposition was not adequately justified and has been reevaluated.

The root cause of the lack of full penetration in the welds is the absence of a procedure implementing the requirements of General Construction Specification G-29M, drawing 1.M.1.2-12, which specified full penetration welds. The lack of weld along the entire lug length and the lack of the specified gap apparently resulted from poor craftsmanship and inadequate inspections.

This deficiency was discovered and reported by a welder who was performing unrelated rework activities for the purpose of resolving zero period acceleration (ZPA) concerns. His action was indicative of his alertness and commitment to quality.

SAFETY IMPLICATIONS

The lack of full penetration welds described above has been evaluated and found not to be significant to safety. The results of an analysis and evaluation of a statistical group of shear lug welds indicate that there is a high degree of confidence, i.e., 95-percent confidence with 95-percent reliability, that these lug welds do not pose a safety concern. The basis for this conclusion is as documented below.

As a result of the reported discrepancies, Specialized Technical Investigation and Analysis, STIA No. 2, was initiated to determine the safety significance of ASME Code, Section III, class 2 and class 3 lug welds that potentially did not conform to the full penetration weld type specified by the pipe support design drawings.

In order to determine the structural integrity of ASME Code, Section III, class 2 and class 3 lug welds, a reanalysis was performed to determine the required fillet weld size of a statistical population of lug welds. This decision was based on results from initial inspections that indicated many lugs also have a weld reinforcement in addition to the full penetration weld specified by the design drawing. Welds known to have been visually inspected for backgouging were not included in the lug weld population under consideration, i.e., lugs with a high confidence of having been welded with full penetration welds were intentionally removed from the statistical population in order to conservatively bias the population toward the lugs with a greater probability of not having full penetration welds. Each weld in the statistical sample was reinspected to ensure that the actual fillet weld reinforcement is sufficient to meet the existing design loads. This approach is conservative because it does not take credit for any partial penetration weld unless the fillet weld reinforcement is not independently capable of resisting the applied design load.

The statistical sample was divided into three groups, independent of size and design load, as follows:

Group 1: 60 lug welds from the total unit 1 and common population.

Group 2: 30 thick lug welds and lugs welded to large bore pipe.

Group 3: 30 lug welds on thin lugs welded to small bore pipe.

There were 120 lug welds reanalyzed to satisfy the applicable portions of ASME Code Case N-318 to determine the required size for fillet welds. The size and length of each of the fillet reinforcement welds on the 120 lug welds were measured by qualified walkdown teams trained in the visual inspection of fillet welds and "as-built" pipe supports. All measurements recorded during the inspection were independently verified by TVA's nuclear quality assurance (NQA) inspectors.

The weld measurements were then compared to determine if the existing weld fillets were of sufficient size to meet the requirements defined by the reanalysis. There were 115 of these lug welds that successfully passed the initial stress analysis. Margins above the minimum calculated size for these lug welds varied from 1.044 to 62.5, based on allowable stress.

There were 5 lug welds that required alternate evaluation as a result of a lack of measurable fillet weld reinforcement. Based on weld joint design and witness hold points used during fabrication and installation, it was confirmed that the minimum partial penetration required (approximately 30 percent) for these 5 lug welds was available. Therefore, these lug welds were determined to be acceptable.

Shear lug welds to American Nuclear Standard Institute (ANSI) B31.1 piping systems (in category I structures) and unit 2 piping systems were not included in the statistical population. However, based on similarities in materials, design methods, and welding procedures, the results of the evaluation performed for unit 1 ASME Code, Section III, class 2 and class 3 lug welds can be extended to include lug welds to ANSI B31.1 piping systems (in category I structures) and unit 2 piping systems.

CORRECTIVE ACTION

All shear lugs on safety-related systems will be addressed. The shear lugs presently installed on ASME Code, Section III, class 1 piping (20 unit 1 and 4 unit 2 shear lugs) have been inspected for backgouging or ultrasonically examined and determined to be acceptable. Lugs on ASME, Section III, class 2 and class 3 code piping, where full-penetration welds were specified on the design drawings, will be reanalyzed using ASME Code Case N-318 to determine the required size for fillet welds or partial penetration welds. For lugs not qualified using an existing reinforcing fillet weld, the required minimum penetration will be established. For welds not meeting minimum requirements, fillet welds meeting the requirements of Code Case N-318 will be added. Additionally, although the ASME code case is not applicable to B31.1 code piping, its logic will be used in the same manner on category I and category I(L) pressure boundary lugs attached with full-penetration welds to this class piping located in category I structures. The welds will require reinspection to determine if the existing fillet welds are of sufficient size to meet design requirements. As a result of the Hanger and Analysis Update Program (HAAUP), the "as-built" conditions for ASME Code, Section III, class 2 and class 3, and ANSI B31.1 category I and category I(L) pressure boundary lugs located in category I structures will be shown on revised design drawings. The WBN Final Safety Analysis Report (FSAR) will be revised to allow the use of ASME Code Case N-318 as endorsed by NRC Regulatory Guide 1.84.

Reanalysis began in February 1988, is presently ongoing, and is scheduled to be complete before fuel load of unit 1. The schedule for reinspection and rework, if required, will be developed based on the results of the reanalysis which is being accomplished as part of TVA's HAAUP.

RECURRENCE CONTROL

In order to prevent recurrence of inadequate weld penetration of the subject shear lug installations, Quality Control Instruction (QCI)-4.03 was revised to require a quality control (QC) hold point on the welding operation sheets to document backgouging. In order to provide 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, previously accepted inspections are reinspected by peer inspectors for adequacy.