

TENNESSEE VALLEY AUTHORITY

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APR 16 1987

WBRD-50-390/87-09
WBRD-50-391/87-09

10 CFR 50.55(e)

U.S. Nuclear Regulatory Commission
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Gentlemen:

WATTS BAR NUCLEAR PLANT - UNITS 1 AND 2 - SAFETY-RELATED HVAC DUCT WELDING -
WBRD-50-390/87-09, WBRD-50-391/87-09 - INTERIM REPORT

The subject deficiency was initially reported to NRC-Region II Inspector Gordon Hunegs on March 12, 1987, in accordance with 10 CFR 50.55(e) as SCRs WBN MEB 8721 and MEB 8722. Enclosed is our interim report. We expect to submit our next report on or about January 15, 1988.

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

Very truly yours,

TENNESSEE VALLEY AUTHORITY

J. A. Homer
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Enclosure

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ENCLOSURE
WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
SAFETY-RELATED HVAC DUCT WELDING
WBN MEB 8721 AND WBN MEB 8722
SCRs WBN 7077, WBN MEB 8714
WBRD 50-390/87-09, WBRD 50-391/87-09
10 CFR 50.55 (e)
INTERIM REPORT

Description of Deficiency

A deficiency has been identified at Watts Bar Nuclear Plant (WBN) affecting the safety-related heating, ventilation, and air conditioning (HVAC) welded ductwork (including the hydrogen collection system) which could prevent the HVAC systems from performing their intended design function. The structural adequacy of the safety-related ductwork for all operating conditions (including a seismic event) is unknown because existing welds were not inspected to verify compliance with engineering requirements.

Safety-related ductwork (including the hydrogen collection system) was fabricated and installed (1978 timeframe) without a Quality Assurance Program (QAP) and without specific welding requirements from engineering. A QAP was established for these systems in 1980. Subsequently, the engineering design drawings were revised (December 1980) to require full penetration welds. Welds completed before this full penetration requirement were not visually inspected for compliance with this criteria. As a result, in April 1981, a stopwork order was issued against all safety-related HVAC systems, and a violation was issued (390, 391/81-05-02), in April 1981, to document the lack of a QAP and failure to report a significant deficiency. The stopwork order was lifted in September 1981, based in part upon the development of an "alternate acceptance criteria" for inspection and testing. The alternate acceptance criteria established for the HVAC system included a leak test in lieu of visual weld inspection for inaccessible welds. Later, the alternate acceptance criteria was authorized to be applied not only to inaccessible welds, but to all welds. This acceptance criteria was incorporated into Construction Specification N3M-914, R2, and was applied to all safety-related HVAC ductwork including the hydrogen collection system. Because the leak tests were performed to 25 percent over design pressure with less than one percent of total volume leakage, the systems were accepted as constructed.

During review of the welded HVAC ductwork, the Weld Evaluation Project (WEP) identified some partial penetration welds where full penetration welds are now specified. This condition had escaped recognition because of the inadequate alternate acceptance criteria specified in Revision 2 of Construction Specification N3M-914 pertaining to the leak test in lieu of weld inspection. The root cause of this deficiency is as follows: Engineering Design (EN DES) Engineering Procedure (EP) 3.10 required a design revision review that would evaluate the effects the design changes would have upon the overall design. This review was not performed on the alternate acceptance criteria for its ability to verify the structural integrity of the ductwork. Therefore, the seismic adequacy of the safety-related ductwork was not addressed. NRC subsequently issued a violation (390, 391/86-24-02) in February 1987 for this failure to provide sufficient design control to assure seismic adequacy.

Significant condition report (SCR) WBN 7077 was issued to document the lack of full penetration welds on unit 2 hydrogen collection system ductwork transition sections. These connections are located up against the containment wall, which precluded the possibility of welding the wall side of the joint from the exterior. This condition is known to exist at each end of the transition sections.

SCRs WBN MEB 8714, WBN MEB 8721, and WBN MEB 8722 were issued to document the inadequately evaluated acceptance criteria for safety-related HVAC duct welding.

Safety Implications

The safety-related ductwork is associated with various ventilation and gas treatment systems. Should a weld fail, the ductwork could separate and, possibly, fail to perform its design function. This could lead to a buildup of airborne radiation, gases, or contaminants during and/or following a design basis seismic event. The hydrogen collection system ductwork is part of the combustible gas control system and is designed to prevent hydrogen, which may be generated following a design basis accident, from reaching concentration levels sufficient for explosion. Failure of this ductwork during a seismic event could adversely affect safe operation of the plant.

Corrective Action

A stopwork order on the circumferential welds in safety-related HVAC ducts was issued January 12, 1987. In addition, TVA will developed a program to establish the structural adequacy of welded safety-related ductwork (including the hydrogen collection system) for all operating conditions (including seismic event). This program will include visual inspection, destructive testing, seismic analysis, and weld repairs as required. The stopwork order on welded HVAC ductwork will remain in place until this program is fully reviewed and approved to adequately resolve the identified welding discrepancies.

The following is a detailed description of this program: The full penetration weld requirement for ductwork established in 1980 is excessive. The safety-related HVAC ductwork code jurisdiction referenced in the FSAR is Sheet Metal and Air Conditioning Contractors National Association (SMACNA), High Velocity Duct Construction Standards, second edition, 1969. This code does not require welding for strength, but only for sealing where minimum leakage is required. The minimum required weld strength, established by analysis, for all operating conditions (including a seismic event) can be met by a weld which is not full penetration but which is fully circumferential. The design drawings and documents will be revised to indicate a weld requirement other than full penetration.

A 100-percent survey (through paint) of the approximately 2,100 TVA welds on the HVAC system will be conducted to determine fully circumferential weld presence and to categorize the weld type. Visible weld defects will be noted, and the welds will be grouped by type (i.e., butt weld, fillet weld, groove

weld, etc.). From each identified weld type, a random statistical inspection sample of welds will be chosen for detailed visual inspection. In addition, all welds on the hydrogen collection duct transition pieces will be inspected. The inspection of these welds, with the paint removed, is to statistically confirm weld quality. Once again, any obvious weld defects (cracks, undercut, etc.) will be noted. Where the weld is not visible on the exterior, access openings will be cut to verify that the duct was welded from the interior.

From the welds inspected, test samples for each weld type will be randomly chosen. Additional test samples will be taken from the welds identified during the survey and the detailed inspection that exhibit the worst case conditions. These samples will be destructively tested to determine weld strength. Analyses will be performed to determine the minimum weld strength required for maintaining structural integrity under all design loading conditions. If the test results from the destructive testing indicate that the welds have a strength greater than the minimum required, no further samples will be taken. If not, based on analysis of test results, additional samples and/or appropriate corrective actions will be taken.

Although the SCRs describe basically round duct (schedule pipe and spiral welded pipe), TVA is applying this corrective action to all safety-related TVA duct welds, including transition pieces welded to round and rectangular duct and rectangular duct to rectangular duct welds.

The final safety analysis report (FSAR) will be updated to include acceptance criteria established in the above program for the welding of the safety-related HVAC systems accomplished before December 29, 1986. The revision will also include the design welding requirements for welding performed after December 29, 1986. This revision will be submitted to NRC at least six months before fuel load of unit 1.

WBN Construction Specification N3M-914, "Quality Assurance Requirements for Construction Testing and Inspection of Safety-Related HVAC Systems," was revised (R3) December 29, 1986, to require visual inspection of welds completed after December 29, 1986. This action should prevent recurrence of the subject deficiency.

TVA will provide a final report on this matter to NRC on or about January 15, 1988.