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APR 12 1988

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

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	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

WATTS BAR NUCLEAR PLANT (WBN) UNITS 1 AND 2 - SAFETY-RELATED HVAC DUCT WELDING - WBRD-50-390/87-09 AND WBRD-50-391/87-09 - SECOND 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. Our first interim report and an extension of report schedule were submitted on April 16, 1987 and January 16, 1988, respectively. Enclosed is our second interim report. We expect to submit our next report on or about September 29, 1989.

Steve Elrod of the NRC Region II office was notified on April 15, 1988, of a delay in submitting this report.

If there are any questions, please telephone C. J. Riedl at (615) 365-8527.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

M. J. Ray for

R. Gridley, Director
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Enclosure
cc: See page 2

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U.S. Nuclear Regulatory Commission

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cc (Enclosure):

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ENCLOSURE

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

SECOND 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 functions. The structural adequacy of the safety-related ductwork for all operating conditions (including a seismic event) is unknown because not all existing welds were 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 with inadequately specified welding requirements by design 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 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 systems included a leak test in lieu of visual weld inspection for inaccessible welds. Later, the alternate acceptance criteria was inappropriately 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 sections 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 completely fail, the ductwork could separate and possibly not 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 combustion. Failure of this ductwork during a seismic event could adversely affect safe operation of the plant. This deficiency does not affect the hydrogen igniters or hydrogen recombiners which are also used to control hydrogen concentration levels.

Interim Progress

Two stopwork orders on the circumferential welds in all safety-related HVAC ducts (spiral-welded duct and hydrogen collection pipe) were issued January 12, 1987. In addition, TVA has developed a program to establish the structural adequacy of welded safety-related ductwork (including the hydrogen collection piping) for all operating conditions, including a seismic event. This program includes weld survey, destructive testing of weld samples, seismic analysis, and weld repairs, as required. Although the SCRs describe basically round duct (scheduled and spiral-welded), TVA is applying these corrective actions to welds on all types of safety-related TVA duct, including the transition pieces welded to round and rectangular ducts, and rectangular duct welded to other rectangular ducts (TVA Class Q and S, Seismic Category I).

The following is a detailed description of the program which will result in the release of the stopwork orders, resolution of existing weld deficiencies in safety-related HVAC ductwork, and assurance of quality in all future duct welds:

Phase I (Walkdown Procedure WP-26) is a 100-percent examination (through paint) of the approximately 9000 TVA field welds on the safety-related HVAC

ductwork. (This weld population, as opposed to the 2100 stated in the first interim report, is a result of the need to uniquely identify each weld as opposed to each joint.) Phase I will be conducted to determine weld presence, note any visible weld discontinuity, and collect data (i.e., number, locate, and classify all welds) for the purpose of uniquely identifying all welds and ensuring presence of circumferential weld metal at each welded joint. This walkdown has been initiated. Two methods, visual examination and an eddy-current examination, are being used on each weld to determine if weld metal exists completely around the weld joint. Any missing weld discovered during inspection of the outside of a welded joint will result in cutting an access opening to determine if the joint was welded from the interior. A stopwork order release will be required in order to weld patches, by issued design output documents, over these access openings.

Phase II will compare the required strength of the welds, established by analysis, to that determined by destructive testing of weld samples taken from the existing welded joints. For this comparison, the information compiled in Phase I will be used to organize welds into groups of weld sizes and types (i.e., butt weld, fillet weld, groove weld, etc.). Each group of welds will be evaluated by testing to determine the existing strength of the welds. Each selected weld will have a test coupon cut out and sent to TVA's Singleton Materials Laboratories to be destructively tested for weld strength. Additional test coupons will be taken from the welds identified during the survey that exhibited the poorest workmanship. Analyses (calculations) will be performed to determine the minimum weld strength required for maintaining structural integrity under all design loading conditions. The weld test strength will be used to ensure that the final configuration is seismically qualified.

The present commitment for classes Q and S ductwork in the FSAR is Sheet Metal and Air-Conditioning Contractors National Association (SMACNA), High Velocity Duct Construction Standards, second edition, 1969, as modified by ORNL-NSIC-65, paragraph 2.8. SMACNA does not require welding for strength, but only for sealing where minimum leakage is required. Future weld requirements for classes Q and S ductwork will be based upon ANSI-N509 requirements as TVA has committed in the FSAR (Tables 6.5-1, 6.5-2, 6.5-3, and 6.5-4). TVA will develop welding and inspection criteria which will be incorporated into a revision of Construction Specification N3M-914 for future work.

Since the previous interim report on this subject, TVA has made a change to the corrective action plan. The random statistical inspection sample of welds for performing a detailed visual inspection with protective coatings removed, to statistically confirm weld quality, has been replaced with a 100-percent eddy-current examination. The fundamental purpose of the statistical inspection sample was to provide confidence in the presence of circumferential weld metal at each welded joint. However, this can be positively accomplished by the visual observation of the welded joint and the subsequent eddy-current examination of the weld, through the protective coating, for weld metal detection. Therefore, the additional step of 100-percent eddy-current

examination provides assurance that all welds are completely circumferential. Destructive testing to verify weld strength, discussed above as phase II, will give adequate indication of significant deficiencies with regard to other weld attributes (porosity, undercut, etc.). Welds in the hydrogen collection duct transition pieces will be included in this revised program in lieu of a detailed visual inspection as previously committed. In our last report the emphasis was upon qualifying the welds alone. The emphasis is now placed upon qualifying the ductwork systems as a whole.

Also, it was stated in the previous interim report that the full penetration weld requirement for ductwork is excessive and that the 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. It was stated that the design drawings and documents will be revised to indicate a weld requirement other than full penetration. As a matter of clarification, the above was based upon analysis performed on spiral-welded ductwork only and did not consider loading discontinuities (i.e., concentrated weights, branch connections, etc.). TVA will perform similar analyses for all affected types of safety-related ductwork before revising the drawings and documents to indicate a weld requirement other than full penetration.

WBN Construction Specification N3M-914 was revised (R3) December 29, 1986, to require visual inspection of welds completed after December 29, 1986. This action should prevent recurrence of the weld inspection deficiency. In addition, Nuclear Engineering Procedure (NEP)-3.3, "Internal Interface Control," which was issued subsequent to occurrence of this deficiency, should provide improved interface control among design organizations. In our first interim report, TVA committed to revising the FSAR to document welding and inspection requirements for welding performed after issue of the stopwork order (January 12, 1987). This has been determined to be unnecessary since the FSAR already commits to compliance to ANSI-N509, when possible, for future component replacement.

TVA will provide more information on this matter to NRC on or about September 29, 1989.