

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

February 19, 1981

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DISTRICT SERVICES UNIT  
US NRC  
DISTRICT SERVICES  
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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 UNIT 1 - SURFACE CRACKS IN LOOP ONE STEAM GENERATOR -  
NCR 1844R - REVISED FINAL REPORT

The subject condition was initially reported to NRC-OIE Inspector  
B. J. Cochran on October 23, 1979, in accordance with 10 CFR 50.55(e).  
Interim reports were submitted on November 23, 1979, January 22, 1980, June  
12, 1980, September 9, 1980, and October 27, 1980. Our final report was  
submitted on January 8, 1981. Enclosed is a revised final report providing  
clarification of TVA's corrective action.

If you have any questions concerning this matter, 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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WATTS BAR NUCLEAR PLANT UNIT 1  
SURFACE CRACKS IN LOOP ONE STEAM GENERATOR  
NCR 1844R  
10 CFR 50.55(e)  
REVISED FINAL REPORT

Description of Condition

While an ultrasonic examination was being performed as part of the preservice inspection program, surface indications were found on the loop one steam generator at Watts Bar Nuclear Plant unit 1. The indications are in the area where fitup attachments had been installed during fabrication. The cracks were found on the inside and outside surfaces near the vessel shell to upper head girth weld.

These surface indications were not discovered in previous examinations by Westinghouse.

Safety Implications

Had these cracks gone uncorrected, the steam generator would not have met the ASME Code requirements. While a pressure boundary failure would not be expected from such surface cracks, this condition could have reduced the margin of safety required by the ASME Code.

Corrective Action

The surface indications have been removed by grinding to a maximum depth of 0.190 inch, which does not violate the minimum wall thickness. All of the required nondestructive examinations of these areas have been completed and TVA is satisfied that this corrective action is sufficient for the indications.

Westinghouse has stated that the surface cracks were caused by delayed hydrogen cracking which may occur several days after welding. This delayed phenomenon is the reason given by Westinghouse for not discovering the cracks during previous examinations. Experience has shown that this type of cracking is characteristically shallow and restricted to a size less than the area of the heat-affected zone. This has been confirmed by destructive metallurgical examinations.

At the time the TVA steam generators were manufactured, no records were required for areas from which temporary attachment welds were removed unless the removal of an attachment weld created a cavity greater than 3/8" or 10 percent of the wall thickness. Thus, Westinghouse has no knowledge of the exact location of any welds involving minor repairs or temporary attachments where fillet welds were utilized. These unidentified areas are not a concern since in this case, the heat affected zone is small (typically 5 to 7 mm deep) and cracks of the size that could result would not jeopardize the vessel integrity. This is supported by a fracture mechanics analysis performed by Westinghouse using ASME methodology as described in item (2) below.

Westinghouse has also reported that a few shallow cracks have been observed in submerged arc structural weldments at other plants, but this condition is rare. There is not a concern about cracks in these weldments in TVA vessels for two reasons:

- (1) TVA has performed a preservice ultrasonic examination of the circumferential structural welds as required by ASME Section XI, and no indications were found in the submerged arc weldments. Thus, TVA has no evidence of cracking in other than attachment welds. TVA will also perform a 100-percent magnetic particle examination of accessible circumferential welds on the loop one steam generator at Watts Bar as additional verification. TVA's inservice inspection program will provide further assurance that indications of this type would be detected should they occur.
- (2) Westinghouse has performed fracture mechanics and crack growth calculations for cracks in the structural weld that experiences the most severe transient, namely the lower core to barrel weld. Their results have determined that the critical size for fracture is about 1.5 inches in depth. The initial crack depth that could grow to this critical size over the 40-year life of the component has been calculated to be about 0.4 inches. Westinghouse has further stated that, based on their experience, the probability of hydrogen cracks of this size in submerged arc welds is very low.

TVA is satisfied that the integrity of the steam generators will not be compromised by delayed hydrogen cracking.