

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

October 29, 1982

WBRD-50-390/81-10  
WBRD-50-391/81-09

U.S. Nuclear Regulatory Commission  
Region II  
Attn: Mr. James P. O'Reilly, Regional Administrator  
101 Marietta Street, Suite 3100  
Atlanta, Georgia 30303

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REGION II  
ATLANTA, GEORGIA

Dear Mr. O'Reilly:

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 - CORROSION OF CARBON STEEL PIPING IN THE ESSENTIAL RAW COOLING WATER SYSTEM - WBRD-50-390/81-10, -391/81-09 - REVISED FINAL REPORT

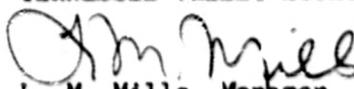
The subject nonconformance was initially reported to NRC-OIE Inspector F. S. Cantrell on December 30, 1980 in accordance with 10 CFR 50.55(e) as NCR WBN NEB 8017. Related Watts Bar NCR 2849R was initially reported to M. Thomas on January 9, 1981. This was followed by our interim reports dated January 29 and May 22, 1981. Since that time, related Watts Bar NCR 3269R was determined to be reportable. Our final report was submitted on September 23, 1981.

Enclosed is our revised final report which describes additional corrective actions to preclude recurrence of this type deficiency. This revision also clarifies the intent of this 50.55(e) item to cover only the Essential Raw Cooling Water System. The same potential deficiency on the High Pressure Fire Protection System is being handled under separate report (WBRD-50-390/82-98, WBRD-50-391/82-95).

If you have any questions, please get in touch with R. H. Shell at FTS 858-2688.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

  
L. M. Mills, Manager  
Nuclear Licensing

Enclosure

cc: Mr. Richard C. DeYoung, Director (Enclosure)  
Office of Inspection and Enforcement  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

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## ENCLOSURE

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2  
CORROSION OF CARBON STEEL PIPING  
IN THE ESSENTIAL RAW COOLING WATER SYSTEM  
10 CFR 50.55(e)  
WBRD-50-391/81-10 and WBRD-50-391/81-09  
REVISED FINAL REPORT

### Description of Condition

It has been found that the original criteria for the use of carbon steel piping in raw water systems at TVA nuclear plants may not be adequate. Corrosion has been found to cause greater than predicted pressure drops when pipes are sized according to standard industry practice. In addition, the corrosion can cause a thinning of the pipe wall which may not have been accounted for in the design of the systems. This condition could affect all raw water systems with carbon steel piping, such as the Essential Raw Cooling Water (ERCW) system and the High Pressure Fire Protection system (reference NCR WBN NEB 8201).

The problem of corrosion has been the subject of considerable study at TVA. A brief history of TVA's investigation of this matter was included in the first interim report.

TVA has written several nonconforming condition reports (NCR's) to document specific problems encountered with corrosion of carbon steel piping and materials in the ERCW system. These NCR's are being handled generically in this report and are discussed below.

NCR 2849R reported that the 1/2-inch prelube lines to the ERCW pump bearings and the 1/2-inch cooling water lines for the ERCW pump motor thrust bearing coolers at Watts Bar Nuclear Plant were found to be severely corroded. These pipes were removed and examined. Nowhere was corrosion found to completely block the pipe. However, it was not determined whether these 1/2-inch lines were capable of passing the design flow. A review of documents revealed that these lines should have been changed to stainless steel as recommended in an internal TVA memorandum. That memorandum contained a statement that the 1/2-inch cooling water lines should be changed to stainless steel at Sequoyah and the same changes should also be made at Watts Bar. The Sequoyah ERCW pumps did not require bearing prelube and the motor thrust bearing cooler line was already stainless steel. This subtle difference between the two plants was not recognized and, thus, the 1/2-inch lines at Watts Bar were overlooked.

NCR 3269R reported that corrosion had formed in the low side of the flow element in the 24-inch diameter ERCW carbon steel process piping on the inlet of the component cooling heat exchanger (HTX) C. The buildup of corrosion had stopped flow to the stainless steel instrument line. The corrosion was removed from the flow element and the instrument line reopened to permit flushing.

### Safety Implications

The corrosion of carbon steel piping in the ERCW system could affect the capability to remove the specific heat load required of them under the worst condition of two-unit operation. Failure to remove sufficient heat from the components served by the ERCW could result in loss of equipment necessary for a safe shutdown and therefore could adversely affect safety of operations of the plant.

### Corrective Action

TVA has completed the reevaluation of the Watts Bar ERCW system in accordance with criteria stated in TVA's Division of Engineering Design (EN DES) Design Guide No. DG-M 3.5.1, "Pressure Drop Calculations for Raw Water Piping and Fittings," and found that changes must be made to ensure operability of the system over the plant life. These changes involve applying a cement mortar lining to the existing carbon steel yard piping, changing selected pipe segments within the buildings to stainless steel, and requalifying certain components for lower flows. The cement mortar lining of the yard piping, as well as many of the unit 1 changes, including NCRs 2849R and 3269R, will be implemented before June 1, 1983. The remaining changes will be completed before August 1, 1984.

To ensure that pressure drop calculations for future piping systems at WBN and other TVA nuclear facilities are performed in accordance with the criteria stated in DC-M 3.5.1, TVA has initiated action to have DG-M 3.5.1 upgraded to a design standard. This will be completed by January 15, 1983. Classification as a design standard will ensure that all new pressure drop calculations comply with the criteria as stated in the design standard. (A design guide is a guide and does not ensure compliance with the criteria.) All safety related systems in TVA's other nuclear facilities, have been, or are now being evaluated using the criteria stated in DG-M 3.5.1. Appropriate corrective action will be implemented as required as a result of these evaluations.

As a part of TVA's investigation of corrosion of carbon steel piping detailed in the report entitled "Corrosion in Carbon Steel Raw Water Piping" (attached to a letter from L. M. Mills to J. P. O'Reilly dated August 25, 1981 for Sequoyah Nuclear Plant NCR SQN NEB 8035), the average wall reduction of all samples was measured and found to be less than 0.040 inch, except for a very few samples where exterior corrosion predominated. The design of all raw water piping on Watts Bar is such that an average wall reduction of 0.040 inch is acceptable. Therefore, the effects of interior corrosion on the average wall reduction has been accounted for in the design of the systems. Localized corrosion of piping may result in leaks in the systems. However, the anticipated rate of leakage would be quite small in comparison to the rated flow of the system, and TVA plans to inspect and/or hydrotest the piping in accordance with ASME Section XI requirements and will identify and repair any such leaks on a periodic basis.