TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

Enclosure retained by Region II

August 25, 1981

SQRD-50-328/81-10

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:

SEQUOYAH NUCLEAR PLANT UNIT 2 - CORROSION OF CARBON STEEL PIPING - SQRD-50-328/81-10 - FINAL REPORT

The subject deficiency was initially reported to NRC-OIE Inspector F. S. Cantrell on December 30, 1980 in accordance with 10 CFR 50.55(e) as NCR SQN NEB 8035. This was followed by our interim reports dated January 29, April 23, and June 9, 1981. Enclosed is our final report. This nonconformance has also been reported for Watts Bar and Bellefonte Nuclear Plants. The enclosed final report presents our resolution to the corrosion issue for Sequoyah.

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, Jr., Director (Enclosure)
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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ENCLOSURE
SEQUOYAH NUCLEAR PLANT UNIT 2
CORROSION OF CARBON STEEL PIPING
SQRD-50-328/81-10
10 CFR 50.55(e)
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 be in excess of the minimum wall thickness considered in the design of the systems. This condition could affect all raw water systems with carbon steel piping, such as the ERCW System, High Pressure Fire Protection System, and the pump room and oil coolers for the centrifugal charging pumps, the safety injection pumps, and the containment spray pumps. Also, most electrical board and room air conditioning units use carbon steel piping.

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 our first interim report.

Nonconformance report 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 lines were later cut up and nowhere was corrosion found to completely block the pipe. It has not been determined whether these 1/2-inch lines were capable of passing the design flow. However, they should have been changed to stainless steel as previously recommended. The recommended changes for Sequoyah were identified in a memorandum dated January 4, 1978. That memorandum contained a statement that 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.

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 ultimately in excessive core damage.

Corrective Action

A portion of the High Pressure Fire Protection System is a dry system that is charged with water by actuation of the preaction system and is not subject to the same corrosion mechanism. Surveillance requirements now provide flow verification, visual inspection, and hydraulic performance surveillance testing which would detect system degradation. Degradation of sections of piping located before the deluge valve would be detected at the time the system hydraulic performance surveillance instruction was performed. In addition to the surveillance program, we are continuing to analyze the flow requirements of the Fire Protection System.

The entire ERCW system was recently tested during the unit 2 preoperational test program completed in May 1981. This test documented the condition of the system at that time. We have developed programs to ensure that future corrosion does not infringe on required component flow rates. If the following programs lead to a prediction of degradation below that which is acceptable, the carbon steel piping will be selectively replaced.

The first program, established as a result of nonconformance report (NCR) no. SQN NEB 8035, involves the periodic inspection of selected sections of small-diameter ERCW piping for volumetric changes and corrosion product buildup. This procedure was written, approved, and performed (for baseline data) in April of 1981 and is required to be conducted once per year.

The second program involves periodically performing an entire system flow balance. A surveillance instruction, which closely follows the preoperational test, has been written and is in the review stages for approval with a completion date of September 15, 1981. The frequency of performance of this instruction will be:

1. TVA will perform the surveillance program within the next nine months. Following the performance, the surveillance program results will be evaluated to determine the necessity for future surveillance. Should the surveillance results warrant future surveillance, an appropriate surveillance interval will be determined.

2. Whenever modifications that alter the flow distribution have been done to the system.

3. Whenever operational considerations, such as the inability to maintain proper component temperatures, indicate that a flow rebalance needs to be done.

At present, due to the system configuration and existing installed instrumentation, the second surveillance must be done on a whole system basis. However, since this method requires so much manpower and operational control to be performed, a series of surveillance instructions to check the system component flows on a branch line basis will be developed. This branch line flow balance surveillance program would be correlated to the whole system flow balance procedure. The whole system flow balance would then need to be performed only to reestablish the system baseline data. The frequency of performance, for the branch line balancing surveillance instructions, will be based on previous testing results available at that time.

As a part of TVA's investigation of corrosion of carbon steel piping detailed in the the attached report entitled "Corrosion in Carbon Steel Raw Water Piping," 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 Sequoyah is such that an average wall reduction of 0.040 inch is acceptable. Therefore, the effects of corrosion on the average wall reduction has been accounted for in the design of the systems. TVA plans to inspect and/or hydro test the piping in accordance with ASME Section XI requirements and will identify and repair any leaks on a periodic basis.