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

December 7, 1983

WBRD-50-390/83-47

U.S. Nuclear Regulatory Commission
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

WATTS BAR NUCLEAR PLANT UNIT 1 - TARGET ROCK PORV OPENING AND CLOSING TIMES - WBRD-50-390/83-47 - FINAL REPORT

The subject deficiency was initially reported to NRC-OIE Inspector P. E. Fredrickson on July 28, 1983 in accordance with 10 CFR 50.55(e) as NCR WBN NEB 8320. Our first interim report was submitted on August 29, 1983. Enclosed is our final report.

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

Records Center
Institute of Nuclear Power Operations
1100 Circle 75 Parkway, Suite 1500
Atlanta, Georgia 30339

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ENCLOSURE

WATTS BAR NUCLEAR PLANT UNIT 1
TARGET ROCK PORV OPENING AND CLOSING TIMES
NCR WBN NEB 8320
WBRD-50-390/83-47
10 CFR 50.55(e)
FINAL REPORT

Description of Deficiency

During hot functional testing at Watts Bar Nuclear Plant (WBN) unit 1, the pressurizer power-operated relief valves (PORV), Target Rock valves model 82UU-001, were tested at 400 lb/in^2g, 1700 lb/in^2g, 1900 lb/in^2g, and 2235 lb/in^2g. These tests showed that the valve opening and closing delay times (i.e., from receipt of signal to start of main disc travel) were longer than expected and that the main disc travel time was shorter than expected. The demonstrated delay times (which were up to 0.45 seconds) exceed the 0.2 second delay time used to calculate the PORV set points for the cold overpressure mitigation system (COMS). The demonstrated main disc stroke time of 10 milliseconds is faster than the 60 milliseconds value used to calculate the thermal-hydraulic loads for input into the piping support design.

Further investigation of this matter has revealed that the valves were not installed per the Target Rock drawing 82UU-001, Rev. D, Note 13. TVA had installed the valves in a horizontal line with the stem vertical whereas the vendor drawings called for the valve to be installed in a horizontal line with the stem to be 45° below horizontal. This unique requirement for the stem to be 45° below horizontal allows the pilot disc chamber to fill with water. TVA's positioning caused the pilot disc chamber to fill with steam. Because the pilot disc chamber must depressurize or pressurize to allow opening or closing of the main valve disc, the difference between steam versus water caused changes in the pressure changing characteristics of the pilot disc chamber and subsequently changed the opening and closing delay time.

The mispositioning of the valves was caused by a failure by TVA designers to recognize the importance of the unusual orientation requirements for the valves as specified on the vendor drawing notes, and then not incorporating these requirements into TVA drawings.

Safety Implication

The fast opening of the main disc may cause higher thermal-hydraulic loads on the piping than were used in the design of the relief line piping supports. These increased loads could damage the pipe supports and subsequently could cause damage to the relief line, safety and relief valves, and pressurizer relief and safety line nozzles. Consequently, an event which required opening only the PORVs could degrade into a loss-of-coolant accident (LOCA).

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Corrective Action

TVA, in conjunction with Target Rock, has determined that the opening and closing times for the PORVs originally provided by Target Rock are correct when the valves are installed with the valve stem 45° below horizontal. Testing done at Sequoyah unit 2 on correctly installed PORVs (test PMT-50) has shown the valves will operate as assumed in both TVA's piping support analysis and the testing done at Target Rock that verified the assumed valve characteristics in water used for the cold overpressurization mitigation system analysis are correct when the valve stem is correctly positioned. As such, TVA is revising its design drawings to reflect correct installation under engineering change notice (ECN) 4224 for unit 1 and ECN 4436 for unit 2. These drawing revisions will be complete for unit 1 by December 30, 1983, and for unit 2 by December 30, 1984. The unit 1 PORVs will be reinstalled by January 31, 1984, and the original installation of the unit 2 valves will be done after the design changes are complete.

To prevent a recurrence, TVA design projects have been informed by memorandum of the unusual orientation requirements for the Target Rock valve and instructed in the necessity of installing the valve with the valve stem 45° below horizontal.