

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

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October 21, 1983

WBRD-50-390/83-03
WBRD-50-391/83-03

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 UNITS 1 AND 2 - IMPROPER OVERLAPPING ANALYSIS
TECHNIQUES - WBRD-50-390/83-03, WBRD-50-391/83-03 - FINAL REPORT FOR UNIT 1
AND FOURTH INTERIM REPORT FOR UNIT 2

The subject deficiency was initially reported to NRC-OIE Inspector P. Fredrickson on January 11, 1983 in accordance with 10 CFR 50.55(e) as NCR WBN CEB 8221 R1. Interim reports were submitted on February 4, June 17, and September 13, 1983. Enclosed is our final report for unit 1 and fourth interim report for unit 2.

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

Very truly yours,

TENNESSEE VALLEY AUTHORITY

DS Kammer

for 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

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

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ENCLOSURE

WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 IMPROPER OVERLAPPING ANALYSIS TECHNIQUES

NCR WBN CEB 8221 R1

WBRD-50-390/83-03, WBRD-50-391/83-03

10 CFR 50.55(e)

FINAL REPORT FOR UNIT 1 AND FOURTH INTERIM REPORT FOR UNIT 2

Description of Deficiency

Analysis overlapping techniques were not incorporated correctly in the analytical mathematical models for certain piping analysis problems. Terminal points were unconservatively overlapped using snubbers; therefore, terminal stiffness was not included in the thermal analysis. Piping systems affected are the Essential Raw Cooling Water, Component Cooling Water, Chemical and Volume Control, Safety Injection, Auxiliary Feedwater, and Reactor Coolant Systems.

The root cause of this deficiency is that structural overlap techniques were used by the WBN piping analysis group before they were issued in a controlled document. As a result, these techniques were misused and/or misunderstood.

Safety Implications

Inadequate analysis techniques has led to potentially inadequate safety-related piping supports which may fail under stress, therefore adversely affecting safe operations of the plant.

Corrective Action

In order to resolve this nonconformance all analysis problems using overlapping techniques were reviewed. Approximately 29 problems on unit 1 and unit 2 were judged to be unacceptable, and were reanalyzed to comply with proper overlapping analysis techniques. Engineering change notices (ECNs) 3013 and 3608 controlled this activity. TVA's Watts Bar Design Project (WBP) will evaluate the new load tables and complete any redesign by December 30, 1983. TVA's Watts Bar Construction Project (WBN) will complete the necessary rework or installation of support and anchors by February 1, 1984.

Eight sets of overlapping rigorous analysis problems were judged to be acceptable according to the guidelines. These problems were evaluated by Impell Corporation, a personal services contractor, to obtain an independent review of the adequacy of the WBN overlap methods.

Impell Corporation selected a benchmark problem to represent these problems. The selected benchmark analysis combined two overlapping subproblems into one problem, and included deadweight, thermal, and seismic inertial loadings.

The results of the combined analysis were compared with the two subproblem analyses for pipe stresses and support loads. The comparison showed that the peak stress for each pipe size run for each ASME code limit for the combined analysis was within 10 percent of the peak stress of the enveloped subproblem analysis. All support design loads were within a 10-percent or 100-pound increase over the subproblem results. These results were judged to be acceptable by the Impell Corporation and by TVA.

The results of the benchmark analysis demonstrate that the overlap method utilized on WEN piping provides a satisfactory basis for determining the structural adequacy of the piping and calculation of support loads, for the eight sets of overlapping problems.

Since the type of overlap evaluated by Impell Corporation was a worst-case type, this benchmark analysis is also considered by TVA to be an adequate verification of the WEN structural overlap guidelines.

Instructions for use of structural analysis techniques were placed in the WEN Rigorous Analysis Handbook on April 25, 1983, as policy statement 1 and policy statement 9 in order to prevent recurrence of this type of deficiency.