

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

5W 157B Lookout Place

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WBRD-50-390/86-41
WBRD-50-391/86-40

U.S. Nuclear Regulatory Commission
Region II
Attention: Dr. J. Nelson Grace, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Dear Dr. Grace:

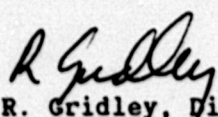
WATTS BAR NUCLEAR PLANT UNITS 1 AND 2 - FAILURE TO INCLUDE ZERO PERIOD
ACCELERATION IN PIPING ANALYSIS - WBRD-50-390/86-41, WBRD-50-391/86-40 -
FINAL REPORT

The subject deficiency was initially reported to NRC-Region II Inspector
Bob Carroll on March 27, 1986 in accordance with 10 CFR 50.55(e) as SCRs
WBN CEB 8553 and WBN CEB 8631 for units 1 and 2, respectively. Our interim
report was submitted on April 24, 1986. Enclosed is our final report.

If there are any questions, please get in touch with J. A. McDonald at
(615) 365-8527.

Very truly yours,

TENNESSEE VALLEY AUTHORITY


R. Gridley, Director
Nuclear Safety and Licensing

Enclosure

cc (Enclosure):

Mr. James Taylor, 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
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Mr. G. G. Zech
Director, TVA Projects
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ENCLOSURE
WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
FAILURE TO INCLUDE ZERO PERIOD ACCELERATION IN PIPING ANALYSIS
WBRE -50-390/86-41 AND WBRD-50-391/86-30
SCRs WBN CEB 8553 AND CEB 8631
10 CFR 50.55(e)
FINAL REPORT

Description of Deficiency

As a result of problem identification report (PIR) WBN CEB 8553 concerning whether the effects of zero period acceleration (ZPA) should have been considered in the piping analysis calculations, TVA contracted with Bechtel Corporation to evaluate this matter. Seismic analyses of some safety-related piping have been performed utilizing the response spectrum method which omits the seismic load contribution of piping dynamic modes with natural frequencies above 33 Hz (ZPA). Previously, natural frequencies above 33 Hz were considered to be insignificant. However, NRC's Standard Review Plan (NUREG-0800), section 3.7.2, indicates that the analysis dynamic load should be within 10 percent of the theoretical load (ZPA contributing factor). Through the evaluation of this PIR, it was determined that in some cases, failure to consider ZPA had resulted in unconservative loads. The cause of this deficiency is that the design criteria for the analysis work was inadequate. The design criteria did not include the effects of ZPA.

Safety Implications

Failure to consider natural frequencies above 33 Hz in the analysis of piping systems could affect many of the category I systems. In the event of a design basis accident, loads that exceed the design allowables could be experienced by piping supports. This condition could result in failure of the associated supports, and subsequent loss of function of essential safety-related equipment. Thus, this condition could adversely affect the safe operations of the plant.

Corrective Action

TVA has conducted a parametric study which established the procedures to be used to include the load contributions due to modes greater than 33 Hz for response spectra analysis. Based on this study, an evaluation of the response spectra analysis will be performed to include the effects of ZPA using hand calculations and computer methods to generate new pipe support design loads where necessary. The TPIPE computer program will be modified to include the "missing mass" method for calculating ZPA effects. All modal superposition time history analysis will be reanalyzed using the direct integration time history method to account for the modes greater than 33 Hz. Support load tables and isometric drawings where applicable will be revised. As required, pipe support designs will be revised and reissued. All unit 1 corrective actions for this item, including reanalysis and support modifications will be

completed by initial fuel loading for WBN unit 1. Engineering change notice (ECN) 6259 has been issued to accomplish the unit 1 work. This ECN will be worked as part of the hanger and analysis update program.

All unit 2 corrective actions for this item, including reanalysis and support modifications, will be completed by initial fuel loading for WBN unit 2. ECN 6260 has been issued to accomplish the unit 2 work.

To prevent recurrence, TVA will revise the design criteria and analysis handbook to address how to account for the higher frequency modes in response spectra and time history analysis. A new section, WBN AH-215, will be added to the analysis handbook. This section will provide hand calculation procedures for calculating the support loads due to modes greater than 33 Hz. This will be completed by initial fuel loading for WBN unit 1.