

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

September 20, 1983

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WBRD-50-390/82-77
WBRD-50-391/82-73
WBRD-50-390/83-14
WBRD-50-391/83-13

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 - FREQUENCY CRITERIA FOR PIPING
SUPPORTS - WBRD-50-390,391/82-77,73,WBRD-50-390,391/83-14,13 - FINAL
REPORT

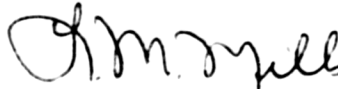
The subject deficiency was initially reported to NRC-OIE Inspector R. V. Crlenjak on July 13, 1982 in accordance with 10 CFR 50.55(e) as NCR WBN SWP 8234. Interim reports were submitted on August 12, October 5, and December 23, 1982 and January 3, March 23, and June 16, 1983. A similar NCR WBN SWP 8319 (WBRD-50-391,391/83-14,13), for which our first interim report was submitted on April 11, 1983, was combined with the subject report. Enclosed is our final report.

This final report provides a combined corrective action and action to prevent recurrence for both NCRs.

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

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
FREQUENCY CRITERIA FOR PIPING SUPPORTS
NCRs WBN SWP 8234 AND WBN SWP 8319
WBRD-50-390,391/82-77,73, AND WBRD-50-390,391/83-14,13
FINAL REPORT

Description of Deficiency - NCR WBN SWP 8234

During an investigation into a dissimilarity of information regarding frequency criteria for piping supports between section 3.9.3.4.2(ld) of the Watts Bar Nuclear Plant (WBN) Final Safety Analysis Report (FSAR) and section 8.2.3, figure 8.2-1 of design criteria WB-DC-40-31.9 (i.e., as amended by design input memorandum (DIM) WB-DC-40-31.9-3 on February 26, 1982, which changed the design criteria from 33 Hz to 20 Hz to represent the natural frequency of a fixed support) the following discrepancies were identified:

1. Uncertainty as to which support types must meet a frequency criteria.
2. Use of a frequency of 20 Hz in some situations, as specified in the design criteria, rather than 33 Hz specified by in the FSAR to represent the natural frequency of a fixed support.
3. Uncertainty as to the use of the total span of the pipe on each side of a support or one-half of that mass in determining the support's natural frequency.

Description of Deficiency - NCR WBN SWP 8319

Below are statements from design criteria document WB-DC-40-31.9 concerning the design requirements for rigidity of seismic pipe supports:

- 8.2.2 It is desirable that all seismic support and supplemental steel be rigid. A measure of rigidity is the deflection under given loads. Rigid-type supports shall not exceed 1/16-inch deflection for the specified design load.
- 8.2.3 A frame or braced type support shall be used wherever practical. The use of simple cantilevers are discouraged because of their lack of stiffness in flexure. In keeping with this concept, the first two seismic supports in a run of piping connected to equipment nozzles must be designed to ensure rigidity. Struts, braced supports, and framed systems designed in accordance with the AISC specification to take the loads in tension or compression are acceptable. Supports designed to carry the load in bending shall be designed to have a natural frequency equal to or greater than 20 Hz using the modeling presented in figure 8.3-1.

TVA's Sequoyah and Watts Bar Design Project (SWP) support designers had interpreted the rigidity requirements as follows: Section 8.2.2 states that deflection is a measure of rigidity and further states that the deflection criteria is 1/16 inch. Section 8.2.3 states that the first two supports adjacent to equipment must be designed to ensure rigidity. Therefore, it is concluded that these supports meet the 1/16-inch deflection criteria.

The originator of WB-DC-40-31.9, TVA's Civil Engineering Support Branch (CEB), states that the requirements for these first two supports should be controlled by the statement in section 8.2.3 which says "Supports designed to carry the load in bending shall be designed to have a natural frequency equal to or greater than 20 Hz." Therefore, meeting the deflection criteria for these supports does not necessarily mean the frequency criteria is met.

During the process of issuing a DIM for WB-DC-40-31.9, CEB was revising these sections to more clearly state the rigidity requirements. During the review of the draft DIM, this difference in requirements and interpretation was discovered. The DIM revision is also going to change the 20 Hz requirements from the first two supports adjacent to all equipment nozzles to the first two supports, on piping greater than two inches, adjacent to rotating equipment. There is a potential impact on approximately 200 supports; however, the expected impact is that approximately 10 supports will require modifications.

Safety Implications

Supports have been designed and built to design criteria, as specified in the FSAR. This may result in inadequate support of safety-related piping and may thus lead to its failure due to seismic and/or thermal stress.

Corrective Action - Combined

DIM WB-DC-40-31.9-6 was issued on March 8, 1983, to clarify the design criteria WB-DC-40-31.9 by stating which supports must meet the frequency criteria. TVA has determined that it will be acceptable to design cantilevers and other supports carrying loads primarily in bending on lines larger than two inches as well as those which are the first two supports adjacent to a pump, compressor, or turbine nozzle, to have a first natural frequency equal to or greater than 20 Hz using mass modeling similar to that present in Figure 8.2-1 of the design criteria WB-DC-40-31.9.

TVA's Division of Engineering Design (EN DES) evaluated 259 pipe supports for units 1 and 2 (the first 2 supports for piping 2-1/2-inch and larger adjacent to a rotating equipment nozzle) to assure that rigidity requirements were met. Of the 182 pipe supports evaluated for unit 1, 180 supports met the rigidity requirements, both for frequency and deflection, and therefore, are adequate. The two supports that did not meet the frequency requirement will be modified by either adding a kick brace or adding a member size to stiffen up the existing member. This effort is being covered under Engineering Change Notice (ECN) 4228 and will be

completed by November 30, 1983. Of the 77 supports evaluated for unit 2, 76 supports met the rigidity requirements, both for frequency and deflection. The one support for unit 2 that was inadequate will be modified in the same manner as ECN 4228. This effort for unit 2 will be covered under ECN 4229 which will be completed by August 20, 1984. All TVA action will be completed for units 1 and 2 by January 30, 1984 and October 20, 1984, respectively.

Additionally, TVA has determined that the mass used in determining the support's natural frequency will be that which is used to evaluate the support allowable stress. All supports of this type on lines larger than two inches were designed to have a first natural frequency equal to or greater than 20 Hz, or the deflection under normalized design load was 1/16 inch or less at the point of application of loading for each component of loading used to evaluate support allowable stress.

Subsections 8.2.2 and 8.2.3 of WB-DC-40-31.9 have been revised to provide clarification and thus, prevent future misinterpretations. Additionally, section 3.9.3.4.2(ld) of the WBN FSAR will be revised to bring it into agreement with the subsections of the subject design criteria.