Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

JUN 21 1993

William J. Museler
Site Vice President, Watts Bar Nuclear Plant

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

WATTS BAR NUCLEAR PLANT (WBN) - UNITS 1 AND 2 - RESPONSE TO NRC QUESTIONS - U-BOLT SUPPORT STABILITY EVALUATION PROGRAM

Reference: TVA letter to NRC, April 8, 1993, response to NRC questions - WBN U-Bolt Evaluation Program

The purpose of this letter is to provide NRC the additional information requested during the teleconference which took place on May 25, 1993 between the NRC staff (Messrs. J. Fair and P. S. Tam) and TVA - WBN personnel.

The ongoing staff review for the WBN U-Bolt Support Stability issue was discussed during this teleconference. Several additional questions were raised and additional information requested as related to this program.

The NRC questions as well as the TVA detailed responses are provided in the enclosure.

During the teleconference, the NRC staff confirmed that the enclosed questions represent the total remaining outstanding concerns in this area. Consequently, TVA believes the provided responses to these questions will lead to a satisfactory resolution of this program.

As discussed in earlier correspondence with your staff, TVA is requesting an expedited review of the enclosed information in order to achieve satisfactory resolution of this design concern in a timely manner.

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Should there be additional questions regarding the enclosed information, please telephone P. L. Pace at (615) 365-1824.

Very truly yours,

W. J. Museler

William J. Museler

Enclosure
cc (Enclosure):
NRC Resident Inspector
Watts Bar Nuclear Plant
P.O. Box 700
Spring City, Tennessee 37381

Mr. P. S. Tam, Senior Project Manager
U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852

U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

ENCLOSURE

TVA RESPONSE TO NRC QUESTIONS
FROM MAY 25, 1993 TELECONFERENCE
ON WBN U-BOLT STABILITY PROGRAM

QUESTION 1:

Table II-2 (Page AII-10) of TVA's April 8, 1993 submittal (Reference 2), implies that stress intensification factors (SIFs) were originally applied at several U-bolt locations. Subsequently, in response to a question, the intensified portion of the stress was removed. NRC questioned why these SIFs were removed from the subsequent evaluation, if the SIF applications were valid?

Background:

On March 2, 1993 TVA presented to NRC the methodology and criteria to address U-bolt stability. Following this presentation, the NRC asked a clarifying question about the effect of global bending on the limit load calculation. In the answer to the question, TVA made some comparisons of design basis pipe stress with the equivalent stress in the limit load calculation. For these comparisons, the portion of stresses caused by SIFs were deducted from the design basis stress results prior to comparing with the bending stresses from the limit load calculations.

ANSWER:

The original NRC question focused upon how the effect of actual service bending stresses were included in the U-bolt calculation. TVA responded, in Reference 2, by displaying the actual global bending stress existing in the limit load calculation and comparing that stress to the global bending design service stress. To compare equivalent quantities in a way consistent with the stress categorization approach used by the ASME Code when limit load concepts are used, (e.g., Figures NB-3222-1, 3224-1, and 3225-1 of Reference 1), the stresses caused by SIFs were deducted from the design service stresses. The design service bending stresses were shown to be adequately considered in the limit load calculation.

QUESTION 2:

Figure II-1 (Page AII-6) of TVA's April 8, 1993 submittal requires clarification. From this figure it is implied that an 50 Kips support load on 30-inch standard pipe will result in a local radial deformation of 5% (1-1/2"). NRC questioned the acceptability of this magnitude local deformation given TVA's rigid support tolerance limits of 1/8".

ANSWER:

As mentioned in the April 8, 1993 submittal, Appendix II (Page 2, 2nd paragraph), the limit load used for the 30-inch pipe size (based on our conservative, closed form equation) is 52.7 Kips. Two-thirds of this, (i.e., 35.2 Kips), gives the <u>allowable</u> load on the pipe. At this load, deformation is 2.2% - 2.6% from the two curves in Figure II-1. For a 30-inch diameter pipe, 2.5% diametral deformation is equivalent to 3/4 inch. A diametral deformation of 3/4 inch corresponds to a U-bolt preload condition that is consistent with the limit load as defined by the ASME Code.

The analysis that served as a basis for the limit load was very conservative with respect to diametral deformations. This is based upon the fact that the models used did not impose any constraints on the cross-section and the pipe was free to ovalize under a concentrated contact load. The presence of the cinched U-bolt will significantly constrain the ovalization and keep the diametral deformation within bounds. This is discussed in Appendix II as the second paragraph under "Summary and Conclusions" on Page 4. The expected diametral pipe deformation with U-bolt restraint for the 30" radial pipe is less than 2% of diameter.

The overall piping analysis deflection criteria remains satisfied since a major part of the diametral deformation is a local pipe deformation that takes place during initial "cinching" of the U-bolt, and is therefore not a part of small variable deformation that takes place during operation under varying support loads. In fact, at the U-bolt locations, the pipe is much <u>less</u> prone to local deformation (i.e., ovalization) than if it had been resting on a frame support, as is the more common supporting arrangement. Furthermore, the ASME Code does not require local pipe deformation to be calculated for a frame support arrangement.

In summary, the U-bolt methodology used conservative calculation methods and explicit calculations of localized deformations at U-bolt locations.

The purpose of the global 1/8" support deflection limit is to ensure that various support behavior assumptions in simplified seismic analyses are reasonably realistic. Since the diametral deformation is limited to the pipe itself and not to global support deflection, the piping analyses will remain valid. In addition, as mentioned above, the presence of the cinched U-bolt actually stiffens the pipe which provides additional validation of these assumptions.

<u>QUESTION 3</u>:

The NRC staff questioned the consideration of installation fit-up stresses at the U-bolt locations. Generally, these stresses are secondary and self-relieving in nature, however, TVA's basis for U-bolt acceptability is an accurate knowledge of total stresses at the subject locations. Consequently, the expected fit-up stresses should be quantified and considered in the U-bolt evaluation.

<u>ANSWER</u>:

Per TVA General Engineering Specification G-94, cold springing is not allowed during installation of the piping without engineering approval. However, to allow for possible fit-up during installation, the pipe may be moved as long as no mechanical devices are utilized (i.e., chains, winches, etc.). Also, G-94 requires rigid supports be removed to allow for piping fit-up. The evaluation which follows provides a conservative estimate of the maximum stresses that could be induced during this fit-up process, in which no mechanical devices are used.

TVA has conservatively evaluated the maximum possible fit-up stresses that may be induced during the fit-up process. Three pipe sizes are evaluated: 2", 6", and 24". These sizes provide a representative range of pipes. Based on G-94, "Fabrication Tolerances," the maximum linear tolerance allowed for piping 36" and less is 1/4", therefore, this evaluation uses 1/4" (the upper limit allowable deflection).

Since G-94 requires that rigid supports be removed prior to correcting piping misfit, the piping span at time of the fit-up is conservatively assumed as twice the recommended B31.1 support spacing. This assumption will provide bounding evaluation results for the actual spans which could tend to be considerably larger.

The results of this evaluation indicate that the highest possible fit-up stress value is insignificant (less than 900 psi), and therefore has no impact on the stress analysis records.

CONCLUSIONS:

The results show that any fit-up stresses induced by a non-design cold spring condition are insignificant in nature and would not impact the existing U-bolt evaluation program.

In addition, Table II-2 of Reference 2 tabulates the maximum piping stresses at U-bolt locations. A review of each of the analysis calculation packages for the pipe supports given in this table shows that none of these analysis problems had design cold spring considerations. Therefore, any possible stresses induced by fit-up would be of an insignificant magnitude.

REFERENCES:

1. 1971 ASME Code thru Winter 1972 Addenda, Section III, Subsection 3650.

2. TVA letter from W. J. Museler to U.S. Nuclear Regulatory Commission, "Watts Bar Nuclear Plant (WBN) - Units 1 and 2 - Response to NRC Questions - U-Bolt Evaluation Program," April 8, 1993, RIMS No. T04 930408 875.

3. ASME Code, Section III, Appendix II, Subsection II-1430.