TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
5N 105B Lookout Place

MAR 2 1988

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

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - NRC INSPECTION REPORT 50-327/87-48 AND 50-328/87-48 - INTEGRATED DESIGN INSPECTION (IDI)

Enclosure 1 provides TVA's revised response for IDI item U3.5-1 to reflect the correct ASME code reference, and a supplemental response to IDI item D5.2-10, provided previously on December 29, 1987. Enclosure 2 provides a list of commitments being made by TVA in this submittal. It is our understanding that the revised responses provided herein complete TVA's actions for SQN unit 2 restart on these items.

If you have any questions, please telephone D. L. Williams at (615) 632-7170.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

M. J. Ray for

M. J. Ray, Deputy Director
Nuclear Licensing and
Regulatory Affairs

Enclosures
cc: See page 2

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U.S. Nuclear Regulatory Commission MAR 2 1988

Enclosures
cc (Enclosures):
Mr. K. P. Barr, Acting Assistant Director
for Inspection Programs
TVA Projects Division
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Mr. G. G. Zech, Assistant Director
for Projects
TVA Projects Division
U.S. Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852

Sequoyah Resident Inspector
Sequoyah Nuclear Plant
2600 Igou Ferry Road
Soddy Daisy, Tennessee 37379

ENCLOSURE 1

SEQUOYAH NUCLEAR PLANT (SQN)

ITEM NO: U3.5-1

TITLE: Piping Code of Record

SUMMARY OF ITEM:

The piping code of record for design as stated in the Final Safety Analysis Report (FSAR) is ANSI B31.1-1967 Edition. Because ANSI B31.1-1967 did not define combinations for the normal, upset, and faulted conditions, TVA used the stress-allowable equations from ASME Section III, Subsection NC-3000, Winter 1972 Addendum, for these plant conditions. In addition to the stress equations, TVA used the stress-allowable limits specified in the ASME Code. This is documented in CEB's Rigorous Piping Analysis Handbook for Piping. CEB's use of the ASME Code stress-allowable limits is not consistent with FSAR Table 3.9.2-3, which commits to the use of ANSI B31.1-1967 stress-allowable limits.

CLASSIFICATION: Documentation

REVISED RESPONSE:

ANSI B31.1-1967 did not define stress allowables or equations for the loading combinations required for SQN; therefore, the stress allowables and equations from ASME Section III, Subsection NC, 1971 Edition through the Winter 1972 Addenda were used. This is consistent with industry practice (see attachment) and is considered appropriate and conservative. This is also consistent with ANSI B31, Code Case 115, which permits the piping designed and constructed in accordance with ASME Section III to be accepted as complying with ANSI B31.7-1969.

Differences exist between the code stress equations in ANSI B31.1-1967 and ASME Section III-NC-W72 on both the right-hand side (RHS) and left-hand side (LHS) of the equations. For the RHS (the stress-allowable side), ASME Section III-NC-W72 provides stress allowables for primary stress combinations classified as upset, emergency, and faulted. ANSI B31.1-1967 provides no such allowables. For the LHS, ASME Section III-NC-W72 provides for the stress intensification factor (SIF) to be applied to the resultant of the three moments (square root of the sum of the squares [SRSS] of the two bending moments and the torsional moment). ANSI B31.1-1967 applies the SIF to the bending moments but not to the torsional moment. It also defines an in-plane and out-of-plane SIF for reduced outlet tees. The LHS values determined based upon ASME Section III-NC-W72 generally bound allowable stress values determined from ANSI B31.1-1967.

The stress in the RHS is the S value at temperature (S_h) for both codes. For many materials, these values are essentially identical. This is not generally true for austenitic steels (such as SA-312 304) that are widely used at SQN. The stress allowables (S_h values) in ASME Section III-NC-W72 for austenitic steels exceed the corresponding values in ANSI B31.1-1967. The basis for both values is consistent. The ANSI B31.1-1967 stress allowables (in accordance with note 6 in Appendix A, Table A-1, ANSI B31.1-1967) are limited by 90 percent of yield at temperature. The same is true for ASME Section III-NC-W72 (in accordance with Table 1-7.2, note 3). Because ANSI B31.1-1967 does not have an S_y (yield strength) table, it is not possible to compare S_y values between ANSI B31.1-1967 and ASME Section III-NC-W72, but a comparison of ASME Section III-NC-W72 with ANSI B31.7-1969 shows that the ANSI B31.7 S_y values for austenitic steels at higher temperatures are lower.

The basis of this is not readily apparent; but because later (1973) B31.1 codes revise S and S_y values for these austenitic steels consistent with the values in ASME Section III-NC-W72, TVA has concluded that the S_h values given in ASME Section III-NC-W72 are appropriate for use at SQN. The allowable stresses promulgated in ASME Section III and later made consistent in B31.1 did not result in additional materials, fabrication, or inspection requirements in B31.1. Further, material requirements for these materials in ANSI B31.1-1967, ANSI B31.7-1969, and ASME Section III-NC-W72 are similar. Therefore, the use of ASME Section III-NC-W72 is appropriate for use and consistent with industry practices for B31.1 plants as well with later code editions wherein ANSI B31.1 and ASME Section III are similar.

Equivalence of the allowable stresses between ANSI B31.1-1967 and ASME Section III, Class 2 and 3 (1971 Edition, Winter 1972 Addendum), is ensured because:

1. The stress criteria are identical; and

2. The allowable stresses were developed by the same committee for both documents.

ANSI B31.1-1967 allowable stresses (S_c, S_h) were based on the lower of 0.25 S_u and 0.625 S_y, where S_u is the ultimate tensile strength and S_y is the yield strength. These are the same criteria that were used in Sections I and VIII of the ASME Boiler and Pressure Vessel Code in 1967. When ASME Section III Class 2 and 3 rules were published, they adopted the stress criteria for Sections I and VIII and were, therefore, identical to ANSI B31.1-1967 in this aspect. ANSI B31.1 was revised in 1973 to eliminate the citation of specific criteria and to replace them with reference to the criteria of ASME Sections I and VIII. Thus, the stress criteria were, and are, identical for ANSI B31.1 and ASME Section III, Class 2 and 3.

The allowable stresses for ANSI B31.1 and ASME Section III are both developed by the Subcommittee on Properties of Metals and its predecessors of the ASME Boiler and Pressure Vessel Committee, using the same database for both sets of allowable stresses. Even though the stress criteria are identical, minor differences may exist from time to time between ANSI B31.1 and ASME Section III, Class 2 and 3, because of a lag on the part of one document or the other in the adoption of changes to the allowable stresses resulting from the addition of later test results to the database.

The FSAR will be revised in the next annual update to change the source of allowable piping stresses from ANSI B31.1.0-1967 to ASME Section III, 1971 Edition through Winter 1972 Addenda. Attached to this response are the proposed revisions to the FSAR.

REFERENCES: None

ATTACHMENT TO ENCLOSURE 1

ANSI B31.1-1967 Code was established for nonnuclear power piping design. The code equations specified in this code are to calculate longitudinal pressure stresses (S_{ep}) and expansion stresses (S_E) as defined in equation 8 of the Code.

No clear definitions were given as to how to calculate the stresses because of seismic and other dynamic loads.

Most of all, ANSI B31.1-1967 Code, as is, is not sufficient for use in the design of nuclear power plants. Specifically, the Code does not provide sufficient detailed code rules to comply with NRC regulator requirements, such as design limits and loading combinations that were specified in Regulatory Guides 1.48 and 1.57, etc.

ANSI B31.7 Code was established in 1969 for nuclear power piping. However, the design rules of nuclear classes 2 and 3 piping are referred back to ANSI B31.1-1967. Therefore, ANSI B31.7-1969 Code also cannot provide sufficient design rules for nuclear power piping to meet regulatory requirements; further, ANSI-B31.7-1969 Code was replaced by ASME III-1971 Code. However, the ASME IIINC, ND Code equations, equations 8, 9, 10, and 11 (or ANSI B31.1 code equations 11, 12, 13, and 14), were not issued until ASME Section III-1972 Addenda. ANSI B31.1 Code was also revised in Summer 1973 Addenda to incorporate these code equations without change of material requirements. In December 1973, ANSI B31.1 Code Case 115 was issued to accept ASME Section III Code rules as complying with the requirements of ANSI B31.7-1969. Therefore, it is the nuclear industry practice to use ASME Section III Code equations to design nuclear classes 2 and 3 piping for those nuclear power projects committed to ANSI B31.1 Code.

Attachment

PROPOSED

FSAR REVISION

(Revised dates on ASME III code reference from 1974 through Winter 1976 Addenda to 1971 through Winter 1972 Addenda. This is the only change made from the TVA December 29, 1987 IDI response.)

NRC IDI 43.5-1

Valve Mk. No.	Set Press.	Accumulation %	Press.	Blowdown %	Press.
47W400-101	1064	10.0	1170	10	958
47W400-102	1077	8.6	1170	10	969
47W400-103	1090	7.3	1170	10	981
47W400-104	1103	6.1	1170	10	993
47W400-105	1117	4.7	1170	10	1005

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All valves are connected to a rigidly supported common header that is in turn connected to the main steam piping through a branch pipe equal in size to the main steam piping. The header and valves are located immediately outside containment in the main steam valve building.

The safety valves are mounted on the header such that they produce torsion, bending, and thrust loads in the header during valve operation. The header has been designed to accomodate both dynamic and static loading effects of all valves blowing down simultaneously. The stresses produced by the following loading effects assumed to act concurrently are within the ~~ANSI, B31.1.0, 1967 code allowable:~~ ASME Section III, 1971 Edition through Winter 1972 Addenda.

1. deadweight effects,

2. thermal loads and movements,

3. seismic loads and movements,

4. safety valve thrust, moments, torsional loading, and

5. internal pressure.

The nozzles connecting each valve to the header are analyzed to assure that for both dynamic and static loading situations, the stresses produced in the nozzle wall are within ANSI B31.1.0, 1967 code allowable for the same loading consideration as the header

The safety valves and power-operated atmospheric relief valves are Seismic Category I components. They have been seismically qualified by analyses per criteria presented in 3.7.3 and Table 3.9.2-3.

Pressure relief valves in auxiliary safety-related systems have been installed considering loads carried in the support members produced by:

1. deadweight of valve and appurtenances,

2. thermal effects,

8. Residual heat removal system

9. Component cooling system

10. Essential raw cooling water

11. Auxiliary boiler piping

12. Upper head injection piping

13. Parts of other systems which require rigorous analysis.

3.9.2.5.2 Analytical Methods

Loading Conditions and Stress Limits

The design loading combinations and the allowable stress limits considered in the design of TVA piping systems within the scope of Subparagraph 3.9.2.5.1 are shown in Table 3.9.2-5. Design loading combinations are categorized with respect to normal, upset, and faulted conditions. ~~Piping components have been designed to allowable stress intensity levels given by the ANSI B31.1-1967 Power Piping Code.~~

~~While the referenced code did not define stress levels for the loading combinations considered in Table 3.9.2-5, the allowable stress intensity levels are in agreement with subsection NG3000 of the ASME, Section III, Winter 1972 Addenda. The referenced subsection is considered to be equivalent to ANSI B31.1 with appropriate consideration to the modifications where they exist.~~

Replace with Attached "Insert A"

Analyses

1. Stress evaluations due to loadings such as deadweight, thermal expansion, and anchor movements are performed using static analysis techniques, while stress evaluations due to earthquake loadings are performed using dynamic analysis techniques. The computer programming for application of both techniques is described in Subparagraph 3.9.2.5.3.

2. Loads on equipment nozzles are combined and evaluated against allowables as follows:

$$F_{DL} + F_{ST} + F_{1/2SSE} \leq \text{Allowable}$$

3. Seismic valve accelerations are generaly maintained below 2 g vertical, and 3 g horizontal. Cases exist such that valve accelerations can exceed these standard limits. Such cases are evaluated and approved individually; this process is controlled by the Rigorous Piping Analysis Handbook 4

INSERT A

Piping components have been designed to the ANSI B31.1 1967 power piping code utilizing the equations and rules from ASME Section III, Winter 1972 Addenda for loading combinations not defined in ANSI B31.1, and the allowable stress and material property values form Appendix I of the ASME Section III, 1971 Edition through Winter 1972 Addenda.

While the ANSI B31.1 1967 code did not define allowable stress limits for some of the loading combinations considered in Table 3.9.2-5, the allowable stress levels are in basic agreement with Appendix I of the ASME Section III, 1971 Edition through Winter 1972 Addenda.

The rules and criteria of ANSI B31.1 1967 are considered to be equivalent to those of section NC3000 of the ASME section III, Winter 1972 Addenda with the appropriate additional consideration of the equation 9 requirements of the ASME code.

Table 3.9.2-3

SAFETY CLASS B, C, AND D

COMPONENT LOADING CONDITIONS AND STRESS LIMITS

COMPONENT

Plant Loading Condition	Piping	Vessels and Storage Tanks (0-15 psig)	Atmospheric Storage Tanks	Pumps	Valves	Containment Penetrations (Nozzles)
Normal	Primary Stresses $\leq S_h$ Expansion Stress $\leq S_a$	Primary Stresses $\leq S_m$ Primary + Secondary $\leq 3\ S_m$	Stresses $\leq S_c$	ASME III Draft for Pumps and Valves. Performance testing in accordance with standards of the Hydraulic Institute Procedures	ASME III, 1968/ANSI B16.5 Ratings	ASME, Section III, 1971 Edition, Subsection NE
Upset	Primary Stresses $\leq 1.2\ S_h$ Expansion Stress $\leq S_a$	Primary Stresses $\leq S_m$ Primary + Secondary $\leq 3\ S_m$	Stresses $\leq S_c$	Structural integrity is assured by the integrity of the connecting piping. Pumps and valves are supported to assure each component is not seismically loaded in excess of the "g" loading specified in the design specification. Pumps and valves have been demonstrated to be rigid ($f_n \geq 25\ H_z$). Higher accelerations and lower natural frequencies may be approved on a case-by-case basis.		ASME, Section III, 1971 Edition, Subsection NE
Emergency	N A	N A	N A			ASME, Section III, 1971 Edition, Subsection NE
Faulted	Primary Stresses $\leq 2.4\ S_h$ Expansion stresses need not be evaluated	Primary Stresses $\leq 1.8\ S_m$ Secondary stresses need not be evaluated	Stresses $\leq 1.25\ S_c$			N A

S_h = * ~~ANSI B 31.1.0 - 1967~~ Code allowable stress at design temperature.

S_m = ASME Section III, 1968 Edition Code allowable stress at design temperature

S_c = AWWA Standard D100 Code allowable stress.

S_a = * ~~ANSI B31.1.0 - 1967~~ Code allowable expansion stress.

NA = No loading condition assigned.

*ASME Section III, 1971 Edition through winter 1972 Addenda.

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Revised by Amendment 3

ITEM NO.: D5.2-10

TITLE: Adequacy of ERCW Instrumentation Provided for Detection of Break in Non-Seismic ERCW Piping

SUMMARY OF ITEM:

In the event of a pipe break in the non-seismic portion of the ERCW piping, operator action is taken based on a high flow alarm and status light in the control room that monitors each ERCW header.

CLASSIFICATION: Design Deficiency

SUPPLEMENTAL RESPONSE:

In the December 29, 1987 response to this item, TVA committed to pursue implementation of an automatic isolation scheme to isolate the Class H ERCW piping going to the turbine building. By this letter, TVA commits to completing the implementation of this modification before SQN unit 2 restart.

ENCLOSURE 2

LIST OF COMMITMENTS

1. U3.5-1

The FSAR will be revised in the next annual update to change the source of allowable piping stresses from ANSI B31.1.0-1967 to ASME Section III, 1971 Edition through Winter 1972 Addenda.

2. D5.2-10

Before unit 2 restart, TVA will complete implementation of an automatic isolation scheme to isolate the Class H ERCW piping going to the turbine building.