Central File
50-390
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TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

November 9, 1979

Mr. James P. O'Reilly, Director
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Region II - Suite 3100
101 Marietta Street
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

OFFICE OF INSPECTION AND ENFORCEMENT BULLETIN 79-04 - RII:JPO
50-327, -328, -390, -391 - SEQUOYAH AND WATTS BAR NUCLEAR PLANTS

In response to your March 30, 1979, letter which transmitted OIE Bulletin 79-04 on Velan valves, we are enclosing the final results of our investigation for Sequoyah Nuclear Plant. We expect to submit the final results of our investigation for Watts Bar Nuclear Plant by February 29, 1980. An interim report on this bulletin was submitted on May 31, 1979.

TVA reported the Velan valve problem to NRC-OIE Region II on March 20, 1979 (NCR MEB 79-13), and on May 22, 1979 (NCR MEB 79-20), in accordance with 10 CFR 50.55(e). The enclosed information completes TVA's response to these nonconformances for Sequoyah Nuclear Plant.

If you have any questions concerning this matter, please get in touch with D. L. Lambert at FTS 854-2581.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Regulation and Safety

Enclosure
cc: Mr. Victor Stello, Jr., Director (Enclosure)
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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ENCLOSURE

RESPONSE TO IE BULLETIN 79-04
FOR SEQUOYAH NUCLEAR PLANT

Action To Be Taken By Licensees and Permit Holders

1. List all Seismic Category I piping systems (or portions thereof) where 3, 4, or 6 inch diameter Velan swing check valves are installed or are scheduled to be installed.

2. Verify for all those systems identified in Item 1 above that correct check valve weights were used in the piping analysis. Explain how and when the correct valve weights were determined.

3. If incorrect valve weights were used, explain what actions have been taken or are planned to reevaluate the piping systems affected.

4. Specify for all the affected systems identified in Item 1 whether modifications were or are required to the piping systems or their supports because of changes in valve weight. Also, include the basis for this determination. For those systems in which the actual valve weight is greater than the design weight provide a summary of stresses and loads and their allowable limits for the piping and its supports.

5. Identify the analytical technique including identification of any computer codes used to determine the stresses indicated in Item 1.

RESPONSE

1. Chemical and Volume Control System (CVCS)
   Safety Injection System (SIS)

   Table 1 provides a summary of the Velan valves installed in Sequoyah with pertinent information.

2. The 38 Velan valves (19 in each unit) shown in table 1 are those installed in seismic Category I systems at the Sequoyah Nuclear Plant. The values of valve weight shown in the table 1 column "Original Weight" are those that were used in the original design of the piping systems and their supports. As indicated on table 1, correct valve weights for 6-inch valves were obtained March 16, 1979, and all other corrected valve weights were obtained on May 15, 1979, from Westinghouse. These weights are shown in the table 1 column "Actual Weights" for those Velan valves installed in Sequoyah.

3-5. The following summarizes what was done to review piping and supports at Sequoyah using the corrected valve weights. The requested summaries of stresses and loads and their allowable limits for the affected piping and its supports are provided in tables 2 and 3 and attachment IA.

CHEMICAL AND VOLUME CONTROL SYSTEM (CVCS)

Table 1 shows a total of seven Velan valves (in each unit) in these systems.

Based on the original analysis, TVA has determined that valves 1-, 2-8442, 1-, 2-8497, 1-, 2-8481A, and 1-, 2-8481B are supported rigidly. Reanalysis of the piping problems containing these valves is unnecessary because the increased valve weight passes directly to the adjacent pipe supports. All affected CVCS pipe supports are rigid seismic supports and/or spring hangers. All revised loads are still within the hanger manufacturer's allowable limits.

Piping problems containing CVCS valves 1-, 2-8378, 1-, 2-8379, and 1-, 2-8381 were reanalyzed utilizing the computer program PISOL. Changes to pipe stresses were found to be minimal and still within allowable limits. New support loads were tabulated, and all supports were reevaluated. The adequacy of all supports was reaffirmed by a combination of the following methods.

1. For standard mechanical supports, the revised support loads were compared with the allowable load from the manufacturer's catalog.

2. For noncatalog item supports, the revised support loads were compared with allowable loads based on allowable stresses.

As a result, no modifications to the piping or its supports are required.

SAFETY INJECTION SYSTEM (SIS)

Table 1 shows a total of twelve Velan valves (in each unit) in these systems.

Based on a review of the SIS piping drawing and computer output, TVA has determined that valves 1-, 2-8922A, 1-, 2-8922B, 1-, 2-8818A, 1-, 2-8818D, 1-, 2-8949A, and 1-, 2-8949D are supported rigidly. Reanalysis of the piping problems containing these valves is unnecessary because the increased valve weight passes directly to the adjacent pipe supports. All affected SIS pipe supports adjacent to these valves are within the allowable load limits of the support.

Piping problems containing SIS valves 1-, 2-8805, 1-, 2-8818B, 1-, 2-8818C, 1-, 2-8949B, 1-, 2-8949C, and 1-, 2-8840 were reanalyzed utilizing the computer program PISOL. Changes to the pipe stresses were found to be minimal and still within allowable limits. New support loads were tabulated and all supports were reevaluated. The adequacy of all supports was reaffirmed by a combination of the following methods.

1. For standard mechanical supports, the revised support loads were compared with the allowable load from the manufacturer's catalog.

2. For noncatalog item supports, the revised support loads were compared with allowable loads based on allowable stresses.

As a result, five supports in each unit required minor modification as indicated in "Corrective Action to be Taken" and in table 3.

PIPING REANALYSIS USING CORRECT WEIGHT OF VELAN SWING CHECK VALVES

PISOL Computer Program

The piping was analyzed for the deadweight and seismic conditions using the PISOL computer program. (A description of the PISOL computer program is presented in the Sequoyah Nuclear Plant FSAR, section 3.9.2.5.) Stress combinations were computed for ANSI B31.1, equations 8, 9U, and 9E. These combinations were then compared to the appropriate allowable stresses. The output of the PISOL computer program provides a summary of stresses and their allowable limits for the reanalyzed piping. Stress summaries based on this output are provided for your information as attachment IA.

Isometric Drawing

Portions of isometric drawing showing the area of interest in each problem are attached. Member numbers and node numbers correspond to the member numbers and node numbers in the PISOL computer program output. The Velan valves are identified on each isometric. (EDS drawing 0600102-03-01-R5
-08-08-R3
-08-11-R5
-09-01-R5
-09-02-R5
-09-05-R3
-09-11-R4)

SUMMARY

Our investigation and reanalysis indicated that the corrected valve weights do not create any overstressing in pipes. Nine supports that were marginal have been modified. One support was voided.

CORRECTIVE ACTION TO BE TAKEN

Nine supports as indicated on table 2 require modification as follows:

Support Drawing No.	Support Modification
1-H63-6	Added a brace to the structural steel extension
1-H20-32	Added a brace to the structural steel extension.
1-H20-16	Specified larger concrete anchors and stiffeners on base plate.
1-H20-17	Specified larger concrete anchors and sitffeners on base plate.
1-H20-58	Increased number of anchor bolts.
1-H20-6	Changed snubber size.
1-H20-396 1-H20-398 1-H20-399	Structural member added to prevent pipe uplift due to small upward vertical load.
1-H20-810	Voided; relieves elbow stress

All revisions will be made in the field by construction forces prior to initial criticality.

TABLE 1

VELAN VALVES INSTALLED IN SEISMIC CATEGORY I
PIPING SYSTEMS AT SEQUOYAH NUCLEAR PLANT

Valve Size (In.)	Rating psi	Valve Tag No.	Velan Figure No.	Location No. Westinghouse	System	Original Wt. (Lb.)	Actual Wt. (Lb.)
3	1500	3C58	8843-016	1-,2-8378**	CVCS	60	85
3	1500	3C58	8843-016	1-,2-8379	CVCS	60	85
3	1500	3C58	8843-016	1-,2-8381	CVCS	60	85
3	1500	3C58	8843-016	1-,2-8442	CVCS	60	85
3	1500	3C58	8843-016	1-,2-8497	CVCS	60	85
3	1500	3C58	8843-016	1-,2-8805	SIS	60	85
4	1500	4C57	78501	1-,2-8922A	SIS	100	135
4	1500	4C57	78501	1-,2-8922B	SIS	100	135
4	1500	4C58	78501	1-,2-8481A	CVCS	100	135
6	1500	4C58	78501	1-,2-8481B	CVCS	100	135
6	1500	6C58*	78704	1-,2-8818A	SIS	225	450
6	1500	6C58*	78704	1-,2-8818B	SIS	225	450
6	1500	6C58*	78704	1-,2-8818C	SIS	225	450
6	1500	6C58*	78704	1-,2-8818D	SIS	225	450
6	1500	6C58*	78704	1-,2-8949A	SIS	225	450
6	1500	6C58*	78704	1-,2-8949B	SIS	225	450
6	1500	6C58*	78704	1-,2-8949C	SIS	225	450
6	1500	6C58*	78704	1-,2-8949D	SIS	225	450
12	1500	12 GM58 SEH	88907-2	1-,2-8840	SIS	2450	3450

*Correct valve weight for 6-inch-diameter valve was obtained on March 16, 1979, from Westinghouse. All other corrected valve weights were obtained on May 15, 1979, from Westinghouse.

**1-,2 indicates a unit 1 and unit 2 valve.

TABLE 2

SEQUOYAH VELAN VALVE EVALUATION

SUPPORT LOAD TABLE FOR EDS ANALYSIS

Valve Location No.	Valve Mfg. No.	System	Problem/ D. P. No.	Direction	Maximum Load (lb) New	Maximum Load (lb) Old	Support Type	Support Drwg. No.	Support Fabricator	Part No.	Max. Load
8949D	78704	RHR/SIS	03-01 (18A)	Lateral	15240	14500	Snubber	1-H63-6	Field, BE	410	Not determined
				Vertical	43398	43190	Rigid Rest.	(1)			
				Lateral (axial)	19108	18900	Snubber				
			(16)	Vertical	36026	36000	Rigid Rest.	"			
			(14)	Vertical	32415	32150	Rigid Rest.	"			
				Lateral	43879	43896	Rigid Rest.	"			
			(35B)	Lateral (E-W)	948	900	Snubber	"			
			(38)	Vertical	1618	1570	Rigid Rest.	"			
				Lateral (N-S)	311	290	Rigid Rest.	"			
			(39)	Vertical	216	140	Rigid Rest.	"			
				Lateral (N-S)	110	90	Rigid Rest.	"			
			(40)	Vertical	1810	1710	Rigid Rest.	"			
				Lateral (N-S)	63	50	Rigid Rest.	"			
8818A	78704	SIS	09-01 (22)	Vertical	23563	17050	Rigid Rest.	"			
				Lateral	7059	6750	Rigid Rest.	"			
			(25)	Lateral	17837	16838	Rigid Rest.	"			
				Lateral (E-W)	20579	18207	Rigid Rest.				
			(29)	Lateral	8780	6644	Rigid Rest.	"			
				Vertical	14728	14000	Rigid Rest.				
				Lateral (axial)	6064	7711	Rigid Rest.				
			(25F)	Vertical	942	720	Snubber	1-H20-32	BE	416	Not determined

TABLE 2

SEQUOYAH VELAN VALVE EVALUATION

SUPPORT LOAD TABLE FOR EDS ANALYSIS

Valve Location	Valve Mfg. No.	System	Problem/ D.P. No.	Direction	Maximum Load (lb) New	Maximum Load (lb) Old	Support Type	Support Drwg. No.	Support Fabricator	Part No.	Max. Load
8818A	78704	SIS	(25F)	Vertical	180	180	Spring	(1)			
				Lateral	841	841	Rigid	"			
8818D	78704	SIS	09-01	Vertical	4630	4590	Rigid Rest.	1-H20-16	BE, Field	123	Not determined
			(41)	Lateral	7243	7771	Rigid Rest.				
			(45)	Vertical	19276	19160	Rigid Rest.	1-H20-17	Field	N/A	"
			(46)	Lateral	7015	8212	Rigid	(1)			
				Vertical	4812	4400	Rigid				
				Lateral (axial)	6631	7356	Rigid				
			(77)	Vertical	17080	16990	Rigid	"			
			(76)	Lateral	16559	2112	Rigid	"			
				Lateral (axial)	20013	21086	Rigid				
8949A	78704	SIS	09-11 (D76)	Vertical	24016	24140	Rigid	"			
			(E75)	Lateral	5215	5615	Rigid	"			
			(B75)	Vertical	19847	20120	Rigid	"			
			(62A)	Vertical	6640	5540	Rigid	"			
				Lateral	3444	4177	Rigid	"			
			(52)	Lateral	6464	5429	Rigid	"			
8805	8843-016	SIS	09-05 (5)	Vertical	435	430	Rigid	"			
			(5A)	Lateral	2072	2278	Rigid	"			
			(34)	Vertical	205	210	Rigid	"			
				Lateral	122	122	Rigid	"			
			(D02)	Lateral	2524	2600	Rigid	"			
				Lateral	2480	2600	Rigid	"			

TABLE 2

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Valve Location No.	Valve Mfg. No.	System	Problem/ D.P. No.	Direction	Maximum Load (lb) New	Maximum Load (lb) Old	Support Type	Support Drwg. No.	Support Fabricator	Part No.	Max. Load
8805	8843-016	SIS									
			(D01)	Vertical	1845	1850	Rigid	(1)			
			(C1F)	Vertical	360	360	Rigid	"			
				Lateral	334	348	Rigid	"			
8378	8843-016	CVC	08-11 (75B)	Lateral	3136	3136	Snubber	"			
				Lateral	6209	6209	Snubber				
			(73B)	Vertical	670	670	Rigid	"			
			(67G)	Vertical	391	360	Rigid	"			
				Lateral	505	494	Rigid	"			
			(67J)	Vertical	582	550	Rigid	"			
				Lateral	1784	1711	Rigid	"			
8379	8843-016	CVC	08-11 (V5)	Lateral	2000	2000	Snubber	"			
			(41B)	Vertical	370	370	Rigid	"			
				Lateral	1428	1428	Snubber	"			
			(43)	Vertical	690	690	Rigid	"			
8381	8843-016	CVC	08-08 (15)	Vertical	1880	1270	Rigid	"			
				Lateral	1397	412	Rigid	"			
			(17)	Lateral	1525	630	Rigid	"			
				Lateral	1848	1002	Rigid				
8949C	78704	SIS	09-11 (65E)	Vertical	15879	16000	Rigid	"			
			(65C)	Vertical	9314	9610	Rigid	"			
				Lateral	10838	11068	Rigid	"			

TABLE 2

SEQUOYAH VELAN VALVE EVALUATION

SUPPORT LOAD TABLE FOR EDS ANALYSIS

Valve Location No.	Valve Mfg. No.	System	Problem/ D.P. No.	Direction	Maximum Load (lb) New	Maximum Load (lb) Old	Support Type	Support Drwg. No.	Support Fabricator	Part No.	Max. Load
8949C	78704	SIS	09-11								
			(E85)	Lateral	6264	6211	Rigid	" (1)			
			(B85)	Vertical	2780	2930	Rigid	"			
8940	88907-2	SIS	09-11	Vertical	7391	6540	Rigid	"			
			(44A)	Lateral	4679	4700	Rigid	"			
			(E69)	Vertical	7838	6940	Rigid	"			
				Lateral	7495	6368	Rigid	"			
			(B60)	Vertical	3442	3560	Rigid	"			
				Lateral	5422	5324	Rigid	"			
			(D60)	Vertical	2250	2260	Rigid	"			
				Lateral	2571	2267	Rigid	"			
			(G60)	Vertical	2111	2550	Rigid	"			
				Lateral	2567	2441	Rigid	"			
			(H60)	Vertical	2477	3070	Rigid	"			
				Lateral	1414	1297	Rigid	"			
			(55A)	Vertical	9309	8940	Rigid	"			
				Lateral	8185	7679	Rigid	"			
			(B63)	Vertical	2877	3120	Rigid	"			
				Lateral	9730	9038	Rigid	"			
			(D63)	Vertical	1794	2010	Rigid	"			
				Lateral	5671	5259	Rigid	"			
			(G63)	Vertical	1580	1990	Rigid	"			
				Lateral	6519	6072	Rigid	"			
			(H63)	Vertical	1619	2040	Rigid	"			
				Lateral	5984	5549	Rigid	"			
			(J63)	Vertical	1549	1970	Rigid	"			
				Lateral	6217	5912	Rigid	"			
8[illegible]3C	78704	SIS	09-02 (64)	Lateral	7688	7005	Rigid	1-H20-58	Field	N/A	Not determined

NOTE: (1) New maximum design loads were evaluated--changes in existing support designs were not required.

TABLE 2
SEQUOYAH VELAN VALVE EVALUATION
SUPPORT LOAD TABLE FOR EDS ANALYSIS

Valve Location No.	Valve Mfg. No.	System	Problem/ D.P. No.	Direction	Maximum Load (lb) New	Maximum Load (lb) Old	Support Type	Support Drwg. No.	Support Fabricator	Part No.	Maximum Load
8818A	78704	SIS	09-01 (15)	Lateral	33,000	25,547	Snubber	1-H20-6	Field, BE	410	Not Determined
8949C	78704	SIS	09-11 (S63)	Lateral Vertical	4,923 459/-4,829	4,932 0/-5490	Rigid Rest.	1-H20-396	Field, BE		Not Determined
			(B81)	Lateral Vertical	2,406 118/-6,766	2,450 0/-6,850	Rigid Rest.	1-H20-398	Field, BE		Not Determined
			(A64)	Lateral	6,276 145/-6,923	6,241 0/-7210	Rigid Rest.	1-H20-399	Field, BE		Not Determined
8949A	78704	SIS	09-11 (L04)	Vertical	(Void)	4,330/ -5,990	Strut	1-H20-810	Field, BE		Not Determined

TABLE 3

SEQUOYAH VELAN VALVE EVALUATION
SUPPORT LOAD TABLE FOR CEB ANALYSIS

Valve Location - Hs	Valve Mfg. No.	System	Maximum Old Load		Maximum New Load		Support Drawing No.	Support Type	Support Fabricator	Part Number	Size	Max. Allowable Load.
			Load	Direction	Load	Direction						
8442	8843-016	CVCS	593	Lateral	595	Lateral	H34-1591	Rigid Rest.	(1)			
			1043	Vertical	1056	Vertical	H34-1591	" "	Field Fab.	NA	–	2320 Lbs
			952	Lateral	954	Lateral	H34-1592	Rigid Rest.	(1)			
			905	Vertical	918	Vertical	H34-1592	" "	Field Fab.	NA	–	2320 Lbs
8497	8843-016	CVCS	50	Lateral	54	Lateral	H34-627	Rigid Rest.	(1)			
			697	Vertical	704	Vertical	H34-488	Spring	Grinnell	Fig. 8 Type B	8	713 Lbs
			19	Lateral	19	Lateral	H34-626	Rigid Rest.				
			105	Vertical	123	Vertical	H34-594	Spring	Grinnell	Fig. 8 Type B	8	713 Lbs
8451A	78501	CVCS	1855	Lateral	1856	Lateral	H34-451	Rigid Rest.	(1)			
			626	Vertical	631	Vertical	H34-451	Rigid Support	Basic Engrs	BE-146	4	1800 lbs
			141	Vertical	171	Vertical	H34-515	Rigid Rest.	Basic Engrs	BE-415	1	1545 Lbs
8481B	78501	CVCS	872	Lateral	874	Lateral	H34-454	Rigid Rest.	(1)			
			1175	Vertical	1182	Vertical	H34-454	Rigid Supp.	Basic Engrs	BE-146	4	1800 lbs
			212	Vertical	240	Vertical	H34-514	Rigid Rest.	Basic Engrs.	BE-415	1	1545 Lbs.
8922A	78501	SIS	291	Lateral (E-W)	293	Lateral (E-W)	H20-491	Rigid Rest.	(1)			
			840	Lateral (N-S)	842	Lateral (N-S)	H20-491	" "	(1)			
8922B	78501	SIS	335	Lateral (E-W)	337	Lateral (E-W)	H20-507	Rigid Rest	(1)			
			262	Lateral (N-S)	264	Lateral (N-S)	H20-507	" "	(1)			

Note (1): CHANGE IN MAXIMUM DESIGN LOADS ARE INSIGNIFICANT - SUPPORT DESIGNS WERE NOT EVALUATED.

EDS PROBLEM NO. 0600104-2.3-01 ATTACHMENT IA

SYSTEM OPERATION MODE CASE NO. ENVP. CASE I & CASE II SHEET NO. 1 of 1 REV. No. 1

Pipe Section	Joint No.	Primary Stresses: Grav. Stress (psi)	Press. Stress (psi)	½ SSE Stress (psi)	External Stress (psi)	Secondary Stresses: Thermal Stress (psi)	S.A.M. Stress (psi)	Load (1) Combination Equation No.	Combined Stress (psi)	Allowable Stress (psi)
MEMBER 21 SWEL 2" SCH160 (SR. 19 VIOLATION)	34	764	2540					(11)	3304	18,200
		764	2540	1492				(12)	4776	21,840
		764	2540	1492				(12')	6233	32,760
						36215	6525	(13) or (14)	42740	27987
MEMBER 21 SWEL 2" SCH160	34	764	2540					(11)	3304	18,200
		764	2540	1492			6525	(12)	11321*	21,840
		764	2540	1492			6525	(12')	19338*	32,760
		764	2540			36215		(~~13~~) or (14)	39519	46157
MEMBER 24B ER. IT. ANCHOR 2" SCH 160	43	471	2540					(11)	3011	18,200
		471	2540	4241				(12)	7252	21,840
		471	2540	4241				(12')	11493	32,760
						24352	1562	(13) or (~~14~~)	25914	27987
MEMBER 22 2" SCH160 SWELBOW	35	594	2540					(11)	3134	18,200
		594	2540	1875				(12)	5009	21,840
		594	2540	1875				(12')	6884	32,760
		594	2540			34658	6147	(~~13~~) or (14)	43921	46157
MEMBER 1C 14" SCH160 ANCHOR ON HOT LEG 1 & 4	27	1727	4390					(11)	6117*	11,840
		1727	4390	2702				(12)	8819	14,208
		1727	4390	2702				(12')	11521	21,312
						15554	2506	(13) or (~~14~~)	18060	26,398
MEMBER 21 SW TO BOSS 2" SCH160	33	1005	2540					(11)	3545	18,200
		1005	2540	1538				(12)	5083	21,840
		1005	2540	1538				(12')	6621	32,760
		1005	2540			35149	6492	(~~13~~) or (14)	45156*	46157
								(11)		
								(12)		
								(12')		
								(13) or (14)		

NOTE: (1) Load Combination Equation No. Based on B31-1 Code - 1973 Summer Addenda

* indicates maximum combined stress

EDS NUCLEAR
220 MONTGOMERY ST. • SAN FRANCISCO, CALIFORNIA 94104 • (415) 421-5055

JOB NO. 0600104
CLIENT TVA
PROJECT Sequoyah Nuclear Plant
TITLE B31.1 Analysis of Piping Systems
Stress Summary
BY SKG
DATE 2-13-75
CHECKED CHL

ATTACHMENT IA

SUMMARY OF MAXIMUM ASME SECTION III CLASS 2 AND 3 STRESSES

Calculation of results are based on criteria in the 1971 Edition of the ASME Boiler and Pressure Vessel Code, Section III including Summer Addenda 1973, plus stress intensification factors of the 1974 Edition of the Code.

I. Sustained Loads

NC-3650

$S_{SL} = PD_o/4\,t_n + 0.75\,i\,M_A/Z \leq 1.0\,S_h$

Load Combination Pressure + Gravity (Eq. 8)

Component: ID C12 type BELB Joint: ID 53 type AWBW

Allowable Stress $1.0S_h$ 15,900 psi Actual Stress, S_{SL} = 4913 psi

II. Occasional Loads

A. Upset Condition

$S_{OL} = P_{max}\,D_o/4t_n + 0.75\,i\,(M_A + M_B)/Z \leq 1.2\,S_h$

Load Combination Pressure + Gravity + OBE (Eq. 9)

Component: ID C02 type BELB Joint: ID 19 type AWBW

Allowable Stress $1.2S_h$ 19,080 psi Actual Stress, S_{OL} = 7817 psi

B. Faulted Condition

$P_{max}\,D_o/4\,t_n + 0.75\,i\,(M_A + \_\_\_\_ M_B)/Z \leq 2.4\,S_h$

Load Combination Pressure + Gravity + SSE + DBA (Inertia) (Eq. 9F)

Component: ID C01 type BELB Joint: ID 15 type AWBW

Allowable Stress $2.4\,S_h$ 38,160 psi Actual Stress, S_F = 10136 psi

III. Thermal Expansion

$S_E = i\,M_C/Z \leq S_A$

Load Combination Thermal + SAM (OBE) (Eq. 10)

Component: ID C03 type BELB Joint: ID 29 type AWBW

Allowable Stress S_A = 27475 psi Actual Stress, S_E = 10317 psi

IV. Sustained Loads plus Thermal Expansion

Evaluated only when the thermal expansion exceeds the allowable stress.

$S_{TE} = PD_o/4\,t_n + .75\,i\,M_A/Z + iM_C/Z \leq (S_h + S_A)$

Load Combination Pressure + Gravity + Thermal + SAM (OBE) (Eq. 11)

Component: ID ____ type ____ Joint: ID ____ type ____

Allowable Stress, $(S_h + S_A)$ = ____ psi Actual Stress, S_{TE} = ____ psi

NOTE: 1) $0.75i \geq 1$

2) $PD^2/D_o^2 - d^2$ was used.

NO.	DATE	REVISION	BY	CKD.	APP.	CLIENT TVA
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		PROJECT SEQUOYAH Nuclear Plant
						UNIT 1
						JOB NO. C600104
						ITEM NO. 02-09 SHT. 1 OF 2

EDS NUCLEAR: [illegible] MONTGOMERY STREET [illegible]

EDS 0052 7/75

ASME SECTION III CLASS 2 AND 3 SUMMARY OF MAXIMUM STRESSES

V. Faulted Primary plus Secondary

$S_{FS} = i\, M_{CF}/Z \leq (3\, S_c)$

Load Combination _____ *

Component: ID 1 type BPCH Joint: ID 2 type AS weld

Allowable Stress, $3\, S_c$ = 56400 psi Actual Stress, S_{FS} = 7795 psi

*Max (DBA Displacements, CT+CP) + SAM (SSE)

NO	DATE	REVISION	BY	CKD.	APP	
1	[illegible]	[illegible]	[illegible]	[illegible]		CLIENT TVA
						PROJECT [illegible] Nuclear Plant
						UNIT 1
						JOB NO. [illegible]
						ITEM NO. [illegible] SHT. 2 OF 2

ATTACHMENT IA

ED UCLEAR
220 MONTGOMERY ST. • SAN FRANCISCO, CALIFORNIA 94104 • (415) 421-5055

JOB NO. 0600104
CLIENT TVA
PROJECT Sequoyah Nuclear Plant
TITLE B31.1 Analysis of Piping Systems
Stress Summary
BY ZKP
DATE 9/10/79
CHECKED RLC 9/18/79

DF PROBLEM NO. 0600104- [illegible]

YSTEM OPERATION MODE CASE NO. I

SHEET NO. 1 of 2 REV. No. 3

Pipe Section	Joint No.	Primary Stresses: Grav. Stress (psi)	Primary Stresses: Press. Stress (psi)	Primary Stresses: ½ SSE Stress (psi)	Primary Stresses: External Stress (psi)	Secondary Stresses: Thermal Stress (psi)	Secondary Stresses: S.A.M. Stress (psi)	Load (1) Combination Equation No.	Combined Stress (psi)	Allowable Stress (psi)
6" SCH 160 MEM C87	D87	246	3945	---				(11)	4191	11840
		246	3945	1037				(12)	5228	14203
		246	3945	1037				(12')	6265	21312
						15739		(13) or (14)	15739	26398
2" SCH 160 MEM 73	36	2204	2640					(11)	4844	18220
		2204	2640	10134				(12)	14978	21864
		2204	2640	10134				(12')	25112	32796
						24260		(13) or (14)	24260	27992
8" SCH 140 MEM C74	D74	2204	4800					(11)	7004	18220
		2204	4800	10134				(12)	17138	21864
		2204	4800	10134				(12')	27272	32796
						6343		(13) or (14)	6343	27992
2" SCH 160 MEM 80.	L05	2204	2640					(11)	4844	18220
		2204	2640	10134				(12)	14978	21864
		2204	2640	10134				(12')	25112	43728 *
						14560		(13) or (14)	14560	27992
								(11)		
								(12)		
								(12')		
								(13) or (14)		
								(11)		
								(12)		
								(12')		
								(13) or (14)		
								(11)		
								(12)		
								(12')		
								(13) or (14)		

NOTE: (1) Load Combination Equation No. Based on B31-1 Code - 1973 Summer Addenda

* ALLOWABLE STRESS [illegible] * GRAV & SEISMIC STRESSES ARE MAX FROM [illegible]

EDS 0052 7/75

Pipe Section	Joint No.	Pressure Stress (psi)	Gravity Stress (psi)	½SSE Stress (psi)	SSE Stress (psi)	Thermal Expansion Stress (psi)	½SSE S. A. M. Stress (psi)	Shock Load Stress (psi)	Combined Stress (psi)	See Notes	Allowable Stress (psi)
[illegible] 57 2" Sch 160 SW To Elbow	90	2540	2246	***	***	***	***	***	4786	(1)	14510
				11041	***	***	***	0	15827	(2)	17412
				***	***	28114	0	***	32900	(3)	41575
				***	22082	***	***	***	26868	(4)	[illegible]
[illegible] 58 2" Sch 160 SW To Elbow	91			***	***	***	***	***	4786	(1)	14510
				11041	***	***	***		15827	(2)	174[illegible]
				***	***	26866	0	***	31652	(3)	41575
				***	22082	***	***	***	26868	(4)	[illegible]
[illegible] 37 3" Sch 160	78	3190		***	***	***	***	***	5436	(1)	14510
				11041	***	***	***		16477	(2)	17412
				***	***	13872	10706	***	30074	(3)	41575
				***	22082	***	***	***	27518	(4)	[illegible]
[illegible] 3" Sch 160	45			***	***	***	***	***	5436	(1)	14510
				11041	***	***	***		16477	(2)	[illegible]
				***	***	13482	3963	***	22881	(3)	41575
				***	22082	***	***	***	27518	(4)	[illegible]
[illegible] 6 3" Sch 160	71			***	***	***	***	***	5436	(1)	14510
				11041	***	***	***		16477	(2)	17412
				***	***	25196	0	***	30632	(3)	[illegible]
				***	22082	***	***	***	27518	(4)	[illegible]

Notes: Combined stresses are calculated according to the rules of ANSI B31.1 - 1967 and TVA criteria

(1) Sustained loads - Pressure stress + Gravity stress $\leq S_h$

(2) Occasional loads - Pressure stress + Gravity stress + ½ SSE stress + Shock load stress $\leq 1.2\ S_h$

(3) Additive loads - Pressure stress + Gravity stress + Thermal Expansion Stress + ½ SSE S. A. M. stress $\leq (S_a + S_h)$

(4) Occasional loads (Faulted Condition) - Pressure stress + Gravity stress + SSE stress $\leq 2.4\ S_h$

(5) Gravity, ½SSE AND SSE STRESSES, REPORTED HERE ARE PEAK STRESSES OF RESPECTIVE LOAD CONDITIONS.

NO	DATE	REVISION	BY	CKD.	APP.	CLIENT	PROJECT	JOB NO.	ITEM NO.	SHT.
[illegible]	[illegible]	[illegible]	ST	RCC	[illegible]	TVA	SNP #1	0600104	08-11	1 OF 1

EDS NUCLEAR: 220 MONTGOMERY STREET • SAN FRANCISCO, CALIFORNIA 94104

ATTACHMENT IA

EDS NUCLEAR
220 MONTGOMERY ST. • SAN FRANCISCO, CALIFORNIA 94104 • (415) 421-5056

PROJECT: TVA-SEQUOYAH NUCLEAR PLANT UNIT NO. 1 EDS PROB. NO. 0600104-09-051
SUBJECT: B31.1 Analysis of Piping Systems - Stress Summary Job No. 0600104
Pipe Description: BORON INJ. FROM PENET X-22 BREAK PT A1 & COLD LEG 1 E2
Prepared by ST Checked by RCC Date 9/8/79 Sheet No. 1 of 1 Rev. No. 1

I. SUPPORTING DATA

Computer Run Seq. No. Gravity _____
Thermal _____
Seismic _____
S.A.M. _____

(2) Pipe Materials ASTM A-376 TP-304 STAINLESS STEEL
(3) Pipe Nominal Diameters & Schedules (in) 3/4"φ, 1"φ, 1½"φ, 2½"φ, 3"φ SCH 160
(4) Normal Operating Temperature (°F) 550 °F
(5) Normal Operating Pressure (psig) 2580 PSIG
(6) Earthquake Response Spectra ENV (1274 & INT CONC STRUCT)

II. THERMAL CONDITION (Includes OBE Seismic Anchor Movement Stress)

(1) Allowable Thermal Expansion Stress = $f(1.25\ S_c + 0.25\ S_h + S_h)$ = 46,100 psi
(2) Actual Maximum Thermal Expansion Stress = 40765 psi
@ Data Point D11, Member Type CRVD. MEM. C11. 1½"φ SCH 160

based on local summation of
(i) Thermal Expansion Stress = 28,620 psi
(ii) Seismic Anchor Movement Stress (OBE) = 6,694 psi
(iii) GRAVITY + LONGITUDINAL PRESSURE STRESS 5454

III. UPSET CONDITION (Includes Operating Basis Earthquake)

(1) Allowable Combined Longitudinal Stress = $1.2\ S_h$ = 20,300 psi
(2) Actual Maximum Combined Longitudinal Stress = 13,808 psi
@ Data Point B2, Member Type ST. MEM. 34 1½"φ SCH 160

based on local summation of
(i) Seismic Stress (OBE) = 6531 psi
(ii) Gravity Stress = 2916 psi
(iii) Longitudinal Pressure Stress = 4361 psi

IV. FAULTED CONDITION (Includes Safe Shutdown Earthquake)

(1) Allowable Combined Longitudinal Stress = $1.8\ S_h$ 30,400 psi
(2) Actual Maximum Combined Longitudinal Stress = 20239 psi
@ Data Point B2, Member Type ST. MEM. 34 1½"φ SCH 160

based on local summation of
(i) Seismic Stress (SSE)=2xSeismic Stress (OBE)= 13062 psi
(ii) Gravity Stress= 2916 psi
(iii) Longitudinal Pressure Stress 4361 psi

Note: Gravity, OBE, SSE stresses reported here are peak stresses of respective load condition.

EDS PROBLEM NO. 0600104-09-01

SYSTEM OPERATION MODE CASE NO. 1 & 2

SHEET NO. 1 of 1 REV. No. 2

Pipe Section	Joint No.	Primary Stresses: Grav. Stress (psi)	Primary Stresses: Press. Stress (psi)	Primary Stresses: ½ SSE Stress (psi)	Primary Stresses: External Stress (psi)	Secondary Stresses: Thermal Stress (psi)	Secondary Stresses: S.A.M. Stress (psi)	Load (1) Combination Equation No.	Combined Stress (psi)	Allowable Stress (psi)
2" SCH 160 Mem. A25	25	970	2,640					(11)	3,610	15,250
		970	2,640	7,480				(12)	11,090	18,300
		970	2,640	7,480				(12')	18,510	27,450
		970	2,640			36,800	1,270	(13) or (14)	41,680*	42,500
2" SCH 160 Mem. A83	77G	1,160	2,640					(11)	3,800	18,310
		1,160	2,640	12,350				(12)	16,150*	21,970
		1,160	2,640	12,350				(12')	28,500*	32,960
						7,090	50	(13) or (14)	7,140	28,020
2" SCH 160 Mem. 88	77N**	1,280	2,640					(11)	3,920	18,310
		1,280	2,640	10,420				(12)	14,340	21,970
		1,280	2,640	10,420				(12')	24,760	32,960
						7,630	60	(13) or (14)	7,690	28,020
16" SCH 40S Mem. 2	3	850	4,530					(11)	5,380	16,830
		850	4,530	5,220				(12)	10,600	20,200
		850	4,530	5,220				(12')	15,820	30,290
						20,140	370	(13) or (14)	20,510	27,650
6" SCH 160 Mem. 51	62	4,940	4,090					(11)	9,030*	16,600
		4,940	4,090	3,190				(12)	12,220	19,920
		4,940	4,090	3,190				(12')	15,410	29,880
						24,790	900	(13) or (14)	25,690	27,590
10" SCH 140 Mem. 13	19	120	5,070					(11)	5,190	11,000
		120	5,070	5,900				(12)	11,090	19,200
		120	5,070	5,900				(12')	16,990	28,800
						13,350	4430	(13) or (14)	17,780	27,440
2" SCH 160 MEM. A77	L77	3,250	2,640					(11)	5,890	15,250
		3,250	2,640	8,300				(12)	[illegible],190	18,300
		3,250	2,640	8,300				(12')	22,490	27,450
		3,250	2,640			32,940	2,640	(13) or (14)	41,470	42,500

NOTE: (1) Load Combination Equation No. Based on B31-1 Code - 1973 Summer Addenda

* [illegible] MAXIMUM [illegible]

ATTACHMENT 1A

EDS NUCLEAR
220 MONTGOMERY ST. • SAN FRANCISCO, CALIFORNIA 94104 • (415) 421-5055

JOB NO. 0600104

PROJECT: Sequoyah Nuclear Plant

CLIENT: TVA

TITLE: B31.1 Analysis of Piping Systems

Stress Summary

BY: W. L. Hom

DATE: 09/15/75

CHECKED: KKL

E[illegible] PROBLEM NO. [illegible]104- [illegible]

SYSTEM OPERATION MODE CASE NO. II

SHEET NO. 2 of 2 REV. No. 5

Pipe Section	Joint No.	Primary Stresses: Grav. Stress (psi)	Primary Stresses: Press. Stress (psi)	Primary Stresses: ½ SSE Stress (psi)	Primary Stresses: External Stress (psi)	Secondary Stresses: Thermal Stress (psi)	Secondary Stresses: S.A.M. Stress (psi)	Load (1) Combination Equation No.	Combined Stress (psi)	Allowable Stress (psi)
12" SCH 40 MEM C57	D67	2204	4270					(11)	6474	16365
		2204	4270	10134				(12)	16608	19638
		2204	4270	10134				(12')	26742	29457
						13040		(13) or (14)	13040	27529
8" SCH 140 MEM C31	B31	2204	2320					(11)	4524	16365
		2204	2320	10134				(12)	14658	19638
		2204	2320	10134				(12')	24792	29457
						8688		(13) or (14)	8688	27529
2" SCH 160 MEM 80	L05	2204	1230					(11)	3434	16365
		2204	1230	10134				(12)	13568	19638
		2204	1230	10134				(12')	25702	39276 *
						26294		(13) or (14)	26294	27529
								(11)		
								(12)		
								(12')		
								(13) or (14)		
								(11)		
								(12)		
								(12')		
								(13) or (14)		
								(11)		
								(12)		
								(12')		
								(13) or (14)		
								(11)		
								(12)		
								(12')		
								(13) or (14)		

NOTE: (1) Load Combination Equation No. Based on B31-1 Code - 1973 Summer Addenda

* ALLOWABLE [illegible]

EE NUCLEAR
220 MONTGOMERY ST. • SAN FRANCISCO, CALIFORNIA 94104 • (415) 421-5055

JOB NO. 0600104

CLIENT TVA

PROJECT Sequoyah Nuclear Plant

TITLE B31.1 Analysis of Piping Systems

Stress Summary

BY [illegible]

DATE 9/10/79

CHECKED [illegible]