TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

January 24, 1980

Director of Nuclear Reactor Regulation
Attention: Mr. L. S. Rubenstein, Acting Chief
Light Water Reactors Branch No. 4
Division of Project Management
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Rubenstein:

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

On January 16, 1980, a meeting was held at Sequoyah Nuclear Plant with NRC-NRR Consultant R. M. Gustafson and TVA employees to discuss welds on pressurizer relief piping. During this meeting, Mr. Gustafson requested additional information which was not available at the plant site. Enclosed is the requested information.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Regulation and Safety

Enclosure

1816 039

B001 SE 1/1

8001280 251

ADDITIONAL INFORMATION ON PRESSURIZER RELIEF LINE
DRAW BEAD ALIGNMENT WELDS

A meeting was held on January 16, 1980, between Roy Gustafson of NRC-NRR and several TVA design and construction personnel. The following information was provided to Mr. Gustafson concerning the draw bead alignment welds on the pressurizer relief line:

1. A drawing of the weld area.
2. The welding procedure and the procedure qualification.
3. Results of the Strauss test performed on a mockup.
4. Westinghouse specifications on water chemistry.
5. Pipe bending procedure.
6. The UT baseline scan for each weld.
7. Certified material test report (CMTR) for the pipe.
8. Special instructions from Engineering Design for this particular weld bead alignment.
9. NDE results.

In addition, Mr. Gustafson requested information that was not available at the time of the meeting. The requested information is contained in the following discussion.

Circumstances Requiring Use of Draw Bead and Discussion of Stress Analysis

During the hot functional test, a pipe support providing restraint in the lateral direction failed to slide as designed, restraining the pipe in the vertical direction. The restraint is located at joint 33 shown on the sketch in enclosure 1. A copy of the restraint design is shown in enclosure 2.

The maximum anticipated vertical movement at joint 33 during normal operation was anticipated to be 2.87 inches assuming a worst case operating temperature of 653° F. The hot functional test had proceeded to an operating temperature of approximately 550° F at the time of discovery of the bound up support. The U-bolt which restrained the pipe in the vertical direction was deflected approximately one inch vertically.

In order to determine the stress levels due to the bound support, an analysis was run with the piping at 550° F and a vertical restraint installed at joint 33. The vertical restraint was free for the one-inch vertical movement simulating the one-inch deformation of the U-bolt. The stress levels for the joints shown in enclosure 1 are tabulated in enclosure 3. These stress levels are below the ASME, Section III allowable stress for nonrepeated stresses as defined by NC-3611.2(f). That allowable stress for A-376T316 is 60,000 lb/in^2. Pressurizer relief nozzle loads for this anomaly load case were forwarded to Westinghouse for review by enclosure 4 and were approved by enclosure 5.

Enclosure 6 gives maximum stress at node 13A during plant operation for occasional loads. Node 13A is within five inches of both draw beads.

Residual Stresses

Residual stresses are considered to be no g[illegible] than the stresses in a repair to base metal or in any other weld in the syst[illegible]. The nature of these stresses at the inside diameter (id) induced by welding are considered to be compressive due to the technique used and consequently will not adversely affect the material's susceptability to stress corrosion cracking (IGSCC). Compressive stresses are known to have a mitigating effect on IGSCC; thus, we do not have stresses which can cause IGSCC.

Heat Input Calculation for Draw Bead Repair

1. Maximum heat input used on the preproduction mockup which passed a Strauss test.

   Amps = 160A
   Volts = 14V
   Travel Speed = 3/4 in/min = TS

   $$\text{Heat input per inch} = \frac{\text{Amps X Volts X 60}}{\text{Travel Speed in/min}}$$

   $$= \frac{14\text{V X 160A X 60}}{0.75\text{ in/min X 1000}}$$

   $$= 179.2 \text{ kilojoules}$$

2. Actual heat input used for production welding.

   Amps = 90A
   Volts = [illegible]1V
   TS = 2 in/min

   $$\text{Heat input per inch} = \frac{11\text{V X 90A X 60}}{2\text{ in/min X 1000}}$$

   $$= 29.7 \text{ kilojoules}$$

Thus, it can be seen that the actual heat input for each draw bead is well within considered acceptable limits.

Anticipated Oxygen Content

Area of concern is located in the 6-inch, schedule 160, vertical pi[illegible] run leading to the pressurizer relief valve at an elevation approxi[illegible]ely level with the top of the pressurizer. The environment is saturated steam at 650° F and 2485 lb/in^2.

Based on the best information available to us from Westinghouse and operating utilities:

1. Maximum oxygen content in the reactor coolant water is controlled to less than 0.1 p/m at temperatures above 180° F by scavenging with hydrazine.

2. During power operation, the residual oxygen concentration will not exceed 0.005 p/m.

3. The highest calculated oxygen concentration expected in the steam is less than 0.2 p/m.

4. EPRI information gives 6 p/m as the threshold value below which IGSCC will not occur in 316 stainless steel (reference GE report No. NEDC-23750-6 dated November 1979, "Alternate Alloy for BWR Pipe Applications, Third Semiannual Progress Report."

It may therefore be concluded that the oxygen environment is not sufficient to produce IGSCC.

Summary

Based on the foregoing discussion and the information given to Mr. Gustafson at the Sequoyah meeting, the following conclusions may be reached:

1. Intergranular stress corrosion cracking (IGSCC) will not occur because:

   a. Satisfactory results of an ASTM A262, Practice E test, on a mockup of a worst case situation indicates that the material (316 stainless steel in the existing condition) is not susceptable to IGSCC.

   b. Residual stresses produced in the weld area will be compressive and, consequently, will not contribute to IGSCC.

   c. Environment for IGSCC does not exist due to low oxygen concentration.

2. Stresses produced by the draw bead technique are considered to be equivalent to those in any other weld in the system and do not adversely affect the Sequoyah piping analysis.

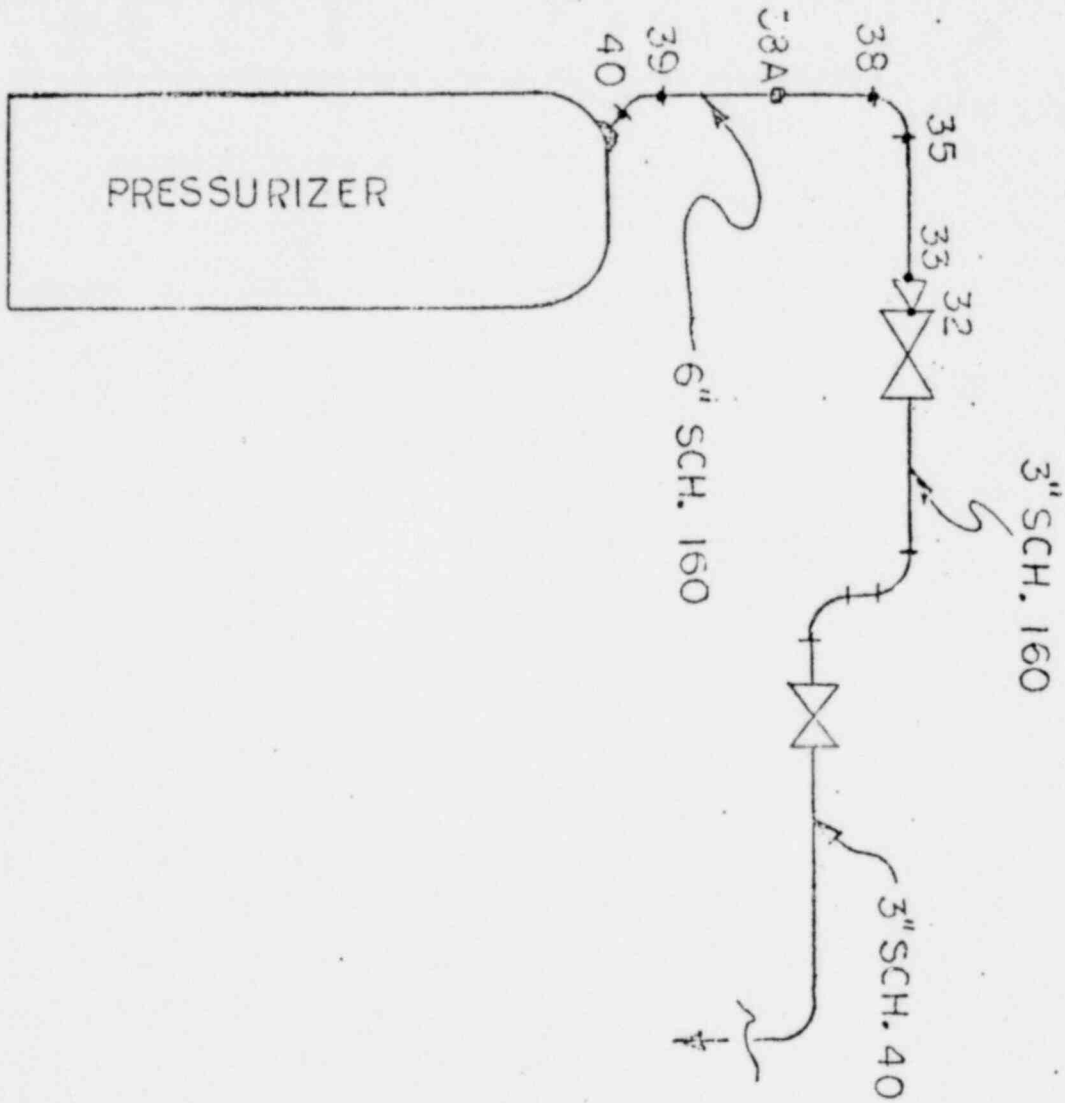
TVA concludes that the subject condition will not compromise safe operation of the plant. Furthermore, we have met or exceeded all licensing and code commitments for Sequoyah.

Enclosure 1

SUBJECT SQNP - Pressurizer Relief PROJECT

Piping Sketch

COMPUTED BY DATE CHECKED BY DATE

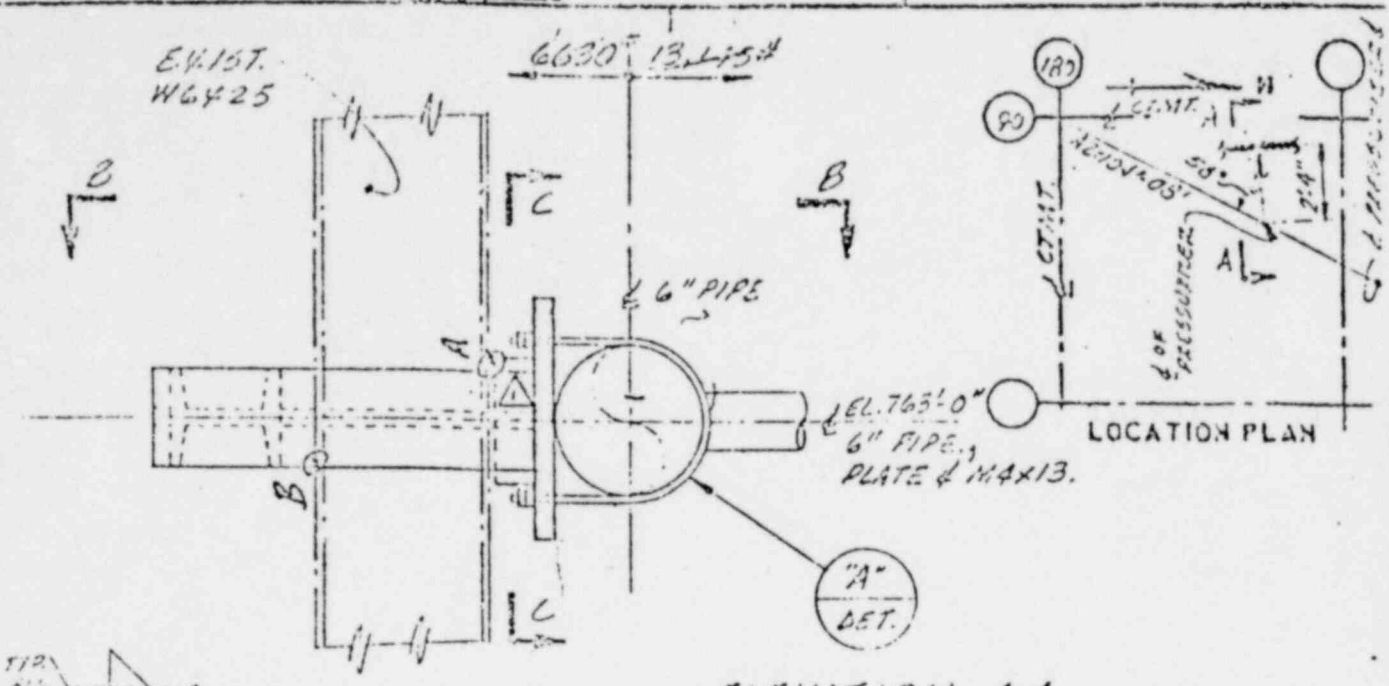


PRESSURIZER RELIEF PIPING SKETCH

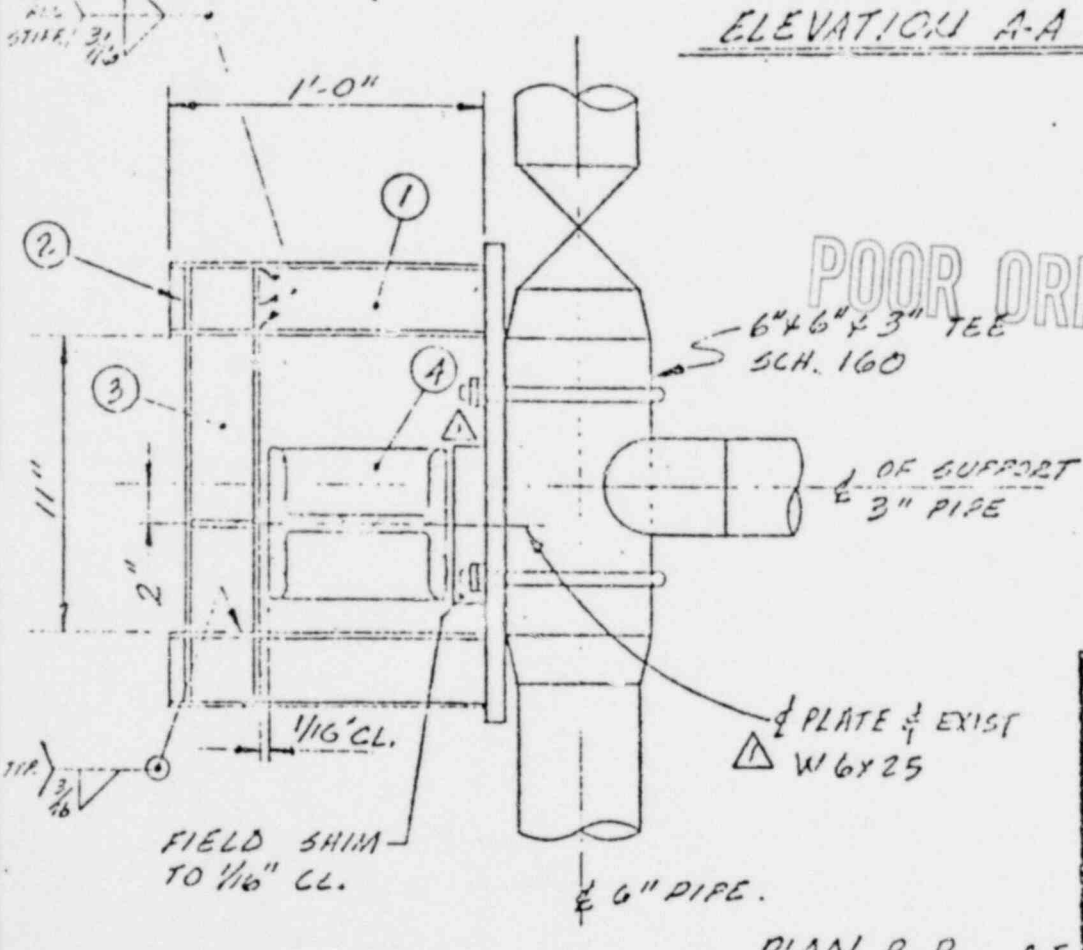
1816 043

CUSTOMER: SEQUOYAH NUCLEAR PLANT UNIT # 1
PIPING CONT. NAVCO. TVA 71C33-32615
ITEM NO. 1

SERVICE: REACTOR COOLANT



ELEVATION A-A



PLAN B-B

POOR ORIGINAL

1816 044

13-03 REV. 0 PT. 3

DESIGN LOAD	+	−
Fx Lbs.	5960	132
Fy Lbs.	−	−
Fz Lbs.	13,030	291

1	EFT	[illegible]	RC	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]

Iso. #: [illegible] Area: [illegible] NUCLEAR T.V.A. CLASS "A"

DWN. [illegible] CHKD. [illegible] DATE [illegible]

REF. DWGS. [illegible]

BASIC ENGINEERS
PITTSBURGH, PENNSYLVANIA 15201
DIVISION OF NATIONAL VALVE AND MANUFACTURING CO.

FILE PRIN

S.O. 62-4150-1[illegible]

SHEET [illegible]

TVA APPROVED

DESIGNED AND DETAILED BY EDS

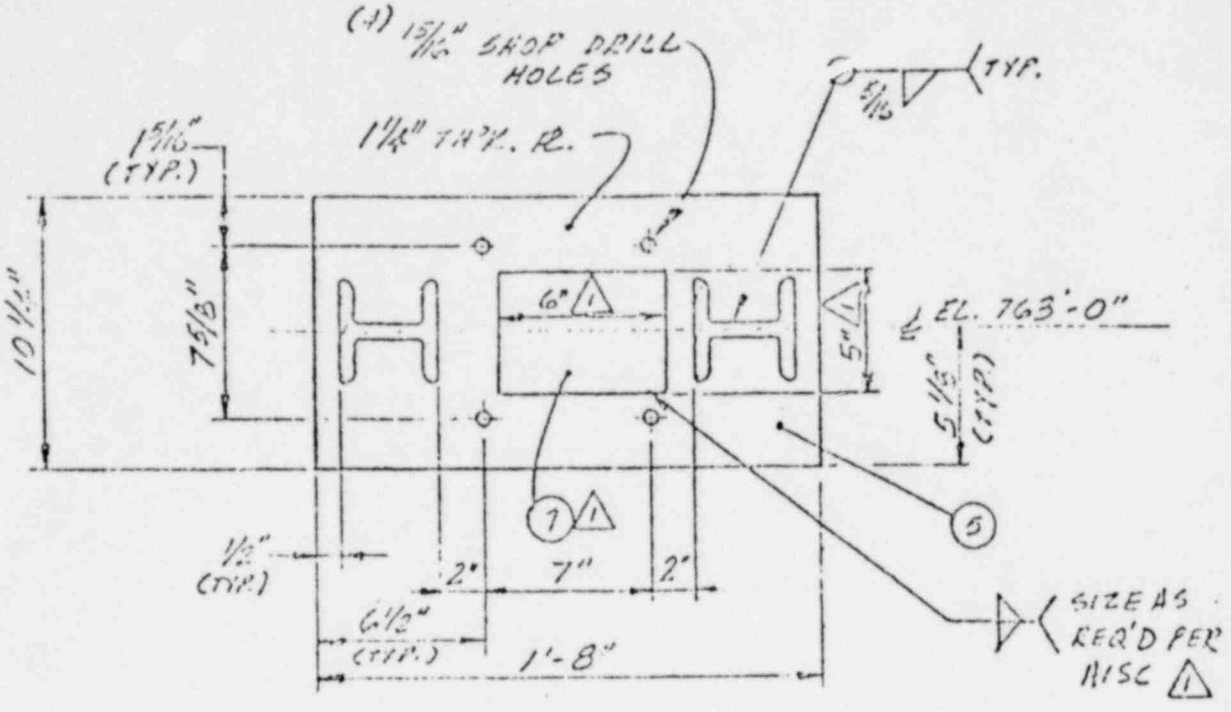
CONTRACT NO. 71C33-32604

EDS Nuclear Inc
San Francisco

Enclosure 2 (p. 2 of 3)

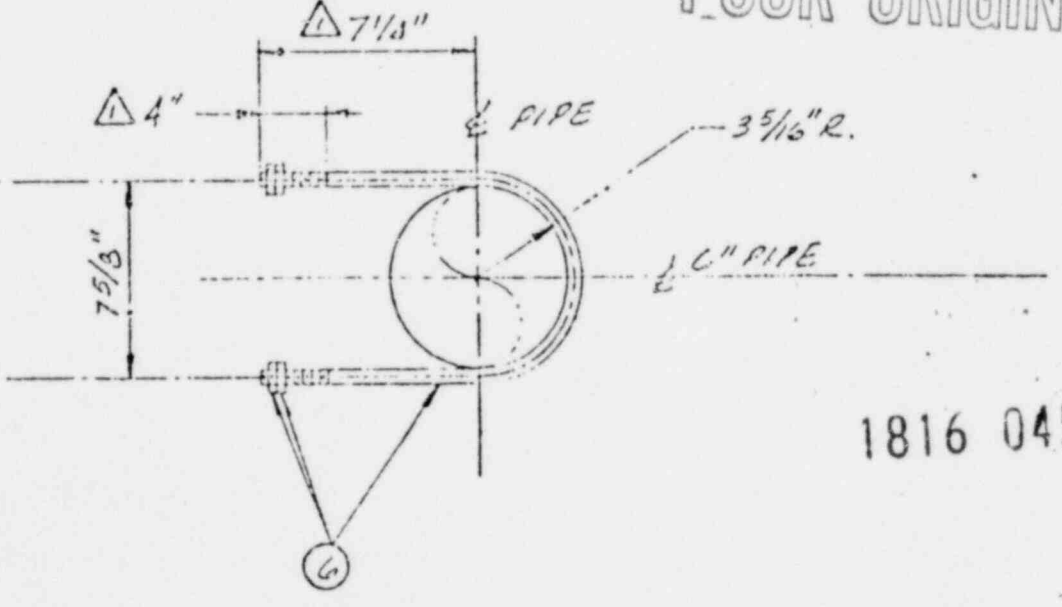
CUSTOMER: SEQUOYAH NUCLEAR PLANT UNIT # 1
PIPING CONT. NAVCO. TVA 77C38-92615
ITEM NO. 1

SERVICE: REACTOR COOLANT



SECTION C-C

POOR ORIGINAL



1816 045

DETAIL "A"

DRWN. [illegible] CHKD.
DATE [illegible] DATE

REF. DWGS. [illegible]

BASIC ENGINEERS
PITTSBURGH, PENNSYLVANIA 15201
DIVISION OF NATIONAL VALVE AND MANUFACTURING CO.

S.O. EE-4140-1L
SHEET [illegible]

TVA APPROVED
BILLING CODE
DESIGNED AND DETAILED TO BE
CONTRACT
For Construction

Enclosure 2 (Pg 3 of 3)

CUSTOMER: SEQUOYAH NUCLEAR PLANT UNIT # 1
PIPING CONT. NAVCO. TVA 71C38-92515
ITEM NO. 1

SERVICE: REACTOR COOLANT

MATERIAL AND OPERATIONS FOR SIZE 6" MK. NO. 1-ECH-93

ASSEMBLIES 1 REQUIRED

PCS.	FOR 1 HORIZONTAL RESTRAINT.	WT.	UNIT PRICE
2	① W4x13, 1'-0" LG.		
10	② 3/8" C.S. STIFFENER PLATES FOR W4x13.		
1	③ W4x13, 0'-11" LG.		
2	④ 3/8" C.S. STIFFENER PLATES FOR EXIST. W8x35.		
1	⑤ 1½" x 10 1/4" C.S. PLATE, 1'-8" LG.		
2	⑥ EE-151, 7/8" ϕ x 2½" LG. 6" ϕ PIPE, D = 7 15/16" E = 4", C = 7 1/2", W1/(4) - 7/8" ϕ HEX NUTS 2'-2½" LG. SPEC. ASTM		
1	⑦ 5" x 6" C.S. PLATE, FIELD TO DETERMINE THICKNESS		

BY TVA

PAINT CARBO-WELD 11 PRIMER BY TVA

POOR ORIGINAL

1816 046

DRWN. CHKD. DATE DATE

REV. 1 2 3 4

REF. DWGS.

BASIC ENGINEERS
PITTSBURGH, PENNSYLVANIA 15201
DIVISION OF NATIONAL VALVE AND MANUFACTURING CO.

P.O. 41C6-14C
SHEET 1-23-93

BILLING COPY
DESIGNED AND DETAILED BY BAS
CONTRACT NO. 71C38-92515
TVA APPROVED

Enclosure 3

Table of Stress Levels

Joint	Stress	Allowable Stress
32	38,215	60,000
33	41,300	60,000
35	18,283	60,000
38	27,083	60,000
38A	23,648	60,000
39	24,754	60,000
40	17,064	60,000

Enclosure 4

TENNESSEE VALLEY AUTHORITY
KNOXVILLE, TENNESSEE 37902
W10C126,400 Commerce Avenue

May 30, 1979

Westinghouse Electric Corporation
Post Office Box 355
Pittsburgh, Pennsylvania 15230

Attention: Mr. M. A. Siano

Gentlemen:

SEQUOYAH NUCLEAR PLANT
NUCLEAR STEAM SUPPLY SYSTEMS
CONTRACT 68C60-91934
LETTER NO. 6349

NOZZLE LOADS APPLIED TO UNIT 1 PRESSURIZER RELIEF LINE NOZZLE (SO 145-01) - NZM-2-6(CW)

During hot functional testing at Sequoyah one of the supports on the pressurizer relief piping seized and would not permit free movement of the pipe; therefore, some yielding occurred in the piping. We have calculated moments and forces for the pressurizer nozzle for the temperature transient which resulted in the bend pipe. The pipe was assumed to act elastically; therefore, we believe that these loads are conservative.

Please review for acceptability the following nozzle loads which are in local coordinates.

Fx(Lbs)	Fy(Lbs)	Fz(Lbs)	Mx(Ft-Lbs)	My(Ft-Lbs)	Mz(Ft-Lbs)
-442	-16,302	993	-20,357	858	-13,664

Your expedient reply will be appreciated.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Original signed by
L. M. Chin

D. R. Patterson, Chief
Mechanical Engineering Branch

cc: Mr. R. E. Lyman

5/24

Enclosure 5

TVA-7495

Westinghouse Electric Corporation
Water Reactor Divisions

Nuclear Technology Division
Box 355
Pittsburgh Pennsylvania 15230

June 4, 1979
TVA Contract No. 58C60-91934
NMT-ST-312
S.O. TVA/TEN-130

4

Mr. D. R. Patterson, Chief
Mechanical Engineering Branch
TENNESSEE VALLEY AUTHORITY
400 Commerce Avenue, W10 C126
Knoxville, Tennessee 37902

Ref.: 1) Letter No. 6349.

NMR

Dear Mr. Patterson:

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT
UNIT NUMBERS 1 AND 2

Loads Applied to Unit 1 Pressurizer Relief Nozzle

The loads for the Unit 1 pressurizer relief nozzle presented in the above referenced letter have been evaluated and are acceptable. The loads resulted from a seized relief pipe support during hot functional testing. For the evaluation the loads were compared with the normal and upset condition allowables for primary plus secondary stresses. It was assumed that there would be only one occurrence of this loading condition, therefore, the fatigue life of the nozzle will not be effected.

If you have any questions concerning the evaluation, please contact me.

Very truly yours,
WESTINGHOUSE ELECTRIC CORPORATION

M. A. Siano, Manager
Tennessee Valley Authority
Projects

JUN 14 1979

D. R. Patterson - 3L

cc: R. E. Lyman - 1L
F. E. Rolston - 1L
C. E. Brewer - 1L
L. M. Mills - 1L

DRP:AH CC:	DRAFT REPLY	COM. COPY	INFO COPY	DUE DATE
EEB, W8C126C-K				
CEB, W9C126C-K			L	
EGB				
CAC				
GFD (RIAS)			I	

1816 049

D. W. Williams
X-4184 4/15/79

MEDS, E4B37 C-K

MASTER FILE NZM-2-1e

ENCLOSURE 6

NODE 13A 1303 STRESSES

		Nominal Stresses lb/in^2	
1.	Blowdown	238	
2.	Gravity (DW)	159.5	
3.	Abnormal Thermal W/PRT	1419.5)	) Use worst thermal and cold spring
4.	Normal Thermal	1607.1)	
5.	Cold Springing W/PRT	2225.6)	
6.	Startup Thermal Mode W/PRT	2446.4)	
7.	OBEXY: Loop A Modes 1 to 17	268.3)	) Use worst
8.	OBEYZ: Loop A Modes 1 to 17	803.9)	
9.	Pressure: Stress @ 2485 lb/in^2 design	3,943 lb/in^2	

Intensification factor is 1.8 for butt weld.

Sum of all stresses for the above load cases:

238 + 160 + 2226 + 2447 + 804 + 3943 = 9818 lb/in^2 nominal

9818 X 1.8 SIF = 17,672 lb/in^2

Allowable = 1.8 Sh for occasional loads

Sh for A376 TP 316 at 650^0 F = 16,700 lb/in^2

Allowable = 1.8 X 16,700 lb/in^2
= 30,240 lb/in^2

and stresses in this area are acceptable.