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P.O. BOX 33189
CHARLOTTE, N.C. 28242

HAL B. TUCKER
VICE PRESIDENT
NUCLEAR PRODUCTION

TELEPHONE
(704) 373-4531

September 27, 1982

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Ms. E. G. Adensam, Chief
Licensing Branch No. 4

Re: Catawba Nuclear Station
Docket Nos. 50-413 and 50-414

Dear Mr. Denton:

On April 6 and 7, 1982 (in Bethesda) and April 19-22, 1982 (in Charlotte) representatives from Duke Power, Westinghouse, the NRC Mechanical Engineering Branch (MEB), and Pacific Northwest Labs (MEB consultant) met to discuss agenda items transmitted by Ms. E. G. Adensam's letter of January 29, 1982.

Attached is the meeting summary which discusses all agenda items except 35, 63, 77, 78, 86, 96, and 117-121, which will be provided later. The response to Item 109 contains proprietary information and is being transmitted by separate letter.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

ROS/php
Attachment

B001

cc: (w/o attachment)
Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

Limited Dist

Mr. P. K. Van Doorn
NRC Resident Inspector
Catawba Nuclear Station

Mr. Robert Guild, Esq.
Attorney-at-Law
314 Pall Mall
Columbia, South Carolina 29201

cc: (w/o attachment)
Palmetto Alliance
2135½ Devine Street
Columbia, South Carolina 29205

Mr. Jesse L. Riley
Carolina Environmental Study Group
854 Henley Place
Charlotte, North Carolina 28207

Mr. Henry A. Presler, Chairman
Charlotte-Mecklenburg Environmental Coalition
943 Henley Place
Charlotte, North Carolina 28207

(w/attachment)
Mr. Gordon Beeman
Pacific Northwest Laboratories
P. O. Box 999
Richland, Washington 99352

MEB Review Meeting
April 19, 1982

Name	Organization
M. L. Childers	Duke - Design/SRAL
L. B. Castles	Duke - Design/MDPE
R. R. Weidler	Duke - Design/MDPE
R. W. Ouellette	Duke - Steam/Licensing
D. P. Norkin	NRC
D. Terao	NRC - MEB
Bob Bosnak	NRC - MEB
H. L. Brammer	NRC - MEB
C. L. Hartzell	Duke - Catawba
R. O. Sharpe	Duke - Steam/Licensing
T. F. Wyke	Duke - Design/Mechanical&Nuclear
H. E. Vanpelt	Duke - Design/Catawba SAG
D. L. Caldwell	Duke - Design/CSAG
C. L. Ray	Duke - Design/Mechanical&Nuclear
G. D. Marr	PNL/MEB-NRC
G. H. Beeman	PNL/MEB-NRC

MEB Review
Attendance List
April 20, 1982

Name	Organization
M. L. Childers	Duke - Design/SRAL
R. W. Ouellette	Duke - Steam/Licensing
C. B. Cheezem	Duke - QA
R. R. Weidler	Duke - Design M/N
L. B. Castles	Duke - MDPE
Bob Bosnak	NRC/MEB
Jim Brammer	NRC/MEB
David Terao	NRC/MEB
Gordon Beeman	PNL/NRC-MEB
Grant Marr	PNL/NRC-MEB
D. P. Norkin	NRC/IE
C. L. Ray	Duke - Design M/N
R. M. Dulin	Duke - Design M/N
D. L. Caldwell	Duke - Design M/N
R. W. Bonsall	Duke - Design M/N
H. E. Vanpelt	Duke - Design M/N
C. L. Hartzell	Duke - Catawba P&L
D. H. Stout	Duke - Design M/N
D. L. Ward	Duke - Design M/N

MEB Review
Attendance List
April 21, 1982

Name	Organization
M. L. Childers	Duke - Design/SRAL
R. W. Ouellette	Duke - Steam/Licensing
Bob Bosnak	NRC - MEB
Jim Brammer	NRC - MEB
David Terao	NRC - MEB
Gordon Beeman	PNL - NRC/MEB
Grant Marr	PNL - NRC/MEB
C. L. Ray	Duke - Design/M&N
D. L. Rehn	Duke - Design/C/E
M. C. Green	Duke - Design/C/E
R. W. Bonsall	Duke - Design/M&N
M. H. Jansen	Duke - Design/M&N
E. C. Rodabaugh	Consultant/ORNL/NRC
S. E. Moore	ORNL
C. H. Boyd	W - SEED
R. W. Beer	W - Equipment Eng.
C. B. Gilmore	W - SEED
J. S. Galembush	W - Nuclear Safety-RCSCL
N. R. Singleton	W - SEED
I. C. Ratsep	W - Duke Projects Licensing
K. N. Jabbour	NRC/DOL/LB#4

MEB Review
April 22, 1982
Attendence List

Name	Organization
M. L. Childers	Duke - Design/Licensing
R. W. Ouellette	Duke - Steam/Licensing
R. A. Jones	Duke - Catawba/Steam
W. R. McCollum	Duke - Catawba/Steam
K. N. Jabbour	NRC/DL/LB#4
H. L. Brammer	NRC/DL/MEB
Bob Bosnak	NRC/MEB
David Terao	NRC/MEB
Gordon Beeman	PNL-NRC/MEB
D. L. Caldwell	Duke - Design
R. M. Dulin	Duke - Design
G. E. Hedrick	Duke - Design
R. C. Gamberg	Duke - Design
C. L. Hartzell	Duke - Steam/Station Licensing

Item 1 - Table 3.2.1, page 1

Explain the reasons behind the classification of the "Waste Evaporator Feed" and the "Vent. Unit Cond. Drain".

Response:

Applying the criteria in NRC Regulatory Guide 1.26, Revision 3, the Waste Evaporator Feed Tank and Ventilation Unit Condensate Drain Tank are in NRC Quality Group D and, consequently, are not required to be seismically designed. However, to minimize the impact of a seismic event on the plant environment, these tanks are seismically Designed at Catawba.

Table 3.2.1-2 (page 1) will be revised (as attached) to show these tanks as Duke Seismic Cateogry II equipment, with qualification to OBE and SSE criteria. This corresponds to Duke Class F equipment.

Table 3.2.1-2 (Page 3)
Summary [illegible] Equipment

Equipment	[illegible]	Quality Assurance Required	(Note 1) Category	Code	Location	(Note 2) Rad Source	Seismic OBE	Seismic SSE	Tornado Wind	Tornado Missile	Remarks - Including Any Environmental Requirements
Cranes											
Containment Polar Crane	C	X	I	As Applicable	C	-	X	X	-	-	Containment Accident Pressure, Dead and Equipment, Live Loads, Hold Down Device, Note 1
Cask Crane	D	X	I	As Applicable	AB	-	X	X	-	-	Dead and Equipment, Live Loads, Hold Down Device, Note 1
Cranes (Excluding Reactor Building and Fuel Handling)	D	-	III	As Applicable	-	-	-	-	-	-	Dead and Equipment, Live Loads
Refueling Machine	W	X	I	As Applicable	C	-	X	X	-	-	
Fuel Handling Machine	W	X	I	As Applicable	AB	-	X	X	-	-	
Tanks											
Recycle Monitor	D	-	III	ASME VIII	AB		-		-	-	Class E
Laundry and Hot Shower	D	-	III	ASME VIII	AB		-	-	-	-	Class F
Waste Monitor	D	-	III	ASME VIII	AB		-	-	-	-	Class F
Mixing and Settling	D	-	III	ASME VIII	AB		-	-	-	-	Class E
Mixing and Settling Reagent	D	-	III	ASME VIII	AB		-	-	-	-	Class E
Floor Drain	D	-	III	ASME VIII	AB		-	-	-	-	Class E
Chemical Drain	D	-	III	ASME VIII	AB		-	-	-	-	Class E
RCP Motor Oil Drain	D*	X	I	ASME VIII	C				-	-	See our Table 3.2.2-2
Waste Gas Decay	D	X	I	ASME III	AB		X	X	-	-	
Waste Drain	D	X	I	ASME III	AB		X	X	-	-	
*Waste Evaporator Feed	D	X	I II	ASME VIII	AB		X	X	-	-	Class F
*Vent. Unit Cond. Drain	D	X	~~I~~ II	ASME VIII	AB		X	X	-	-	Not Code Stamped Class F
Spent Resin Storage	D	X	I	ASME III	AB		X	X	-	-	
Refueling Water Storage	D	X	I	ASME III	YD		X	X	X	-	
Reactor Makeup Water Storage	D	-	III	ASME VIII	YD		-	-	X	-	Not Code Stamped
Boron Recycle Holdup	D	X	I	ASME III	AB		X	X	See Note (4)	See Note (4)	
Boric Acid	D	X	I	ASME III	AB		X	X	See Note (4)	See Note (4)	
Fuel Oil Storage	D	X	I	ASME III	YD		X	X	-	-	Buried - Not Code Stamped
Component Cooling Surge	D	X	I	ASME III	AB		X	X	-	-	
Steam Gen. Blowdown	D	-	III	ASME VIII	TB		-	-	-	-	
Backwash	D	-	III	ASME VIII	TB		-	-	-	-	Not Code Stamped
Upper Surge	D	-	III	ASME VIII	TB		-	-	-	-	
Condensate Storage	D	-	III	ASME VIII	TB		-	-	-	-	Not Code Stamped
Upper Surge Dome	D	-	III	ASME VIII	TB		-	-	-	-	
Evap. Concentrate Holdup	D	-	III	ASME VIII	AB		-	-	-	-	Class E - Not Code Stamped
Demin. Water Storage	D	-	III	ASME VIII	SB		-	-	X	-	
Heater Blowoff	D	-	III	ASME VIII	TB		-	-	-	-	
[illegible] Heater Drain	-	-	III	ASME VIII	TB		-	-	-	-	
R.W. Storage	D	-	III	ASME VIII	SB		-	-	-	-	Not Code Stamped
Turbine Oil Transfer	-	-	III	ASME VIII	TB		-	-	-	-	Not Code Stamped
Fire Protection [illegible]		-	III	ASME VIII	SB			-	-	-	
Filtered Water	-		III	ASME VIII	SB		-	-	X	-	Not Code Stamped
K.T. Sulfuric Acid	D		III	ASME VIII	YD		-	-	X	-	Not Code Stamped
Evap. Concentrates Batch	D	-	III	ASME VIII	AB		-	-	-	-	Class E - Not Code Stamped

Attachment Item #1

Rev 1

Item 2 - Table 3.2.1 page 2

Provide safety related category for RCP Motor Oil Fill Tank.

Response:

Refer to response to Item 117.

Item 3 - 3.2.2.1, page 3.2-3

Where has an orifice of size 3/8" ID been sued to protect a component in the reactor coolant pressure boundary?

Response:

The criteria used to define the Class 1/Class 2 interface for the reactor coolant system were briefly discussed. It was identified that a 3/8" orifice is used to define the Class 1/Class 2 boundary because a break downstream of the orifice can be handled by the normal charging system. The Staff concerns involved what type of piping was downstream of the orifice. It was verified that Class 2 piping was connected downstream of any 3/8" reactor coolant system pressure boundary orifice. Based on the above discussions, this item was closed.

Item 4 - 3.2.2.1, page 3.2-4

The applicant states that Safety Class 2 applies to components of the reactor coolant pressure boundary not covered in Safety Class 1.

What components of the reactor coolant pressure boundary are not Safety Class 1?

Response:

This item was discussed in conjunction with Item 3 and relates to the classification of certain components which make up the reactor coolant pressure boundary as Class 2. It was pointed out that when a 3/8" orifice is used to define the Class 1 RCS pressure boundary, components downstream of the orifice (which are part of the RCS pressure boundary) are Class 2. Typically, such Class 2 components consist of small piping and valves. It was also pointed out that there are no Class 2 components in the RCS pressure boundary unless they are located on the Class 2 side of the Class 1/Class 2 pressure boundary interface as defined in Section 3.2 of the Catawba FSAR. Based on the above discussions, this item was resolved.

Item 5 - Table 3.2.2-2, page 1

Auxiliary Steam System references Note 22. Where is Note 22? It is also referenced on pages 3, 7, 8, 11, 13, and 14.

Response:

Note 22 is provided (see attached).

Table 3.2.2-2 (Page 16)

NOTES (Cont'd)

(9) X = Protected by virtue of location in a structure designed for tornado wind and missiles

(10) As Applicable

(11) Tank is provided with diaphragm membrane for oxygen exclusion

(12) Performance test required

(13) Redundant electric heaters are supplied

(14) AMCA Class III and performance tested in accordance with AMCA Standard Test Code for air moving devices.

(15) United Laboratories

(16) Tanks are designed for all external forces due to soil and water, including buoyancy

(17) ASME Code Case 1205

(18) The Diesel Generator Engine and engine mounted components and piping are Seismic Category I, seismically qualified in accordance with IEEE Standard 344-1975. The seismic qualification stems from a modal analysis based on mathematical model derived from experimentally generated data from low level inpedance test performed by the manufacturer. Tests were conducted under two excitation spectrums (2-13 Hz and 9-35 Hz) to cover the relavent frequency band of the seismic disturbance. The results of the modal analysis, published by Delaval in report number 75017-705 Volumes I, II, and III, constitutes the seismic qualification.

(19) ASME, C13

(20) See Table 6.2.5-1

(21) As documented in Engineering Justification Report SES-JR-10, the one inch containment isolation valves for this system were purchased as Duke Class F instead of Duke Class B. This was necessary due to the high system design pressure (8000 psig) which exceeded the pressure/temperature ratings of the ASME Section 111 Code.

(22) Seismically qualified per IEEE Standard 344.

(23) Exceptions:

a. Evaporator vessels are seismic.
b. Steam supply piping is seismic and built to ANSI-B31.1.0 (1967).
c. Component cooling water supply piping is built to ASME III, Class 3.

Item 6 - Table 3.2.1-2, page 4

Explain the reasons behind the ASME Code and Safety Class classifications of Fuel and Control Rod Assemblies and Burnable Poison Rod Assemblies and Control Rod Drive Mechanisms.

Response:

The classification of various components in Table 3.2.2-2 were discussed and clarified as follows:

a. Fuel Assemblies - It was pointed out that the criteria used to clarify components in ANS 18.2 are presently geared to fluid systems components and that fuel assemblies did not specifically fit into this criteria. Thus, ANS safety classficiation for fuel assemblies in the Catawba FSAR were defined as N/A (not applicable). However, if you apply a broad interpretation of the ANS criteria to fuel assemblies they can be classified as ANS Safety Class 2 because they are used to direct flow through the core and remove heat from the core. It was also pointed out that the fuel assemblies for Catawba are designed and fabricated in accordance with requirements for an ANS Safety Class 2 component. Based on the above, Table 3.2.2-2 (attached) has been revised to reflect an ANS Safety Class 2 classification.
b. Control Rod Assemblies - The classification in Table 3.2.2-2 was correct and no further clarification of this item was required.
c. Burnable Poison Rods - This component is defined as non-nuclear safety (NNS) because it does not perform any function required to shutdown the plant. Consequently, the ANS Safety Classification (NNS) in Table 3.2.1-2 is correct. Based on the above, this item was resolved.
d. Control Rod Drive Mechanisms (CRDM's) - The classification of this component was discussed in detail. The CRDM pressure housing should be classified as ANS Safety Class 1 and ASME Code Class 1. The non-pressure boundary portions

of the CRDM's are classified as non-nuclear safety (NNS). Table 3.2.2-2 (attached) has been revised to reflect the above classification. Based upon the above, this item was resolved.

Based on the above discussions and the attached revisions to Table 3.2.2-2 this item was resolved.

ATTACHMENT 10 ITEM 6

Table 3.2.2-2 (Page 4a)

Summary of Criteria - Mechanical System Components

System	Component or System	(2) Scope	(3) Safety Class	(4) Code	(5) QA Reqd.	(6) Location	(7) Rad. Source	(8) Seismic OBE	(8) Seismic DBE	(9) Tornado Wind	(9) Tornado Missile
6	Fuel Assemblies	W	NA 2	-	X	C	X	X	X	X	X
	Control Rod Assemblies	W	2	-	X	C	X	X	X	X	X
	Burnable Poison Rod Assemblies	W	NNS	-	-	C	X	-	-	X	X
7	Reactor Vessel Internals	W	2	III-2 N/A	X	C	X	-	-	X	X
	Control Rod Drive Mechanisms (NON PRESSURE BOUNDARY)	W	NNS	-	-	C	X	X	X	X	X
	Reactor Coolant Pumps	W	1	III-1	X	C	X	X	X	X	X
	Steam Generators (tube)	W	1	III-1	X	C	X	X	X	X	X
	(shell)	W	2	III-2	X	C	X	X	X	X	X
	Pressurizer	W	1	III-1	X	C	X	X	X	X	X
	Pressurizer Relief Valves	D	1	III-1	X	C	X	X	X	X	X
	Pressurizer Safety Valves	D	1	III-1	X	C	X	X	X	X	X
	Pressurizer Relief Tank	W	NNS	VIII	-	C	X	-	-	X	X
	RC Pump Motor Drain Tanks	D	NNS	VIII	-	C	X	-	-	X	X
	RC Pump Motor Drain Tank Pump	D	NNS	-	-	C	X	X	X	X	X
	Valves	D	1,2,3,NNS	III-1,2,3 B31.1.0	X	C,AB	X	-	-	X	X
	Pressurizer Relief Tank Sump Vessel	D	NNS	(10)	-	AB	X	-	-		
6	CONTROL ROD DRIVE MECHANISM (PRESSURE HOUSING)	W		ASME III-1	X	CD		X	X		

Item 7 - Table 3.2.1-2, page 4

Explain the ASME Code and Safety Class classification of the reactor vessel internals.

Response:

The reactor internals for the Catawba plant were fabricated prior to implementation of sub-section NG of the ASME Code. However, the reactor internals were designed and fabricated consistent with the requirements of the ASME Code but do not have a specific code stress report or stamp. In order to reflect the actual as-built criteria for the reactor internals, Table 3.2.2-2 (attached) has been revised to indicate that the ASME Code is not applicable. Additionally, Section 3.9.3 has been revised as discussed in Item 113 to indicate that the above criteria are applicable to the reactor internals. It was also pointed out that the reactor internals designation includes core support structures. Based on the above and the revised FSAR sections, this item was resolved.

ATTACHMENT TO ITEM 1

Table 3.2.2-2 (Page 4a)

Summary of Criteria - Mechanical System Components

System	Component or System	(2) Scope	(3) Safety Class	(4) Code	(5) QA Reqd.	(6) Location	(7) Rad. Source	(8) Seismic OBE	(8) Seismic DBE	(9) Tornado Wind	(9) Tornado Missile
A	Fuel Assemblies	W	NA 2	-	X	C	X	X	X	X	X
	Control Rod Assemblies	W	2	-	X	C	X	X	X	X	X
	Burnable Poison Rod Assemblies	W	NNS	-	-	C	X	-	-	X	X
7	Reactor Vessel Internals	W	2	III-2 N/A	X	C	X	X	X	X	X
	Control Rod Drive Mechanisms (NON PRESSURE BOUNDARY)	W	NNS	-	-	C	X	-	-	X	X
	Reactor Coolant Pumps	W	1	III-1	X	C	X	X	X	X	X
	Steam Generators (tube)	W	1	III-1	X	C	X	X	X	X	X
	(shell)	W	2	III-2	X	C	X	X	X	X	X
	Pressurizer	W	1	III-1	X	C	X	X	X	X	X
	Pressurizer Relief Valves	D	1	III-1	X	C	X	X	X	X	X
	Pressurizer Safety Valves	D	1	III-1	X	C	X	X	X	X	X
	Pressurizer Relief Tank	W	NNS	VIII	-	C	P	-	-	X	X
	RC Pump Motor Drain Tanks	D	NNS	VIII	-	C	P	-	-	X	X
	RC Pump Motor Drain Tank Pump	D	NNS	-	-	C	P	-	-	X	X
	Valves	D	1,2,3,NNS	III-1,2,3 B31.1.0	X	C,AB	X	X	X	X	X
	Pressurizer Relief Tank Sump Vessel	D	NNS	(10)	-	AB	X	-	-	X	X
6	CONTROL ROD DRIVE MECHANISM (PRESSURE HOUSING)	W	1	ASME III-1	X	CB		X	X		

Item 8 - Table 3.2.2-2, page 6

The table shows the Nuclear Sampling System as NNS, Code III-3 but not seismically designed. Is this consistent?

Response:

Listing, the Nuclear Sampling System as NNS, Code III-3 but not seismically designed is not consistent. The Sample coolers are B31.1 (non-seismic). Table 3.2.2-2 (page 6) will be revised accordingly (as attached).

Question #8

Agenda Item #8 - Attachment

Table 3.2.2-2 (Page 6)

Summary of Criteria - Mechanical System Components

System	Component or System	(2) Scope	(3) Safety Class	(4) Code	(5) QA Reqd.	(6) Location	(7) Rad. Source	(8) Seismic OBE	DBE	(9) Tornado Wind	Missile
	Valves	D&W	1,2,3	III-1,2,3	X	C,AB	P	X	X	X	X
	Gas/Water Inter. Membrane	W	2	III-2	X	AB	-	X	X	X	X
NM	Nuclear Sampling System										
	Sample Vessels	D	NNS	(10)	-	AB	X	-	-	X	X
	Sample Heat Exchanger (tube)	D	NNS	[illegible]	-	AB	X	-	-	X	X
	(shell)	D	NNS	[illegible]	-	AB	X	-	-	X	X
	Delay Coil	D	2	III-2	X	C	X	X	X	X	X
	Valves	D	2,3	III-2,3	X	C,AB	X	X	X	X	X
NR	Boron Thermal Regeneration System										
	Heat Exchangers										
	Moderating (tube)	W	3	III-3	X	AB	X	X	X	X	X
	(shell)	W	3	III-3	X	AB	X	X	X	X	X
	Letdown Chiller (tube)	W	3	III-3	X	AB	X	X	X	X	X
	(shell)	W	NNS	VIII	-	AB	-	-	-	X	X
	Letdown Reheat (tube)	W	2	III-2	X	AB	X	X	X	X	X
	(shell)	W	3	III-3	X	AB	X	X	X	X	X
	Chiller Units	W	NA	-	-	AB	-	-	-	X	X
	Chiller Surge Tanks	W	NNS	VIII	-	AB	-	-	-	X	X
	Boron Chiller Pumps	W	NA	III-3	-	AB	-	-	-	X	X
	NR Thermal Regeneration Demineralizers	W	3	III-3	X	AB	X	X	X	X	X
	Valves	D	2,3	III-2,3	X	AB	X	X	X	X	X
NS	Containment Spray System										
	Containment Spray Pumps	D	2	III-2	X	AB	X	X	X	X	X
	Containment Spray HX (tube)	D	2	III-2	X	AB	X	X	X	X	X
	(shell)	D	3	III-3	X	AB	P	X	X	X	X
	Containment Spray Nozzles	D	2	-	X	C	P	X	X	X	X
	Valves	D	2	III-2	X	C	P	X	X	X	X
NV	Chemical and Volume Control System										
	Pumps										
	Reciprocating Charging	W	2	III-2	X	AB	X	X	X	X	X
	Centrifugal Charging	W	2	III-2	X	AB	X	X	X	X	X
	Boric Acid Transfer	W	3	III-3	X	AB	-	X	X	X	X
	Heat Exchangers										
	Regenerative	W	2	III-2	X	C	X	X	X	X	X
	Letdown (tube)	W	2	III-2	X	AB	X	X	X	X	X
	(shell)	W	3	III-3	X	AB	P	X	X	X	X
	Excess Letdown (tube)	W	2	III-2	X	C	X	X	X	X	X
	(shell)	W	2	III-2	X	C	P	X	X	X	X
	Seal Water (tube)	W	2	III-2	X	AB	X	X	X	X	X
	(shell)	W	3	III-3	X	AB	P	X	X	X	X

Rev. 2
Entire Page
Revised

Item 9 - Table 3.2.1-2, page 9

In the Diesel Generator Engine Starting Air System the starting air tanks are seismically designed yet the air compressors are not. How many starts can be provided by the air tanks?

Response:

FSAR section 9.5.6.2.1 addresses this concern. The starting air storage capacity of each redundant diesel engine is sufficient for a minimum of five successful engine starts without the use of the air compressors.

Item 10 - Table 3.2.1-2, page 15

Footnote 21 references Engineering Justification Report SES-JR-10. Provide a copy of this report.

Response:
A copy of Engineering Justification Report Number SES-JR-10 is attached.

• This response is to MEB Review Agenda item #10 - Table 3.2.1-2 pg 15

DUKE POWER COMPANY

DESIGN ENGINEERING - SYSTEMS AND EQUIPMENT SECTION

ENGINEERING JUSTIFICATION REPORT

Date: February 17, 1978	Report No: SES-JR-10
To: R. L. Dick	Originated By: V. H. Shellhorse 2-20-78
Station: Catawba 1-2	Checked By: E. D. Lindsay 2-20-78
System: Equipment Decontamination (WE)	Approved By: R E Miller 2-21-78
File No: CN-1205.01	QA Approval: C. A. Bell 3-7-78

Variation Reported By and Date: R. C. Bucy - January 30, 1978

Description of Variation:

Valves tagged 1,2/WE/20, 22 appear on flow diagrams CN-1568-1.0 and CN-2568-1.0. These valves have design conditions of 8000 psig @ 120°F, and are shown as Duke Safety Class B. Because of the high pressure class required, these valves cannot be purchased to ASME III, Class 2.

Engineering Analysis Required:

Review the system requirements and service to verify design conditions and Duke Safety Class. Identify alternate design code or standard, if appropriate.

Calculations:

None

Engineering Conclusion:

The valves are used in a containment isolation application which normally requires conformance with ASME III. The equipment decontamination system (WE) is not frequently used and will not be used within the containment during reactor operation. Valves designed for an internal pressure of 8000 psig and seismic loading provide adequate assurance of containment isolation under conditions of containment pressure following postulated LOCA. Purchase the valves to the best available codes and standards as Duke Safety Class F.

S. K. Blackley, Jr., Chief Engineer
Mechanical & Nuclear Division

V. H. Shellhorse

By: V. H. Shellhorse, Engineer Associate

/ah

cc: D. G. Beam (2)
D. G. Gardner
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R. C. Bucy
H. E. Edwards
J. W. Kosko (Catawba - AI)

Item 11 - Table 3.2.2-3

Footnote 1 states that Duke Power Company established an "effective code date" for the station in accordance with 10 CFR 50.55a, reviews and may elect to comply with portions or all the latest versions of the above codes. This is acceptable as long as different versions of the ASME Code are not used for evaluation of the same system or component. Provide a commitment to this effect.

Response:

Table 3.2.2-3 will be revised (as attached) to provide the following commitment:

> Specific provisions of ASME Code editions and Addenda later than those identified on the above table may be utilized with the mutual consent of Duke Power and the N Type Certificate Holder (if other than Duke). Whenever specific provisions of a later code are utilized, all related requirements will also be satisfied.

Item 12 - In the primary loop, what size breaks are postulated for the design of pipe whip restraints? What size breaks are postulated in the primary loop for determination of compartment pressurization and asymmetric loads? If breaks for either case are less than full size, provide justification.

Response:

Westinghouse presented information on the size of pipe breaks in the RCS which were assumed in the design and analysis. For breaks at the reactor vessel nozzle a break opening area of 85 square inches was assumed. All other circumferential breaks postulated in the RCS were full double-ended breaks. The above break sizes were used in the design of restraints, mass and energy release calculations (see FSAR Section 6.2.1.2), and reactor coolant system analysis including asymmetric LOCA load analyses.

The design of the RCS restraints was performed by Duke. Consequently, routine design information such as restraint stiffnesses, gaps, and loads were routinely exchanged as design information between Westinghouse and Duke. In the case of the reactor vessel nozzle restraints Westinghouse calculated break opening areas based on the Duke design. The results of this analysis were presented at the meeting. Actual break opening areas are less than 40 square inches. Thus, the assumed value of 85 square inches was conservative.

Based on the above, this item was resolved.

Item 13 - The FSAR states that breaks are postulated at locations where the cumulative usage factor exceeds 0.2 for normal and upset operating conditions.

(a) Breaks are to be postulated where the cumulative usage factor exceeds 0.1. Show that your analysis complies with the SRP.

(b) The criteria is evaluated under loadings resulting from normal and upset operating conditions including the OBE. Change this to comply with the SRP.

Response 13a:

The basis for a cumulative usage factor of 0.2 was discussed. Specifically, this factor was accepted by the Staff as part of their review and acceptance of WCAP 8082 on the basis that a sufficient number of breaks were postulated for the RCS. Westinghouse agreed to revise the FSAR and replace the specific cumulative usage factor of 0.2 with a reference to WCAP 8082 in the text of Section 3.6.

Based on the above discussion and the attached FSAR changes, this item was resolved

Response 3b:

As identified in Item 51, OBE loads are considered under the upset condition. Appropriate FSAR changes were made relative to Item 51.

Based on the above and Item 51, this item was resolved.

ATTACHMENT TO ITEM 13a

CNS

c) Damage to the high head safety injection lines connected to the other leg of the affected loop or to the other loops is prevented.

d) Propagation of the break to high head safety injection line connected to the affected leg is prevented if the line break results in a loss of core cooling capability due to a spilling injection line.

3.6.2.1.1.1 Postulated Piping Break Locations and Orientations

In each leg of the Reactor Coolant System, a minimum of three postulated rupture locations shall be selected in the following manner:

→ INSERT A

~~Breaks shall be postulated at the terminal end points and at all locations in a run or branch in which the cumulative usage factor exceeds 0.2 for normal and upset operating conditions or in which the range of primary plus secondary stress intensity for normal and upset operating conditions exceeds 80 percent of the ASME Section III Code allowable on an elastic basis (2.4 S). In the event that a location between the terminal end points cannot be chosen in this manner, the point of highest fatigue usage shall be used to obtain a total of three break locations.~~

At each possible break location, consideration must be given to the occurrence of either a circumferential or longitudinal break. As discussed in Reference 1, a circumferential rupture is more likely than a longitudinal rupture for reactor coolant piping. Only in the case of one elbow is a longitudinal rupture postulated.

Circumferential breaks are perpendicular to the longitudinal axis of the pipe.

Longitudinal breaks are parallel to the longitudinal axis of the pipe. Certain longitudinal break orientations may be excluded on the basis of the state of stress at the location considered.

For the main reactor coolant piping system, eleven discrete break locations were determined by stress and fatigue analyses. The locations are given in Table 3.6.2-1 and shown in Figure 3.6.2-2. The postulated locations conform to the criteria stated above and are discussed in Reference 1.

Break type at each discrete break location are presented in Table 3.6.2-1. The results of the analyses which lead to the break orientations are discussed in Reference 1.

3.6.2.1.1.2 Postulated Piping Break Sizes

For a circumferential break, the break area is the cross-sectional area of the pipe at the break location, unless pipe displacement is shown to be limited by analysis, experiment or physical restraint.

For a longitudinal break, the break area is the cross sectional area of the pipe at the break location unless analytically or experimentally shown otherwise. A longitudinal break area less than the cross sectional area of the

INSERT A

[For the reactor coolant system breaks are postulated as described in WCAP 8082 (Reference 1).

Item 14 - 3.6.2.1.1.2, page 3.6-9

Identify the analysis, experimental data or physical restraint characteristics which have been used to limit pipe displacement. For and breaks with areas other than the full cross-sectional area of the pipe.

Response:

As discussed in Item 12, limited breaks are assumed and justified at the reactor vessel nozzle. All other circumferential breaks are full double-ended breaks.

Based on the above and Item 12, this item was resolved.

Item 15 - 3.6.2.1.1, page 3.6-10

Item (b) mentions encased or jacketed piping. Where has it been used? Show that the required inservice inspection can be performed.

Response:

Duke provided drawings of the Main Steam Guard Pipe during the review meeting. Duke agreed to provide drawings which define break exclusion regions (as attached). Attached drawings show weld locations which will be subject to inservice inspection to comply with the break exclusion region requirements. For welds not marked, breaks will be postulated if required in accordance with FSAR Section 3.6. This item was closed.

SEE

APERTURE

CARDS

AVAILABILITY____PDR______CF________HOLD________

NUMBERS OF PAGES. 8

Item 16 - 3.6.2.1.1, page 3.6-11

Item j) provides criteria for describing the effects an impingement jet has on various sizes of target pipe.

It is the staff's position that this criteria has not yet been demonstrated to be valid when applied to jet impingement. Therefore, either:

1) Remove this criteria from the FSAR and provide a commitment to properly evaluate the cases where it was used; or
2) Demonstrate through experimental and analytical data that such criteria are, in fact, conservative and correct. (Note: The comparison to the whipping pipe recently proposed on the McGuire docket is not acceptable.)

Response:

Duke's present criteria state that no unacceptable interactions occur when a target pipe is hit by jet impingement from a source pipe of equal or smaller nominal pipe size and wall thickness. The NRC's Standard Review Plan, Section 3.6.1, and the American Nuclear Society's Standard ANS 58.2 either state or imply that no unacceptable interaction occurs when a target pipe is impacted by a source pipe of equal or smaller size and wall thickness. Since neither of the aforementioned documents places limits on the system conditions, e.g., temperature, pressure, materials, impact velocity, moment arm or support considerations, the case of impact rather than jet impingement becomes the limiting or more severe condition for the following reasons:

1. The load on the target pipe will be less for the jet impingement case by an amount equal to the source pipe's impacting mass.
2. The maximum jet force is on the broken source pipe and not on any target in the path of the jet. This is true for the following reasons:
   a. The source pipe reacts to the full jet thrust associated with the break.
   b. Any target pipe intercepts only a portion of the jet.
   c. Thermodynamic and drag losses begin immediately upon jet issuance from the broken pipe.

d. The jet impingement energy will be dissipated due to jet deflection off the target pipe, i.e., the pipe being a cylindrical target only receives the maximum jet load at a single point along its surface the remaining jet loading is deflected by the curved surface at varying angles.

Conversely, by using the present, accepted NRC and ANS criteria for a whipping pipe, if an acceptable interaction is identified when a target pipe of same or larger size and wall thickness is struck by a source pipe, it is assumed that the target pipe arrests the whip from the source pipe. When this occurs the maximum steady state jet force will then be transmitted to the target pipe for the duration of blowdown.

Based upon the foregoing, it is Duke Power Company's position that the loading conditions resulting from pipe whip are more severe than those from pure jet impingement for both impact and steady state conditions. Therefore, the present Duke criteria are conservative and adequate for evaluation of the acceptability or unacceptability of piping as jet impingement targets and consistent with industry practice.

Item 17 - 3.6.2.1.2, page 3.6-11

Item j) indicates that certain exceptions to the criteria may be taken. In addition to indicating where these exceptions are taken, provide the analytical or experimental bases(es) for the exceptions.

Response:

No exceptions to the criteria are currently being used based on experimental or analytical data for a whipping pipe or jet considered capable of developing throughwall leakage cracks in equal or larger nominal pipe sizes with thinner wall thickness. Page 3.6-11 will be revised (as attached) to ensure that exceptions will be documented when they develop.

Attachment item 17

3) Seismic loadings equivalent to the Operating Basis Earthquake (OBE) are used in the analysis of piping systems for the purpose of postulating break locations. Protective structures are designed to withstand the effects of the postulated piping failure in combination with loadings associated with the Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) within the respective design load limits for the structures.

e) Consideration is given to the potential for a random single failure of an active component subsequent to the postulated pipe rupture. Where the postulated piping break is assumed to occur in one of two or more redundant trains of a dual-purpose moderate-energy essential system (i.e., one required to operate during normal plant conditions as well as to shut down the reactor and mitigate the consequences of the piping rupture), single failures of components in the other train or trains of that system only are not assumed; provided the system is designed to seismic Category I standards, is powered from both offsite and onsite sources, and is constructed, operated, and inspected to quality assurance, testing, and inservice inspection standards appropriate for nuclear safety systems.

f) In the event of a postulated break in the piping in one unit, safe reactor shutdown of the affected unit cannot preclude the capability for safe shutdown of the reactor of the unaffected unit(s).

g) Containment structural integrity is maintained by limiting the combination of break sizes and types to the design basis capability (i.e., temperature, pressure, and leakage rate) of the containment.

h) For those postulated breaks classified as a loss-of-reactor coolant, the design leak tightness of the containment fission product barrier shall be maintained.

i) The conditions within the control room or any other location where manual action is required to assure safe shutdown to the cold condition are such as to assure habitability and comply with the requirements of General Design Criterion 19.

j) A whipping pipe or jet is assumed not to cause failure of other pipes of equal or greater size and equal or greater thickness. Smaller and thinner pipes are assumed to encounter unacceptable damage upon impact. A whipping pipe or jet is considered capable of developing through-wall leakage cracks in equal or larger nominal pipe sizes with thinner wall thicknesses, except where experimental or analytical data for the expected range of impact energies demonstrate the capability to withstand the impact without failure.

k) Piping Breaks Within The LOCA Boundary (See Figure 3.6.2-1)

1) All LOCA breaks are allowed to damage any non-LOCA line except essential systems, and steam and feedwater lines.

If an exception is taken, the basis of the exception will be documented in file material.

Item 18 - 3.6.2.1.2.1, pages 3.6-13 to 16

This pipe break criteria is not in compliance with the latest version of SRP 3.6.2 (NUREG-0800).

Response:

Duke will revise FSAR page 3.6-14 (as attached) to assure that break locations will be calculated whenever the cummulative factor, u, is greater than .1. Documentation is provided for NRC review. This item was closed.

Question #18

CNS

Terminal ends are considered as piping originating at structures or components (such as vessel and equipment nozzles and structural piping anchors) that act as rigid constraint to the piping thermal expansion. Typically, the anchors assumed for the piping code stress analysis would be terminal ends. The branch connection to the main run is one of the terminal ends of a branch run, except intersections of runs of comparable size and fixity which have a significant effect on the main run need not be considered terminal ends when the stress analysis model includes both the run and branch piping and the intersection is not rigidly constrained to the building structure.

a) Breaks in Duke Class A piping are postulated at the following locations (see Table 3.2.2-3 for class correlations):

1) The terminal ends of the pressurized portions of the run.

2) At intermediate locations selected by either one of the following methods:

i) At each weld location of potential high stress or fatigue, such as pipe fittings (elbows, tees, reducers, etc.), valves, flanges, and welded attachments, or

ii) At all intermediate locations between terminal ends where the following stress and fatigue limits are exceeded,

a) The maximum stress range shall not exceed 2.4 S_m except as noted below.

b) The maximum stress range between any two load sets (including the zero load set) shall be calculated by Eq. (10) in Paragraph NB-3653, ASME Code, Section III, for normal and upset plant conditions and an operating basis earthquake (OBE) event transient.

If the calculated maximum stress range of Eq. (10) exceeds the limit (2.4 S_m) but is not greater than 3 S_m, the limit of $U < 0.1$ shall be met.

If the calculated maximum stress range of Eq. (10) exceeds 3 S_m, the stress ranges calculated by both Eq. (12) and Eq. (13) in Paragraph NB-3653 shall not exceed 2.4 S_m or the limit of $U < 0.1$.

c) U shall not exceed 0.1

where:

S_n = primary-plus secondary stress-intensity range, as calculated from Equation (10) in Subarticle NB-3600 of the ASME Boiler and Pressure Vessel Code, Section III.

Question #18

The following is a list of problems which have no Equation 10 stresses between 2.4 and 3.0 S_m.

NI-04
NI-05
NI-12
NC-10
NC-11
NC-13
NC-25
NC-26

Component types are as follows:

FGBW - flush ground butt weld
AWBW - as-welded butt weld
FILW - fillet weld
AWTT - as-welded tapered transition joint
BELB - butt welded elbow
SELB - socket welded elbow
STEE - socket welded tee
SRED - socket welded reducer
BRED - butt welded reducer
CRVP - curved pipe

					Duke Power Company Catawba Unit 1
					PAGE
	CLS	5/26/82	[illegible]	5/26/82	OF
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PROBLEM CC-NI-01

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
43/66W	2.614	16,292	42,587	AWBW
94/160W	2.942	16,292	47,931	FILW
69/99W	2.480	16,328	40,493	AWBW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
80/11/03. 15.25.40.

Duke Power Company
Catawba Unit #1

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PROBLEM CC-NI-02

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
52/93W	2.562	16,292	41,740	AWTT
55/97W	2.563	16,292	41,756	AWBW
71,71A/ 132R,133L	2.780	16,328	45,392	BELB
71A/133L	2.756	16,328	45,000	AWTT
73/135W	2.725	16,292	44,396	AWTT
75/139W	2.564	16,292	41,773	AWBW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
80/10/31. 17.24.28.

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PROBLEM CC-NI-03

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
19/20W	2.770	20,000	55,400	FILW
24/26W	2.419	20,000	48,380	FILW
25/27W	2.466	20,000	49,320	FILW
25,26/ 27R, 28L	2.989	20,000	59,780	SELB
26/28W	2.474	20,000	49,480	FILW
42/55W	2.743	20,000	54,860	FILW
44/58R	2.699	20,000	53,980	SELB
44A/59W	2.539	20,000	50,780	FILW
38/93B	2.665	20,000	53,300	STEE

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
80/10/09. 18.47.03.

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PROBLEM CC-NI-06

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
13/34W	2.503	17,430	43,627	AWTT
A14/36W	2.510	17,430	43,749	AWBW
18/47W	2.866	17,430	49,954	AWTT
C07B/30L	2.791	17,430	48,647	BELB

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
81/04/27. 15.51.51

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PROBLEM CC-NI-07

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
AA2B/8W	2.504	17,430	43,645	FGBW
45/15W	2.406	20,000	48,120	AWTT
45A/16W	2.447	20,000	48,940	AWTT

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
81/04/27. 17.02.28.

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PROBLEM CC-NI-20

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
10A/10W	2.949	16,820	49,602	AWBW
12B,13/ 14R,15L	2.480	16,820	41,714	BRED
13/15W	2.471	16,820	41,562	FILW
15A/17W	2.429	20,000	48,580	FILW
16/20W	2.482	20,000	49,640	FILW
17/21W	2.472	20,000	49,440	FILW
17AA/22W	2.427	20,000	48,540	FILW
148/135W	2.997	16,820	50,410	FILW
149D/141R	2.843	16,820	47,819	CRVP
149E/142L	2.986	16,820	50,225	CRVP

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
81/02/09. 17.29.36.

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PROBLEM CC-NI-21

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
98/92W	2.466	16,820	41,478	FILW
98,99/ 92R,93L	2.479	16,820	41,697	SRED
181D/144W	2.784	20,000	55,680	FILW
185A/146W	2.879	20,000	57,580	FILW
187/148W	2.666	16,820	44,842	FILW
187,187A/ 148R,149L	2.663	16,820	44,792	SRED
189B/153W	2.876	16,820	48,375	AWBW
193/158W	2.616	16,820	44,001	AWBW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
81/01/30. 08.40.56.

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PROBLEM CC-ND-01

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
C01A/4W	2.435	19,800	48,213	AWBW
69A/87R	2.787	20,000	55,740	BELB
70/88L	2.810	20,000	56,200	BELB

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
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82/02/04. 19.04.55.

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PROBLEM CC-ND-02

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
C31A/4W	2.706	19,800	53,579	AWBW
C71A/86R	2.531	20,000	50,620	CRVP
C71B/87L	2.581	20,000	51,620	CRVP

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
82/02/04. 19.05.13

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PROBLEM CC-NC-03

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
34A/74W	2.455	16,820	41,293	AWBW
36/76B	2.716	20,000	54,320	BTEE
50A/85W	2.824	16,862	47,618	AWTT
C15A/86W	2.527	16,862	42,610	AWTT
C15A/86R	2.432	16,862	41,008	BELB
C15B/87L	2.638	16,862	44,482	BELB
C14A/90W	2.625	16,820	44,153	AWBW
C14B/91WR	2.898	16,820	48,744	AWBW
44/94R	2.599	16,862	43,824	BELB
42/96L	2.692	16,862	45,393	BELB
C11A/98W	2.713	16,820	45,633	AWBW
C11B/99W	2.645	16,820	44,489	AWBW
C18A/107W	2.586	16,820	43,496	AWBW
C18B/108W	2.677	16,820	45,027	AWBW
66/113R	2.585	16,862	43,588	BELB

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
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82/04/14. 07.02.18

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Duke Power Company

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PROBLEM CC-NC-03

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
68/115L	2.573	16,862	43,386	BELB
C21A/117W	2.924	16,820	49,182	AWBW
C21B/118W	2.700	16,820	45,414	AWBW
C22A/121W	2.664	16,862	44,920	AWTT
C22A/121R	2.722	16,862	45,898	BELB
C22B/122L	2.550	16,862	42,998	BELB
C22B/122W	2.617	16,862	44,128	AWTT
73A/123W	2.992	16,862	50,451	AWTT

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
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82/04/14. 07.02.18

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PROBLEM CC-NC-07

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
4/4R	2.447	16,840	41,207	BELB
7AA/9R	2.549	16,840	42,925	BELB
7BB/10L	2.489	16,840	41,915	BELB
7CC/11R	2.439	16,840	41,073	BELB
7DD/12L	2.506	16,840	42,201	BELB
8/14R	2.591	16,840	43,632	BELB
9/15L	2.614	16,840	44,020	BELB
16/28R	2.949	16,532	48,753	BELB
17/29L	2.944	16,532	48,670	BELB
20W/36W	2.653	16,520	43,828	AWTT
20C/39R	2.864	16,532	47,348	BELB
80/48K	2.854	16,292	46,497	CRVP
81/49L	2.871	16,292	46,774	CRVP
81C/50R	2.832	16,328	46,241	BELB
81E/52L	2.810	16,328	45,882	BELB
81D/51W	2.917	16,328	47,629	AWBW
83/56W	2.403	16,292	39,150	AWBW
66/114W	2.981	16,820	50,140	FILW
65/115W	2.776	20,000	55,520	FILW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
82/03/26. 17.03.29.

Duke Power Company

Catawba Unit #1

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0	TW	5/25/82	CLS	5/26/82

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PROBLEM CC-NC-07

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
34B/123R	2.517	16,820	42,336	CRVP
34C/124L	2.532	16,820	42,588	CRVP
45B/144L	2.460	16,800	41,328	CRVP
46A/146R	2.644	16,800	44,419	CRVP
46B/147L	2.663	16,800	44,738	CRVP
47A/149R	2.627	16,800	44,134	CRVP
47B/150L	2.472	16,800	41,530	CRVP
50/156R	2.545	16,800	42,756	CRVP
71/183W	2.794	20,000	55,880	FILW
72/184W	2.773	20,000	55,460	FILW
117/192W	2.552	16,292	41,577	AWBW
142/226R	2.989	16,800	50,215	BRED
145/230L	2.826	16,800	47,476	BRED

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
82/03/26. 17.03.29.

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					Duke Power Company
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PROBLEM CC-NC-08

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/	S_n/S_m	S_m	S_n	Comp. type
31/32	2.975	16,328	48,576	BELB
32M	2.623	16,328	42,828	BELB
32N	2.582	16,328	42,159	BELB
32O	2.748	16,328	44,869	BELB
32P	2.834	16,328	46,274	BELB
33	2.877	16,292	46,872	CRVP
34	2.770	16,292	45,129	CRVP
35	2.555	16,328	41,718	BELB
36	2.585	16,328	42,208	BELB
62	2.560	16,328	41,800	BELB
63	2.888	16,840	48,634	BELB
69	2.980	16,840	50,183	BELB
75A	2.842	16,520	46,950	AWTT
78B	2.588	16,520	42,754	AWTT
101Z	2.823	16,800	47,426	AWBW
101Y	2.414	16,800	40,555	AWBW
101A	2.854	16,800	47,947	CRVP
101C	2.723	16,800	45,746	CRVP
101I	2.700	16,800	45,360	AWBW
117	2.885	20,000	57,700	FILW
112	2.554	16,292	41,610	AWBW
118	2.774	20,000	55,480	FILW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
82/03/23. 17.47.35.

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PROBLEM CC-NC-08

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
126	2.766	20,000	55,320	FILW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
82/03/23. 17.47.35.

REV	BY	DATE	CHECKED	DATE
0	TL	5/25/82	CLS	5/26/82

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PROBLEM CC-NC-12

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
83,83/ 50R,51L	2.985	20,000	59,700	BELB
107,108/ 81R,82L	2.624	18,040	47,337	BRED
108/82W	2.422	16,830	40,762	AWBW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
80/09/29. 16.55.38

REV	BY	DATE	CHECKED	DATE	
					Duke Power Company
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0	CLS	5/19/82	[illegible]	5-?-82	PAGE 1 OF 1

PROBLEM CC-NV-09

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
88/123W	2.580	20,000	51,600	FILW
89/124W	2.870	20,000	57,400	FILW
94/130W	2.508	20,000	50,160	FILW
95/131B	2.750	20,000	55,000	STEE
104/137W	2.602	20,000	52,040	FILW
110/148W	2.456	20,000	49,120	FILW
110,111/ 148R,149L	2.877	20,000	57,540	SELB
111/149W	2.442	20,000	48,840	FILW
118,118A/ 157R,158L	2.751	20,000	55,020	SELB
118B/159W	2.404	20,000	48,080	FILW
118B,120/ 159R,160L	2.888	20,000	57,760	SELB
120/160W	2.534	20,000	50,680	FILW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
82/01/11. 17.13.12.

REV	BY	DATE	CHECKED	DATE
0	CLC	5/14/82	JRD	5-14-82

Duke Power Company

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PROBLEM CC-NV-10

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
S4/4W	2.511	20,000	50,220	FILW
S6/8W	2.681	20,000	53,620	FILW
S7/9W	2.734	20,000	54,680	FILW
S20/25W	2.467	20,000	49,340	FILW
S31/39W	2.531	20,000	50,620	FILW
S35/44W	2.835	20,000	56,700	FILW
S36/45W	2.594	20,000	51,880	FILW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
81/08/13. 20.06.49.

Duke Power Company

Catawba Unit #1

REV	BY	DATE	CHECKED	DATE
0	CLS	5/17/82	JPT	5-17-82

PROBLEM CC-NV-11

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
81C/7W	2.662	20,000	53,240	FILW
77/10W	2.778	20,000	55,560	FILW
76/11W	2.847	20,000	56,940	FILW
74/13W	2.999	20,000	59,980	FILW
73/15W	2.810	20,000	56,200	FILW
72/16W	2.757	20,000	55,140	FILW
70,71/ 17R,18L	2.590	20,000	51,800	SELB
69,68/ 19R,20L	2.668	20,000	53,360	SELB
65/24W	2.645	20,000	52,900	FILW
63L/25W	2.597	20,000	51,940	FILW
63/37B	2.402	20,000	48,040	STEE
62/38W	2.502	20,000	50,040	FILW
61,60/ 39R,40L	2.755	20,000	55,100	SELB
59/41W	2.430	20,000	48,600	FILW
58/42W	2.815	20,000	56,300	FILW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq. #
81/08/13. 18.48.05.

REV	BY	DATE	CHECKED	DATE
0	CLS	5/14/82	JPJ	5-14-82

Duke Power Company

Catawba Unit #1

PROBLEM CC-NV-12

The following are nodes which have Equation 10 stresses between 2.4 and 3.0 S_m

DCP/SOP	S_n/S_m	S_m	S_n	Comp. type
67/9R,10L	2.454	20,000	49,080	SELB
12/16W	2.845	20,000	56,900	FILW
13/17W	2.617	20,000	52,340	FILW
14,15/ 18R,19L	2.523	20,000	50,460	SELB
16,17/ 20R,21L	2.968	20,000	59,360	SELB
17/21W	2.531	20,000	50,620	FILW
21/28W	2.541	20,000	50,820	FILW
31/40W	2.422	20,000	48,440	FILW
16/20W	2.412	20,000	48,240	FILW

S_n-Equation 10 stress

S_m-allowable stress

S_n and S_m stresses are given in psi.

REFERENCE:
Computer Seq #
81/08/14. 02.07.58.

REV	BY	DATE	CHECKED	DATE
0	CLS	5/26/82	[illegible]	5-26-82

Duke Power Company

Catawba Unit #1

PAGE 1 OF 1

Item 19 - 3.6.2.1.2.1, page 3.6-16

Item c)2)i) indicates the criteria for selecting intermediate pipe break locations in Duke Class E, G, and H piping systems.

It is the staff's position that, since Table 3.2.2-3 indicates that these piping systems are not designed for seismic loadings, pipe breaks should be postulated so as to clearly demonstrate that failure of the system will not results in any loss of capability of essential systems and components to withstand the further effects of any single active component failure and still perform all functions required to shutdown the reactor and mitigate the consequences of the postulated piping failure. Therefore, provide a commitment to meet this position.

Response: The attached revision to FSAR page 3.6-16 clarifies Duke's position.

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break locations is determined separately for the normal plant condition load combination and for that upset plant condition which has the highest stress.

c) Breaks in Duke Class E, F, G and H piping are postulated at the following locations (See Table 3.2.2-3 for class correlations)

1) The terminal ends of the pressurized portions of the run.

2) At intermediate locations selected by one of the following methods:

i) For Class E, F, G, and H Piping:

At each intermediate weld location of potential high stress or fatigue~~, such as pipe fittings (elbows, tees, reducers, etc.), valves, flanges, and welded attachments~~; or

ii) For Class F Piping:

At all locations where the stress, S, Exceeds $0.8\ (1.2\ S_h + S_A)$, where:

S = stresses under the combination of loadings associated with the normal and upset plant condition loadings and an OBE event, as calculated from the sum of equations (9) and (10) in subarticle NC-3600 of the ASME Boiler and Pressure Vessel Code, Section III.

S_h = basic material allowable stress at maximum (hot) temperature, per ANSI B31.1.0.

S_A = allowable stress range for expansion stresses, per ANSI B31.1.0.

3) For Class F Piping:

If there are not at least two intermediate locations where S exceeds $0.8\ (1.2\ S_h + S_A)$, a minimum of two separate locations are chosen based upon highest stress. Intermediate breaks are not postulated in sections of straight pipe where there are no pipe fittings, flanges, valves or welded attachments.

3.6.2.1.2.2 Postulated Piping Break Locations For Moderate-Energy Piping Systems

Systems identified as containing moderate-energy piping are examined by detailed drawing review for postulated through-wall cracks as defined below. Systems analyzed for consequences of postulated piping cracks are listed in Table 3.6.1-2.

Item 20 - 3.6.2.1.2.3, page 3.6-17

Item a)3 states circumferential breaks are assumed to result in pipe separation of one diameter displacement of ruptured piping sections unless physically limited by piping restraints. Show where piping restraints are used to limit pipe displacements.

Response:

Limited break areas have not, to date, been used for temperature or pressure calculations. Neither have limited break areas been used for whip or jet impingement analyses. Page 3.6-17 will be revised (as attached) to commit Duke to provide an example of limited break areas when used.

Attachment item 20

CNS

a) Cracks in Duke Class B, C and F piping are postulated at the following locations:

1) The terminal ends of the pressurized portions of the run.

2) At intermediate individual locations of potential high stress or fatigue (e.g. pipe fittings, valves, flanges and welded attachments) that result in the maximum effects from fluid spraying, flooding or environmental conditions except in portions of piping where the maximum stress range is less than 0.4 ($1.2\ S_h + S_A$) as defined in items b)2)ii) and c)2)ii) of Section 3.6.2.1.2.1.

b) Cracks in Duke Class E, G and H piping are postulated at the following locations:

1) The terminal ends of the pressurized portions of the run.

2) At intermediate individual locations of potential high stress or fatigue (e.g. pipe fittings, valves, flanges and welded attachements) that result in the maximum effects from fluid spraying, flooding or environmental conditions.

3.6.2.1.2.3 Postulated Break Type, Size, and Orientation

a) Circumferential Pipe Breaks

The following circumferential breaks are postulated in high-energy fluid system piping at the locations specified in Section 3.6.2.1.2.1.

1) Circumferential breaks are postulated in fluid system piping and branch runs exceeding a nominal pipe size of 1 inch, except where the maximum stress range exceeds the limits of Section 3.6.2.1.2.1, items b) and c)2)ii) but the circumferential stress range is at least 1.5 times the axial stress range.

2) Where break locations are selected in fittings in accordance with Section 3.6.2.1.2.1 without the benefit of detailed stress calculations, breaks are postulated at each weld, in piping greather than one inch NPS, to the fitting, valve, or welded attachment. Alternately, a single break location at the section of maximum stress range may be selected as determined by detailed stress analyses or tests on a pipe fitting.

3) Circumferential breaks are assumed to result in pipe severance and separation amounting to at least a one-diameter lateral displacement of the ruptured piping sections unless physically limited by piping restraints. If credit is taken for a limited break area due to piping restraints, then each case will be documented in the file material.

Item 21 - 3.6.2.1.2.3, page 3.6-18

Identify in Item a)4 where limited pipe displacement, line restrictions, flow limiters, positive pump - controlled flow, and the absence of energy reservoirs are used to reduce the jet discharge.

Response:

Duke provided drawings of limited reservoirs and an analysis example. This information was found acceptable and the item was closed.

Item 22 - 3.6.2.1.2.3, page 3.6-18

In Item a)5 are all possible targets of the whipping pipe examined?

Response:

Duke has unrestrained whipping pipe inside containment as follows:

A. Two break locations in the normal letdown line from penetration M-347 to the regenerative heat exchanger nozzle D. (2")

B. One break location in the seal water injection line from penetration M-344 to reactor coolant pump 1C nozzle C. (2")

Please note that both breaks in item A above are inside the regenerative heat exchanger room and thus totally separated from any other systems.

Item 23 - 3.6.2.1.2.3, page 3.6-19

In Item c)4 elaborate on the statement, "Throughwall cracks are not postulated inside containment."

Response:

We will revise page 3.6-19 (as attached) to state that both moderate and high energy leakage cracks are enveloped by high energy line brakes inside containment. For this reason throughwall cracks are not postulated inside containment.

Attachment Item 23

CNS

5) Piping movement is assumed to occur in the direction of the jet reaction unless limited by structural members, piping restraints, or piping stiffness as demonstrated by inelastic limit analysis. For the purpose of analysis, breaks are assumed to reach full size one millisecond after break initiation.

c) Through-Wall Leakage Cracks

The following through-wall leakage cracks should be postulated in moderate-energy fluid system piping at the locations specified in Section 3.6.2.1.2.2.

1) Cracks are postulated in moderate-energy fluid system piping runs exceeding a nominal pipe size of one inch.

2) Fluid flow from a crack is based on a circular opening of area equal to that of a rectangle one-half pipe diameter in length and one-half pipe wall thickness in width.

3) The flow from the crack is assumed to result in an environment that wets all unprotected components within the compartment, with consequent flooding in the compartment and communicating compartments.

4) Cracks are not postulated in portions of Duke Class B, C, or F piping where the stresses are less than 0.4 ($1.2\ S_h + S_A$). Throughwall cracks are not postulated inside containment because environmental consequences are enveloped by high energy circumferential breaks.

3.6.2.1.3 Failure Consequences

The interactions that are evaluated to determine the failure consequences are dependent on the energy level of the contained fluid. They are as follows:

a) High-Energy Piping

1) Circumferential Breaks and Longitudinal Splits

a) Pipe Whip (displacement)
b) Jet Impingement
c) Compartment Pressurization
d) Flooding
e) Environmental Effects (Temperature, humidity)

b) Moderate-Energy Piping

1) Through-wall leakage cracks

a) Flooding
b) Environmental Effects (Temperature, humidity)
c) Water Spray

2) Throughwall leakage cracks
a) Environmental Effects (Temperature, Humidity)
b) Flooding

3.6.2.2 Analytical Methods to Define Forcing Functions and Response Models

3.6.2.2.1 Reactor Coolant System Dynamic Analysis

Item 24 - 3.6.2.2.1, page 3.6-21

The computer codes SATAN-IV and THRUST should be included in the list of computer codes in Section 3.9.1.2.3

Response:

In the reactor coolant loop piping analysis the computer codes SATAN IV and STHRUST were used to calculate the blowdown forces for postulated pipe breaks. The computer code THRUST was not used for Catawba. Additionally, the SATAN IV code has been added to the list of codes identified in Section 3.9.1.1. Based on the above discussion and the attached FSAR revisions, this tiem was resolved.

ATTACHMENT TO ITEM 24

→ SATAN II - SPACE TIME DEPENDENT ANALYSIS OF LOSS OF COOLANT ACCIDENT THAT TREATS A_L PHASES OF BLOWDOWN LOADS.

4. STHRUST - hydraulic loads on loop components from blowdown information.

5. WECAN - finite element structural analysis.

6. DARI - WOSTAS - dynamic transient response analysis of reactor vessel and internals.

7.

3.9.1.3 Experimental Stress Analysis

No experimental stress analysis methods have been used for the Catawba project.

3.9.1.4 Considerations for the Evaluation of the Faulted Condition

3.9.1.4.1 Loading Conditions

The reactor coolant loop piping is evaluated in accordance with the criteria of ASME III, NB-3650 and Appendix F. The loads included in the evaluation result from the SSE, deadweight, pressure, and LOCA loadings (loop hydraulic forces, asymmetric subcompartment pressurization forces, and reactor vessel motion).

The structural stress analyses performed on the reactor coolant system consider the loadings specified as shown in Table 3.9.1-2. These loads result from thermal expansion, pressure, dead weight, Operating Basis Earthquake (OBE), Safe Shutdown Earthquake (SSE), design basis loss of coolant accident, and plant operational thermal and pressure transients.

3.9.1.4.2 Analysis of the Reactor Coolant Loop

The loads used in the analysis of the reactor coolant loop piping are described in detail below.

Pressure

Pressure loading is identified as either membrane design pressure or general operating pressure, depending upon its application. The membrane design pressure is used in connection with the longitudinal pressure stress and minimum wall thickness calculations in accordance wi h the ASME Code.

The term operating pressure is used in connection with determination of the system deflections and support forces. The steady-state operating hydraulic forces based on the system initial pressure are applied as general operating pressure loads to the reactor coolant loop model at change in direction or flow ar a.

Dead Weight

A dead weight analysis is performed to meet Code requirements by applying a 1.0 g load downward on the complete piping system. The piping is assigned a distributed mass or weight as a function of its properties. This method provides a distributed loading to the piping system as a function of the weight of the pipe and contained fluid during normal operating conditions.

Item 25 - 3.6.2.2.2.1, page 3.6-23

Is the discharge coefficient equal to something other than 1.0 for any conditions?

Response:

The discharge coefficient is assumed to be 1.0 in the absence of analytical results or experimental data for calculating the dynamic force of the jet discharge. No values other than 1.0 have been used. If values less than 1.0 are used, justification will be provided in the FSAR.

Item 26 - 3.6.2.2.2.3, page 3.6-25

In the first paragraph, the applicant states that a dynamic load factor of 2.0 shall be used in the absence of an analysis justifying a lower value. What kind of analysis is performed? How low a value is used? Justify any values less than 2.0.

Response:

Duke has not used a value less than 2.0 for dynamic load factor to date. If a lessor value is used in the future, an analytical justification will be provided. This item was closed.

Item 27 - 3.6.2.3.1, page 3.6-25

In Item 1) of General Criteria for Pipe Whip Evaluation, what kind of analysis justifies a value lower than 2.0?

In Item 2) nonlinear pipe and restraint material properties may be used as applicable. Where have nonlinear properties been used and what values are used?

In Item 3) all targets of a whipping pipe must be looked at. Provide assurance that this has been done.

Response:

A lower value than 2.0 is justified in systems where crush pipes are used and a rigorous time history analysis is done (by computer programs viz. PRTHRUST and PIPERUP); and also if the backup structure is shown to be rigid* compared to the cursh pipe, in most cases a DLF of less than 2.0 can be anticipated.

*Tests for rigidity for backup structure:

A) The natural frequency of the backup structure should be more than 33 Hz.

B) The elastic stiffness of backup structure is at least 3 times that of the crush pipe.

Type of analysis outlined above justifies using a value less than 2. As of this date we have not used a value less than 2.

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The ratio A_i/A_j represents the portion of the total mass flow from the jet which is intercepted by target structure. A dynamic load factor of 2.0 shall be used in the absence of an analysis justifying a lower value.

3.6.2.3 Dynamic Analysis Methods to Verify Integrity and Operability

3.6.2.3.1 General Criteria for Pipe Whip Evaluation

1) The dynamic nature of the piping thrust load shall be considered. In the absence of analytical justification, a dynamic load factor of 2.0 is applied in determining piping system response.

2) ~~Nonlinear~~ (Elastic - perfectly plastic) (~~elastic-plastic strain hardening~~) pipe and ~~restraint~~ crushable material properties may be considered as applicable. Consideration for crushable materials is described in table 3.6.2-3

3) Pipe whip is considered to result in unrestrained motion of the pipe along a path governed by the hinge mechanism and the direction of the thrust force. A maximum of 180° rotation may take place about any hinge.

4) The effect of rapid strain rate of material properties is considered. A 10 percent increase in yield strength is used to account for strain rate effects.

3.6.2.3.2 Analysis Methods

The pressure time history, jet impingement load on targets, and the thrust resulting from the blowdown of postulated ruptures in piping systems is determined by thermal and hydraulic analyses or conservative simplified analyses.

In general, the loading that may result from a break in piping is determined using either a dynamic blowdown or a conservative static blowdown analysis. The method for analyzing the interaction effects of a whipping pipe with a restraint will be one of the following:

1) Equivalent static method
2) Lumped parameter method
3) Energy balance method

In cases where time history or energy balance method is not used, a conservative static analyses model will be assumed.

The lumped parameter method is carried out by utilizing a lumped mass model. Lumped mass points are interconnected by springs to take into account inertia and stiffness properties of the system. A dynamic forcing function or equivalent static loads may be applied at each postulated break location with unacceptable pipe whip interactions. Clearances and inelastic effects are considered in the analyses.

t27

The energy balance method is based on the principle of conservation of energy. The kinetic energy of the pipe generated during the first quarter cycle of movement is assumed to be converted into equivalent strain energy, which is distributed to the pipe or the support. The strain in the restraint is limited to 50 percent of the ultimate uniform strain.

3.6.2.3.3 Pipe Whip Restraint Design

When required, restraints are designed to protect essential components from the dynamic effects of pipe whip and jet impingement. The loadings on the restraint are determined by one of the methods outlined in Sections 3.6.2.2 and 3.6.2.3. The design of these restraints follows the guidelines of AISC (Ref. 4); however, since pipe rupture is associated with the faulted plant condition, higher stress allowables are permitted as identified in Table 3.6.2-3. Where a restraint is also designed to function as a piping support, the discussion in Section 3.9.3.1.5 is applicable. Rupture loads with a dynamic load factor of 2.0 shall be added to the faulted loads and the support designed for faulted condition per table 3.9.3-11.

3.6.2.4 Mechanical Penetrations

Mechanical penetrations are treated as fabricated piping assemblies meeting the requirements of ASME Section III, Subsections NC and NE and which are assigned the same classification as the piping system that includes the assembly (i.e., Class A through H as defined in Table 3.2.2-3 except that Class C through H lines are upgraded to Class B between Containment isolation valves).

The process line making up the pressure boundary is consistent with the system piping materials, fabrication, inspection, and analysis requirements of ASME Section III, Subsection NC.

Critical high temperature lines and selected engineered safety system and auxiliary lines (regardless of temperature) require the "Hot Penetration" assembly as shown on Figure 3.6.2-8 which features the exterior guard pipe for the purpose of returning any fluid leakage to the Containment and for protection of other penetrations in the building annular space. Other lines are treated as cold penetrations since a leak into the annular space would not cause a personnel hazard or damage other penetrations in the immediate area.

Penetration assemblies and their anchorages are analyzed in accordance with Table 3.2.2-3 and applicable response spectra curves (0.5 percent damping) as developed from the method described in Section 3.7.2 and enveloped for conservatism. Loading combinations and stress criteria for penetrations are shown in Table 3.6.2-2. The design of guard pipes considers the simultaneous effects of pressure and jet loadings resulting from a rupture within the guard pipe and the SSE loadings.

3.6.2.4.1 General Design Information for All Mechanical Penetrations

The following definitions are utilized to distinguish the categories of mechanical penetrations.

Item 28 - 3.6.2.3.3, page 3.6-26

The last sentence references Section 3.9.3.1.5 for a discussion of where restraints have been designed to function as supports. Provide the design criteria and an example of the analysis techniques used for these duel function supports.

Response:

As mentioned in Section 3.9.3.1.5, Table 3.9.3-11 is used to combine pipe rupture loads with pipe support loads in faulted condition only. A dynamic load factor of 2.0 is used on the pipe rupture loads. The design criteria is same as the pipe-support design in faulted condition.

An example of this design is lower elbow restraint on the main steam system in Reactor Building.

This item is closed.

Item 29 - 3.6.2.4, page 3.6-26

The second paragraph discusses the process pipe making up the pressure boundary.

What size is the process pipe?

Response:

For most cases, size of process pipe would be same as header of main piping where process piping is attached.

Item 30 - 3.6.2.4.2, page 3.6-28

Provide details of field welds between the guard pipe attachment and reactor building anchor section as discussed in Item b.

Response:

Drawings were provided during 4-19-82 review meeting which supply the necessary details.

Item 31 - 3.6.2.4.4, page 3.6-29

This section refers to Section 6.6 for a discussion of access for inservice inspection. Item 3) of Section 6.6.8 (page 6.6-2) indicates that access ports will be provided where possible. In addition to indicating which welds are not examinable because of a lack of access, provide an engineering basis for why the ports are not possible.

Are there any "break exclusion" regions used in any seismic Category I piping systems?

Response:

Refer to the response to item 15. This item was closed.

Item 32 - Table 3.6.1-1

Provide details of the Safety Injection System and Main Steam System relative to the pipe break protection method (c).

Response:

Refer to the response for item 15. This item was closed.

Item 33 - Table 3.6.1-3, page 2

Explain comparison of SAR Section 3.6.1.1.2 with NRC criteria. What analyses have been performed to show insufficient energy to develop sudden failure? In Item a) are the consequences of breaks in the excluded lines considered? What criteria are used to postulate breaks and cracks, and in which systems?

Response:

Regarding the first part of this question , the NRC Staff states in question No. 110.2 of Attachment 1 that it conceded that such systems (in Table 3.6.1-3, page 2 of Catawba FSAR) may not have sufficient energy to develop sudden, catastrophic failures. Regarding the second part, the consequences of these failures are enumerated in FSAR section 3.6.1.1.2.

It is our position that the NRC Staff has accepted the criteria in Table 3.6.1-3, p. 2 provided that all the effects mentioned above are to be included in the station analyses. Since these analyses are specified no further action is required.

Criteria used to postulate breaks for these systems are the same as those used for a moderate energy system. Example: AS System is the only system to which this criteria has been applied (50 psig and 298°F).

Item 33-Attachment #1

ATTACHMENT 1

110 MECHANICAL ENGINEERNG BRANCH

110.1 (3.6.1.1) RMS The first paragraph of Section 3.6.1.1.1 (page 3.6-1) implies that precluding the formation of plastic hinges will result in jet impingement effects not causing unacceptable consequences to essential components. Indicate how this is accomplished.

110.2 (3.6.1.1) (Table 3.6.1-3) (RSP) The fourth paragraph of Section 3.6.1.1.2 (second full paragraph on page 3.6-2) and Table 3.6.1-3 (pages 2 and 7) indicate that non-liquid piping systems with a pressure less than 275 psig are not considered high energy regardless of the temperature.

RMS The staff concedes that such systems may not have sufficient energy to develop sudden, catastrophic failures. However, it is the staff's positon that such an approach does not properly consider the consequences should a limited failure occur. These would include jet impingement and the environmental effects of pressure, temperature, humidity, and wetting of equipment. Therefore, either:

(1) Remove this criteria from the FSAR and provide a commitment to properly evaluate the cases where it was used; or

(2) As a minimum, provide assurance that the above concerns have been addressed.

110.3 (3.6.1.1) (RSP) The seventh paragraph of Section 3.6.1.1.2 (fifth full paragraph on page 3.6-2 and item c(4) of section 3.6.1.2.2 (sic)(page 3.6-16 indicate that systems which do not contain mechanical pressurization equipment are not considered moderate energy.

RMS It is the staff's position that such an approach does not properly consider the consequences should a failure occur. These would include the normal moderate energy effects of flooding, spray, and wetting of equipment. Therefore, provide a commitment to include these systems as moderate energy.

110.4 (3.6.1.1) RMS The first paragraph of item b) of Section 3.6.1.1.2.1 (pages 3.6.-2 and 3) is unclear in indicating when jet impingement interactions are considered. In addition to correcting the typographical ommission, provide examples of how each of the criteria assures that the safety function is not impaired.

110.5 (3.6.1.1) RMS The second paragraph of item b) of Section 3.6.1.1.2.1 (first full paragraph on page 3.6-3) indicates that you assume that jet impingement will not effect concrete structural integrity. Provide the basis(es) for this assumption.

Item 34 - Table 3.6.1-3, pages 2 and 3

This item notes Duke's exception to postulating terminal end breaks at the shut off valve which separates the pressurized and non-pressurized portions of a piping run.

It is the staff's position that this is the only logical location for such a terminal end. Postulating the break elsewhere in the pressurized side limits the length of whipping pipe available. Postulating the break anywhere in the nonpressurized side would not result in a release of energy. Therefore, provide a commitment to meet this position or alternatively, treat the entire piping system as it if were a high energy piping system and postulate breaks and provide protective measures accordingly (i.e., assume the shut off valve to be normally open.)

Response:

A terminal end is considered at piping which is rigidly constrained in regards to thermal expansion. Piping stresses either side of the closed valve will be approximately the same, therefore terminal end classification based on constraint and high stresses is not applicable. If the stress analysis indicates that an intermediate break is required at the valve then the normal analyses will be performed for that break.

Item 35a - Table 3.6.1-3, pages 3 and 4, SAR Section 3.6.2.1.2.1

The criteria is a deviation from the SRP. A minimum of two break locations is required.

Response:

Table 3.6.1-3, pages 3 and 4 will be revised (as attached) to delete the reference to not postulating intermediate breaks in Class B, C piping, where stress intensity is less than 0.4 $(1.2\ S_h + S_A)$.

to this closed valve.

MEB 3-1, Section B.1.b(6)

Section B.1.b(6) requires that guard pipe assemblies between containment isolation valves meet the following requirements:

a. The design pressure and temperature should not be less than the maximum operating temperature and pressure of the enclosed pipe under normal plant conditions.

b. The design stress limits of Paragraph NE-3131(c) should not be exceeded under the loading associated with design pressure and temperature in combination with the safe shutdown earthquakes.

c. Guard pipe assemblies should be subjected to a single pressure test at a pressure equal to design pressure.

MEB 3-1, Sections B.1.c(1) and B.1.d(1)

Intermediate breaks in Class 2 and 3 piping are postulated where the stresses exceed 0.8 ($1.2S_h$ + S_A) but at not less than two locations based on highest stress. Where the piping consists of a

ting at structure or components that act as rigid constraint to the piping thermal expansion. Typically, the anchors assumed for the code stress analysis would be terminal ends. Stresses in the system either side of the closed valve will be about the same; therefore, terminal end classification based on constraint and high stresses are not applicable. Duke reviews these closed valve locations to assure high stresses are not developed as a result of rigid constraint from nearby anchors of component connections in the non-pressurized portion of the piping.

SAR Section 3.6.2.4

Duke criteria is different from NRC criteria as described and justified below:

Guard pipes provided between containment isolation valves are designed in accordance with SAR Section 3.6.2.4. Guard pipes are subjected to a pressure test as required by the material specification before welding to the penetration assembly.

It is impractical to test guard pipes in the finished penetration assembly due to the configuration and potential damage to internal process pipe and associated insulation. Independent design analysis have been conducted to provide assurance that Duke penetration designs are acceptable. In addition, the extent of NDT conducted on guard pipes to flued head butt weld is such to assure integrity of design.

~~SAR Section 3.6.2.1.2.1~~

~~Duke criteria is different from NRC criteria as described and justified below:~~

~~Intermediate breaks in Class B and C piping are~~

Attachment item 35a

straight run without fittings, welded attachments, and valves, and all stresses are less than 0.8 $(1.2S_h + S_A)$, a minimum of one location should be chosen based on highest stress.

~~not postulated at locations where the stresses are less than 0.4 $(1.2S_h + S_A)$. Breaks in such low stressed piping are not considered credible. Breaks are not postulated in straight runs of pipe that contains no fittings, flanges, valves, or welded attachments.~~

MEB 3-1, Sections B.1.c(2) and B.1.d(2)

Breaks in non-nuclear piping should be postulated at the following location:

a. Terminal ends,

b. At each intermediate pipe fitting, welded attachment, and valve.

SAR Section 3.6.2.1.2.1

Duke criteria is generally equivalent to NRC criteria as described and justified below:

Breaks in Duke Class F piping (non-nuclear, seismic) are postulated at terminal ends and at intermediate locations based on the use of ASME Section III analysis techniques, the same as Duke Class B and C piping. Duke Class F piping is constructed in accordance with ANSI B31.1 and is dynamically analyzed and restrained for seismic loadings similar to ASME Section III piping. Materials are specified, procured, received, stored, and issued under Duke's QA program similar to ASME Section III materials except that certificate of compliance in lieu of mill test reports are acceptable on minor components, and construction documentation for erected materials is not uniquely maintained. Construction documentation for erected materials is generically maintained. MTR are required for the bulk of piping materials.

MEB 3-1, Section B.2.e

Through-wall cracks may be postulated instead of breaks in those fluid systems that qualify as high energy fluid systems for short operational periods. This operational period is defined as

SAR Section 3.6.1.1.2

Duke criteria is generally equivalent to NRC criteria as clarified below:

The operational period that classifies such sys-

Item 36 - Table 3.6.2-1

In Item 11 are there no intermediate breaks postulated in the pressurizer surge line?

Response:

There are 2 intermediate breaks postulated in the pressurizer surge line. We will revise the title of Table 3.6.2-1 (as attached) to indicate the Table refers to the Main Coolant Loop.

Attachment item 36

Table 3.6.2-1

Postulated Break Locations For The Main Coolant Loop

Location of Postulated Rupture	Type
1. Reactor Vessel Inlet Nozzle	Circumferential
2. Reactor Vessel Outlet Nozzle	Circumferential
3. Steam Generator Inlet Nozzle	Circumferential
4. Steam Generator Outlet Nozzle	Circumferential
5. Reactor Coolant Pump Inlet Nozzle	Circumferential
6. Reactor Coolant Pump Outlet Nozzle	Circumferential
7. 50^{o} Elbow on the Intrados	Longitudinal
8. Loop Closure Weld in Crossover Leg	Circumferential
9. Residual Heat Removal (RHR) Line/Primary Coolant Loop Connection	Circumferential (Viewed from the RHR line)
10. Accumulator (ACC) Line/Primary Coolant Loop Connection	Circumferential (Viewed from ACC line)
11. Pressurizer Surge (PS) Line/Primary Coolant Loop Connection	Circumferential (Viewed from the PS line)

Item 37 - Table 3.6.2-2

Are all penetrations Duke Class B? If not, are they evaluated for emergency conditions?

Response:

We will revise Table 3.6.2-2 (as attached) to clarify that no Class 1 piping penetrates containment. All mechanical piping penetrations of the Containment Vessel are Duke Class B. No Class 1 piping is routed through mechanical piping penetrations. When piping, "rated" less than Class B, is routed through the containment vessel the pipe is upgraded to Class B in the area of the penetration.

Table 3.6.2-2

Stress Criteria For

Reactor Containment Mechanical Penetrations

Duke Class B[2]

	CONDITION	PIPING LOADS	CRITERIA
1.	Normal	Thermal Displacement +Pressure +Weight	ASME III, NC-3600
2.	Upset	Thermal Displacement +OBE (Displacement) +Pressure +Weight +OBE (Inertia)	ASME III, NC-3600
3.	Faulted	Thermal Displacement(1) +SSE (Displacement)(1) +Pressure +Weight +SSE (Inertia) +Pipe Rupture	ASME CODE CASE 1606

NOTES:

(1) For the faulted condition, the displacement induced stresses are considered primary stresses.

(2) All mechanical piping penetrations of the Containment Vessel are Duke Class B

Item 38 - Table 3.6.2-3

Define variables -- for example, F_y, F_t, F_e, etc.

Response:

F_t - Allowable tensile stress

F_a - Axial stress permitted in the absence of bending moment

F_b - Bending stress permitted in the absence of axial forces

F_u - Allowable shear stress

F_e - Euler stress divided by a factor of safety

F_y - Minimum yield stress for the type of steel used

Item 39 - Table 3.6.2-3

This table provides stress allowables for pipe rupture restraints. It is the staff's position that the strain limit for such restraints is one half of the ultimate uniform strain. Therefore, provide assurance that your stress based criteria is always as conservative as the above strain criteria.

Response:

All pipe rupture restraints are elastically designed. The strain ratio of ultimate to elastic limit is approximately 10. Hence, per NRC requirement we can stretch steel up to 5 times beyond elastic limit. Thus, our stress based criteria is at least 5 times more conservative than NRC staff's strain criteria. This item was closed.

Item 40 - Table 3.6.2-6, page 1

Provide stresses for rerouted pipe at break locations 1NI-122-048, -049, -050, and 1NI121-050, -051, -052, -053.

Response:

Table 3.6.2-6, page 1 will be revised (as attached) to include the following information:

Break	Equation 10 (psi)	Equation 12 (psi)	Equation 13 (psi)	Usage Factor
1NI122-048	42763			.0
1NI122-049	41718			.0
1NI122-050	Break Location Deleted			
1NI121-051	37750			.0
1NI121-052	Break Location Deleted			
1NI121-053	37114			.0

TABLE 3.6.2-6 (Page 1)

SUMMARY OF STRESS AT BREAK LOCATIONS
FOR SAFETY INJECTION (NI) LINES FOR UNIT 1
INSIDE CONTAINMENT CLASS A PIPE

Figure No.	Piping Location Figure No.(1)	Break No.	Equation 10 S_n(psi)(2)	Equation 12 S_e(psi)(2)	Equation 13 S(psi)(2)	Usage Factor U(3)	Location Criteria(4)
3.6.2-22	3.6.2-40	1NI-011-023	50326	8211	16373	.001	TE
		1NI-011-024	53425	9274	26321	.0	IB
3.6.2-23	3.6.2-40	1NI-011-025	52020	8749	16797	.002	TE
		1NI-011-026	55695	9993	26892	.0	IB
3.6.2-24	3.6.2-40	1NI-021-028	54862	8735	27790	[illegible]	IB
		1NI-021-029	51532	8162	17107	[illegible]	TE
3.6.2-25	3.6.2-40	1NI-021-030	54846	7119	27023	.0	IB
		1NI-021-031	51580	7950	17009	.0	TE
3.6.2-26	3.6.2-39	1NI-041-032	84692	4364	25455	.052	TE
		1NI-041-033	87185	5787	25029	.039	IB
		1NI-041-034	79707	4636	20724	.029	IB
3.6.2-27	3.6.2-39	1NI-051-036	92327	6798	24421	.080	TE
		1NI-051-037	112005	7931	23147	.065	IB
		1NI-051-038	100676	4689	19469	.043	IB
3.6.2-28	3.6.2-39	1NI-061-040	124248	12745	27228	.190	TE
		1NI-061-041	118472	14571	24454	.099	IB
		1NI-061-042	98044	11940	19452	.075	IB
3.6.2-29	3.6.2-39	1NI-071-044	132715	11719	26915	.177	TE
		1NI-071-045	112511	10545	23931	.078	IB
		1NI-071-046	88980	10197	18580	.061	IB
3.6.2-30	3.6.2-39	1NI-122-048	42763			.0	TE
		1NI-122-049	41718			.0	IB
		1NI-122-050	Break Location Deleted				
3.6.2-31	3.6.2-39	1NI-121-051	37750			.0	IB
		1NI-121-052	Break Location Deleted				
		1NI-121-053	37114			.0	TE
3.6.2-32	3.6.2-39	1NI-202-054	93031	2304	14886	.607	TE
		1NI-202-055	80517	3532	18132	.128	IB
		1NI-202-056	57726	11606	43883	.024	IB
		1NI-202-057	57121	12380	43782	.025	IB
		1NI-202-058	57171	10933	42538	.023	IB
3.6.2-33	3.6.2-39	1NI-201-059	94158	4676	14617	.742	TE
		1NI-201-060	84588	7048	17392	.205	IB

Attachment item 40

Added by … 1

Item 41 - Table 3.6.2-6, pages 1 and 2

What are the allowable stresses?

Response:

Break No.	Allowable Stress (psi)
1NI-011-023	16292
1NI-011-024	15328
1NI-011-025	16292
1NI-011-026	16328
1NI-021-028	16328
1NI-021-029	16292
1NI-021-030	16328
1NI-021-031	16292
1NI-041-032	17387
1NI-041-033	17430
1NI-041-034	17430
1NI-051-036	17430
1NI-051-037	17430
1NI-051-038	17430
1NI-061-040	17387
1NI-061-041	17430
1NI-061-042	17430
1NI-071-044	17387
1NI-071-045	17430
1NI-071-046	17430
1NI-122-048	16328
1NI-122-049	16328
1NI-122-050	Break Location Deleted
1NI-121-051	16328
1NI-121-052	Break Location Deleted
1NI-121-053	16328
1NI-202-054	16820
1NI-202-055	16820
1NI-202-056	16820
1NI-202-057	16820
1NI-202-058	16820
1NI-201-059	16820
1NI-201-060	16820
1NI-215-061	16820
1NI-215-062	16820
1NI-211-063	16820
1NI-211-064	16820
1NI-211-065	16820
1NI-031-066	19982
1NI-031-067	20000
1NI-031-068	20000
1NI-031-069	20000

Item 42 - Table 3.6.2-8, page 4

Provide information on rerouted pipe for break locations noted above.

Response:

Table 3.6.2-8, page 4 will be revised as attached.

revised

TABLE 3.6.2-8 (Page 4)

SUMMARY OF PROTECTIVE REQUIREMENTS INSIDE CONTAINMENT
CATAWBA NUCLEAR STATION UNIT 1
PIPING SYSTEM SAFETY INJECTION (NI)

Break No.	Break Type(1)	Thrust Direction(1)	Whip Formed(2)	Effect on Required Components	Acceptable/ Unacceptable	Required Fix
1NI-071-046	Circ.	Upstream	Yes	Jet impingement on: 3" RTD Line, 3" NC Charging Line Pipe whip into safety related cable trays	Unacceptable due to the loss of minimum engineered safety features.	Restraint 1NI-R-46A
		Downstream	Yes	Jet impingement on: 2" NV Sealwater Line, Safety Related Cable Trays Pipe whip into 3" RTD Line, 3" NC Charging Line	Unacceptable due to more than 120% break propagation in affected loop, loss of minimum engineered safety features	Restraint 1NI-R-46B
1NI-122-048	Circ.	Downstream	No	Jet impingement on: 2" BB Sample Line, Safety Related Cable Trays	Unacceptable due to the loss of minimum engineered safety features	Jet Deflection Shielding Provided
1NI-122-049	Circ.	Upstream	No	Jet impingement on: 4" NC Line, 2" RTD Hot Leg, Cranewall.	Unacceptable due to more than 120% break propagation in affected loop.	Jet Deflection Shielding Provided
		Downstream	No	Jet impingement on: 2" NI Line, S.G. 1A Support Struct., 3" RTD Line, 3/4" NC Line, Cranewall	Unacceptable due to more than 120% break propagation in affected loop.	Jet Deflection Shielding Provided
1NI-122-050	Break Location Deleted					

Attachment item 42

revision
- new page -

TABLE 3.6.2-8 (Page 4A)

SUMMARY OF PROTECTIVE REQUIREMENTS INSIDE CONTAINMENT
CATAWBA NUCLEAR STATION UNIT 1
PIPING SYSTEM SAFETY INJECTION (NI)

Break No.	Break Type(1)	Thrust Direction(1)	Whip Formed(2)	Effect on Required Components	Acceptable/ Unacceptable	Required Fix
1NI-121-051	Circ.	Downstream	No	Jet impingement on: 2" BB Sample Line, Safety Related Cable Trays	Unacceptable due to the loss of minimum engineered safety features	Jet Deflection Shielding Provided
1NI-121-052	Break Location Deleted					
1NI-121-053	Circ.	Upstream	No	Jet impingement on: 3" NC Charging Line, Refueling Tunnel Wall, 1½" NI Boron Line, 2" RTD Line.	Unacceptable due to more than 120% break propagation in affected loop	Jet Deflection Shielding Provided
		Downstream	No	Jet impingement on: 2" NI Line, S.G. 1A Support Structure, Cranewall, 3" RTD Line.	Unacceptable due to more than 120% break propagation in affected loop	Jet Deflection Shielding Provided

Item 43 - Figures 3.6.2-6, -7, -8

Provide details of welds in penetration areas.

Response:

Drawings were provided during 4-19-82 review meeting which supplied the necessary details.

Item 44 - 3.7.1.3, page 3.7-3

Justify critical damping values for bolted steel structures.

Response:

This agenda item was deleted.

Item 45 - 3.7.1.3, page 3.7-3

The fourth paragraph discusses the CRDMs and their seismic supports. What portions of the CRDMs are seismically designed?

Response:

As discussed in Item 7, the CRDM pressure housing is an ANS Safety Class 1 and ASME Code Class 1 component which is seismically designed. Additionally, Section 3.9 (Page 3.9-57) identifies the CRDM pressure housing as a Class 1 component. Based on the above discussions and the revisions to Table 3.2.2-2 identified in Item 7, this item was resolved.

Item 46 - 3.7.3, page

What criteria is used for determining significant modes for piping systems?

Response:

Section 3.7.3.8.2, page 3.7-30 of the FSAR defines significant modes as all modes having a period greater than .0303 seconds.

Item 47 - 3.7.2.5, page 3.7-14

The applicant states "When the ground response spectra are used the acceleration values corresponding to 20 Hz are used as a minimum value for the design of piping and components. The acceleration values at 20 Hz are greater than the values corresponding to a rigid system and therefore are conservative." Provide an example for this design method for piping and components.

Response:

The statement cited in the above item was included in the FSAR only to emphasize what acceleration values are used as a minimum. The acceleration values at 20Hz are greater than those above 20 Hz. All seismic analysis problems use the acceleration values at 20 Hz for frequencies above 20 Hz thereby generating conservative results. The acceleration values used for frequencies below 20 Hz relate to the response spectra curves.

Item 48 - 3.7.2.7, page 3.7-15

The method of combining modal responses is acceptable only if the absolute value of "the product of the responses of the modes in each group of closely spaced modes and a coupling factor ε" is added to the square root of the sum of the squares of all modes. The equation should be:

$$R_T^2 = \sum_{i=1}^{N} R_i^2 + 2 \sum_{j=i}^{S} \sum_{K=M_j}^{N_j} \sum_{\ell=K+1}^{N_j} \left| R_K \ R_\ell \right| \varepsilon_{K\ell}$$

Response:

The equation identified in Section 3.7.2.7 contained a typographical error which was discussed and corrected at this meeting. During this discussion it was also agreed that absolute value signs should be added to this equation. The attached FSAR change has been made to Section 3.7.2.7 of the Catawba FSAR to correct this equation. Based on the above and the attached FSAR change, this item was resolved.

ATTACHMENT TO ITEM 48

CNS

3.7.2.7 Combination of Modal Responses

The overall structural response for Duke designed structures is obtained by combining the modal contributions of all the modes considered. This accomplished using the square root of the sum of the squares as discussed in Section 3.7.2.1. The provisions of Regulatory Guide 1.92 are not applicable to the design of the Catawba Nuclear Station structures.

For analysis under the Westinghouse scope, the total unidirectional seismic response is obtained by combining the individual modal responses utilizing the square root of the sum of the squares method. For systems having modes with closely spaced frequencies, this method is modified to include the possible effect of these modes. The groups of closely spaced modes are chosen such that the difference between the frequencies of the first mode and the last mode in the group does not exceed 10 percent of the lower frequency. Groups are formed starting from the lowest frequency and working towards successively higher frequencies. No one frequency is included in more than one group. Combined total response for systems which have such closely pscaed modal frequencies is obtained by adding to the square root of the sum of the squares of all modes the product of the responses of the modes in each group of closely spaced modes and a coupling factor ε. This can be respresented mathematically as:

$$R_T^2 = \sum_{i=1}^{N} R_i^2 + 2 \sum_{j=1}^{S} \sum_{K=M_j}^{N_j-1} \sum_{\ell=K+1}^{N_j} \left| R_K R_\ell \right| \varepsilon_{K\ell}$$

Where:

R_T = total unidirectional response

R_i = absolute value of response of mode i

N = total number of modes considered

S = number of groups of closely spaced modes

M_j = lowest modal number associated with group j of closely spaced modes

N_j = highest modal number associated with group j of closely spaced modes

$\varepsilon_{K\ell}$ = coupling factor with

$$\varepsilon_{K\ell} = \left[1 + \left(\frac{\omega'_K - \omega'_\ell}{(\beta'_K \omega_K + \beta'_\ell \omega_\ell)}\right)^2\right]^{-1} \qquad (3.7.2\text{-}1)$$

Item 49 - 3.7.2.7, page 3.7-15

What is the duration of the operating basis earthquake?

Response:

This item was clarified by the Staff in that the question was directed toward the time duration used for the OBE in the modal response equations contained in Section 3.7.3.1.2 (Pages 3.7-15/16) of the FSAR. Westinghouse indicated that in all cases a minimum of 5 OBE's with a minimum duration of 10 cycles or 10 seconds was used in the analysis of components and piping systems. This minimum duration is consistent with the OBE duration identified in Standard Review Plan 3.7.2. Based on the above discussions, this item was resolved.

Item 50 - 3.7.3.1.2, page 3.7-20

Several referenced figures, Figures 3.7.3-1, 3.7.2-1, are missing. Provide a timetable for their inclusion in the FSAR.

Response:

The referenced figures 3.7.3-1 and 3.7.2-1 are already included.

Item 51 - 3.7.3.2, page 3.7-28

How many earthquake cycles are postulated for BOP piping?

The number of cycles for NSSS components is not given in Table 3.9.1-1 as stated in the first paragrpah. Provide this information.

Response:

Page 3.7-28 will be revised (as attached) to include the following:

3.7.3-2 Determination of Number of Earthquake Cycles

(A) NSSS System

Where fatique analysis of mechanical systems and components within Westinghouse scope are required, Westinghouse specifies, in the equipment specification, the number of cycles of the OBE to be considered. The number of cycles for NSSS components is given in Table 3.9.1-1.

(B) ASME, Section III, Class I piping other than NSSS

For the design of Class I piping, an average of 5 equivalent operational basis earthquakes (OBE) and a total of 200 stress cycles for piping systems will be used for the full plant lifetime. One safe shutdown earthquake (SSE) with 100 stress cycles for piping systems will be used.

Table 3.9.1-1 will be revised (as attached) to provide the missing information (number of cycles for NSSS components).

Attachment to item 51

F = the total right hand side of the equation of motion (Equation (3.7.3-22) or (3.7.3-23)

$\Delta t = t_{n+2} - t_{n+1} = t_{n+1} - t_n$

The value of β is chosen equal to 1/3 in order to provide a margin of numerical stability for nonlinear problems. Since the numerical stability of Equation (3.7.3-24) is mostly determined by the left hand side terms of that equation, the right hand side terms were replaced by F_{n+2}. Furthermore, since the time increment may vary between two successive time substeps, Equation (3.7.3-24) may be modified as follows:

$$\frac{2}{(\Delta t + \Delta t_1)} [M] \left\{ \frac{x_{n+2} - x_{n+1}}{\Delta t} - \frac{x_{n+1} - x_n}{\Delta t_1} \right\} + \frac{1}{(\Delta t + \Delta t_1)} [C] \{x_{n+2} - x_n\}$$

By factoring x_{n+2}, x_{n+1}, and x_n, and rearranging terms, Equation (3.7.3-25) is obtained as follows:

$$\begin{aligned} \{C_5 [M] + C_3 [C] + (1/3) [K]\} \{x_{n+2}\} &= \{F_{n+2}\} \\ &+ \{C_7 [M] - (1/3) [K]\} \{x_{n+1}\} \\ &+ \{C_2 [M] + C_3[C] - (1/3)[K]\} \{x_n\} \end{aligned} \qquad (3.7.3\text{-}26)$$

where

$$C_2 = \frac{2}{\Delta t_1(\Delta t + \Delta t_1)}$$

$$C_3 = \frac{1}{\Delta t + \Delta t_1}$$

$$C_5 = \frac{2}{\Delta t(\Delta t + \Delta t_1)}$$

$$C_7 = C_2 + C_5$$

The above set of simultaneous linear equations is solved to obtain the present values of nodal displacements $\{x_+\}$ in terms of the previous (known) values of the nodal displacements. Since [M], [C], and [K] are included in the equation, they can also be time or displacement dependent.

3.7.3.2 Determination of Number of Earthquake Cycles

Where fatigue analyses of mechanical systems and components within Westinghouse scope are required, Westinghouse specifies, in the equipment specification, the

(A) NSSS System

(B) ASME, Section III, Class I piping other than NSSS

For the design of Class I piping, an average of 5 equivalent operational basis earthquakes (OBE) and a total of 200 stress cycles for piping systems will be used for the full plant lifetime. One safe shutdown earthquake (SSE) with 100 stress cycles for piping systems will be used.

number of cycles of the OBE to be considered. The number of cycles for NSSS components is given in Table 3.9.1-1. ~~The fatigue analyses are performed and presented as part of the components stress report.~~

~~For Duke Class B, C, and F piping, the number of postulated earthquake cycles is well below the levels for which the stress range reduction factor (f) would have a value other than unity.~~

3.7.3.3 Procedure Used for Modeling

Refer to Section 3.7.3.1.2 for modeling procedures for subsystems in Westinghouse scope of responsibility.

Seismic piping other than the NSSS is analyzed as a number of seismic subsystems. The response of the supporting structure (a seismic system) is an input to these analyses.

3.7.3.4 Basis for Selection of Frequencies

In theory, the seismic response of piping can be reduced by designing it to have a fundamental frequency much different from that of the supporting structure. In application, the range of practical piping frequencies is limited by other factors. Too flexible a system can have excessive sag, weight stresses, and vibration during normal operation; too rigid a system results in a congested and costly array of supports, particularly where thermal expansion is present. For these reasons, the piping typically has some dynamic modes at high - response forcing frequencies of the structure. The piping analysis methods described in Section 3.7.3.8 account for this, and the piping is designed to withstand the resulting loads.

The analysis of equipment subjected to seismic loading in the Westinghouse scope involves several basic steps, the first of which is the establishment of the intensity of the seismic loading. Considering that the seismic input originates at the point of support, the response of the equipment and its associated supports based upon the mass and stiffness characteristics of the system, will determine the seismic accelerations which the equipment must withstand.

Three ranges of equipment/support behavior which affect the magnitude of the seismic acceleration are possible:

1. If the equipment is rigid relative to the structure, the maximum acceleration of the equipment mass approaches that of the structure at the point of equipment support. The equipment acceleration value in this case corresponds to the low-period region of the floor response spectra.

2. If the equipment is very flexible relative to the structure, the equipment will show very little response.

3. If the periods of the equipment and supporting structure are nearly equal, resonance occurs and must be taken into account.

ATTACHMENT TO ITEM 51

NOTES:

1. This column presents the design transients which have been analyzed for the Class 1 piping systems and the Reactor Coolant nozzles. All transients are assumed to occur at full power except the following:

Plant Condition	Power Level
Heatup/Startup	0%
Cooldown/Shutdown	0%
Unit Loading at 5% per min.	15%
Step Load Increase of 10%	90%
Inadvertent Actuation of SI	0%
All Test Conditions	0%
Steam Line Break	0%

2. Conditions are defined as the following:

Normal — any condition in the course of system startup, operation in the design power range, hot standby and system shutdown, other than Upset, Emergency, Faulted, or Test Conditions.

Upset — any deviation from normal conditions anticipated to occur often enough that design should include a capability to withstand the conditions without operational impairment, including transients caused by a fault in a system component requiring its isolation from the system, transients resulting from any single operator error or control malfunction, and transients caused by a loss of load or power. Upset conditions also include any abnormal incidents not resulting in a forced outage and also forced outages for which the corrective action does not include any repair of mechanical damage.

INSERT A

Emergency - (infrequent incidents) — Those deviations from normal conditions which require shutdown for correction of the conditions or repair of damage in the system. The conditions have a low probability of occurrence but are included to provide assurance that no gross loss of structural integrity will result as a concomitant effect of any damage developed in the system.

Faulted (Limiting Faults) - Those combinations of conditions associated with extremely-low-probability, postulated events whose consequences are such that the integrity and operability of the nuclear station may be impaired to the extent that considerations of public health and safety are involved.

Test — Test conditions are those tests in addition to the 10 hydrostatic or pneumatic tests permitted by NB-6222 and NB-6322 (ASME Section III) including leak tests or subsequent hydrostatic tests.

ATTACHMENT TO ITEM 51

3. Number of occurrences is the calculated or postulated number of occurrences based on a 40 year plant design life.

4. X - transient analyzed for this system
   - - transient not analyzed for this system

– INSERT A –

AS A MINIMUM, 5 OBE'S WERE POSTULATED OVER THE LIFE OF THE PLANT. EACH OBE CONTAINED AT LEAST 10 CYCLES AT MAXIMUM STRESS LEVELS.

Item 52 - 3.7.3.5, page 3.7-29

For which seismic piping has the equivalent static load method of analysis been used? Provide an example of this analysis.

Response:

There has been no use to date of the equivalent static load method of analysis for seismic Category I piping. Page 3.7.29 will be revised (as attached) to commit Duke to provide an example of the equivalent static load method if used for seismic Category I piping.

Attachment item 52

In all cases, equipment under earthquake loadings is designed to be within code allowable stresses.

Also, as noted in Section 3.7.3.1, rigid equipment/support systems have natural frequencies greater than 33 Hz.

3.7.3.5 Use of Equivalent Static Load Method of Analysis

For seismic piping, the equivalent static load method involves the multiplication of the total weight of the equipment or component member by the specified seismic acceleration coeeficient. The magnitude of the seismic acceleration coefficient is established on the basis of the expected dynamic response characteristics of the component. Components within Westinghouse scope which can be adequately characterized as a single degree of freedom systems are considered to have a modal participation factor of one. Seismic acceleration coefficients for multi-degree of freedom systems which may be in the resonance region of the amplified response spectra curves are increased by 50 percent to account conservatively for the increased modal participation. If the equivalent static test method is used for seismic Category I piping, an example will be provided to the NRC.

3.7.3.6 Three Components of Earthquake Motion

Methods used to account for three components of earthquake motion for Westinghouse subsystems are given in Section 3.7.2.6.

For seismic piping other than NSSS, analysis is performed using simultaneous three-direction excitation. Directional responses are combined into a total response by taking the square root of the sum of the squares (SRSS) of individual responses. This method conforms fully to the recommendations of Regulatory Guide 1.92.

3.7.3.7 Combination of Modal Responses

Methods used to combine modal responses for subsystems in Westinghouse's scope of responsibility are given in Section 3.7.2.7.

For seismic piping other than the NSSS, modal responses are combined into a total response by taking the square root of the sum of the squares (SRSS) of individual responses. The responses from groups of closely spaced modes, defined as having frequencies between the lowest frequency in the group and a frequency ten percent higher, are combined by absolute summation; the resulting response for each group is then combined by SRSS with the remaining responses from the modes which are not closely spaced. This method conforms fully to the recommendations of Regulatory Guide 1.92.

3.7.3.8 Analytical Procedures for Piping

The criteria for determining which piping is to be seismic are discussed in Section 3.2.1. All seismic piping is classified Seismic Category I. The specific analytical procedures used in qualifying the pipe depend on its size, temperature, structural frequency, and other factors as discussed in this section.

Item 53 - 3.7.3.8, page 3.7-29

The applicant states that the specific analytical procedures used in qualifying the pipe depend on its size, temperature, structural frequency, and other factors as discussed in this section. What criteria is used in qualifying the pipe?

Response:

Table 3.7.3-1 only lists alternate piping, assuming all other piping to be rigorous piping (analyzed rigorously). The attached matrix is provided as a reference to easily distinguish alternate scope piping from rigorous scope piping.

Attachment item 53

DESIGN CLASSIFICATION

SIZE	CLASS	SCH.	TYPE OF ANALYSIS *** — RIGOROUS ANALYSIS **	TYPE OF ANALYSIS *** — ALTERNATE ANALYSIS METHODS
TUBING * 1/4"	B,C,	ALL	---	ALL
3/8"		ALL	---	ALL
1/2"		ALL	---	ALL
3/4"		ALL	---	ALL
PIPE 1/2" To 1"	A.	ALL	All	---
	B,C	10S	$\geq$301° or $\geq$276 PSI	$\leq$300° and $\leq$275 PSI
		40	$\geq$301° or $\geq$686 PSI	$\leq$300° and $\leq$685 PSI
		80	$\geq$651° or $\geq$2486 PSI	$\leq$650° and $\leq$2485 PSI
		160	$\geq$651° or $\geq$2486 PSI	$\leq$650° and $\leq$2485 PSI
1 1/4" To 4"	A	All	All	---
	B,C,	10S	$\geq$301° or $\geq$276 PSI	$\leq$300° and $\leq$275 PSI
		40	$\geq$301° or $\geq$686 PSI	$\leq$300° and $\leq$685 PSI
		80	$\geq$301° or $\geq$1486 PSI	$\leq$300° and $\leq$1485 PSI
		160	$\geq$301° or $\geq$1486 PSI	$\leq$300° and $\leq$1485 PSI
5" To 22"	A	All	All	---
	B	All	All	---
	C	All	All	---
24" And Larger	A	All	All	---
	B	All	All	---
	C	All	All	---

FOOT NOTE

$\geq$ EQUAL TO OR GREATER THAN

$\leq$ EQUAL TO OR LESS THAN

* SAFETY RELATED INSTRUMENT & PROCESS TUBING

** HIGH ENERGY LINES ARE RIGOROUS

*** PIPING WHICH WITHIN THE ALTERNATE ANALYSIS METHODS MAY BE ANALYZED AS RIGOROUS

.tem 54 - 3.7.3.8.1, page 3.7-30

A period of 0.033 seconds corresponds to a frequency of 30.3 cps. In Regulatory Guide 1.60 the cutoff is 33 cps. Justify the use of the lower frequency as the c'toff.

Response:

Duke will revise FSAR Sections 3.7.3.8.1 and 3.7.3.8.2 as attached. This change establishes the cutoff between flexible and as 33 cps.

The third paragraph of 3.7.3.8.2 states that typically all modes having a period greater than 0.033 seconds are used in the analysis. The 0.033 seconds should be changed to 0.0303 seconds. All piping analysis work with the exception of Class 2/3 has been analyzed using 0.0303 seconds. The class 2/3 piping has been done using 0.033 seconds and 0.0303 seconds. Our experience has been that there is essentially no difference between analysis work pe~formed with either 0.0303 seconds or 0.033 seconds.

The example problem shown in the FSAR (CAF) was run using 0.033 seconds as a cutoff. The stress ratios and support loads for CAF using 0.0303 seconds as a cutoff are attached to justify the position that there is essentially no difference.

This item was closed.

Attachment item 54

3.7.3.8.1 Static Analysis of Rigid Piping

0.0303

Pipirg subsystems with a period of less than 0.033 seconds are considered rigid. This piping is designed for a uniform static coefficient equal to the maximum floor acceleration at the appropriate location in the structure.

3.7.3.8.2 Rigorous Analysis of Flexible Piping

0.0303

Piping subsystems with a period greater than 0.033 seconds are considered flexible. Some of this piping can be handled by the simplified, conservative alternate analysis described in Section 3.7.3.8.3 below. The remaining flexible pipe is analyzed using the modal response spectrum method, as follows:

Each pipe is idealized as a mathematical model consisting of lumped masses connected by elastic members. Lumped masses are located at carefully selected points in order to adequately represent the dynamic and elastic characteristics of the pipe system. Using the elastic properties of the pipe, the flexibility matrix for the pipe is determined. The flexibility calculations include the effects of the torsional, bending, shear, and axial deformations. In addition, for curved members, the stiffness is decreased in accordance with ASME III for applicable nuclear piping systems.

Once the flexibility and mass matrices of the mathematical model are calculated the frequencies and mode shapes for all significant modes of vibration are determined. Typically, all modes having a period greater than 0.033 seconds are used in the analysis. In cases where the seismic model for a particular pipe is very large, a lesser number of modes may be used, provided the omitted modes lie in the flat region (rigid side) of the applicable response spectrum. This assures that the results include all significant contributions.

0.0303

The mode shapes and frequencies are solved in accordance with the following equation:

$$(K - w_n^2 M)\, \phi_n = 0$$

in which:

- K = square stiffness matrix of the pipe loop
- M = mass matrix for the pipe loop
- W_n = frequency for the n^{th} mode
- ϕ_n = mode shape matrix of the n^{th} mode

After the frequency is determined for each mode, the corresponding spectral acceleration is read from the appropriate response spectrum for the pipe. Using these spectral accelerations, the response for each mode is found by solving the following equation:

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

CLASS 2 AND 3 STRESS SUMMARY

VERIFICATION OF COMPUTER RESULTS

THIS COMPUTER ANALYSIS COVERS ITEMS RELATED TO NUCLEAR SAFETY. THE QUALITY HAS BEEN ASSURED IN ACCORDANCE WITH PROCEDURES SET FORTH IN THE EDS QUALITY ASSURANCE MANUAL ESTABLISHED TO COMPLY WITH THE REQUIREMENTS CONTAINED IN 10 CFR 50, APPENDIX B, AND ASME BOILER AND PRESSURE VESSEL CODE, SECTION III.

THE PROGRAM USED HAS BEEN DEVELOPED, DOCUMENTED AND VERIFIED FOR PRINCIPAL USE IN ACCORDANCE WITH PROCEDURES SET FORTH IN THE EDS QUALITY ASSURANCE MANUAL

THE PROGRAM INPUT AND OUTPUT FOR THIS ANALYSIS HAVE BEEN PREPARED, CHECKED AND APPROVED IN ACCORDANCE WITH PROCEDURES SET FORTH IN THE APPROPRIATE QUALITY ASSURANCE MANUAL AS NOTED BELOW

PREPARED BY DATE

CHECKED BY DATE

APPROVED BY DATE

CLASS 2 AND 3 STRESS SUMMARY

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

STRESSES FOR EQUATION 8 SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1														
	1	A1	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3813.56	0.254
	2		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4177.17	0.278
	3		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4203.44	0.280
	4		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3892.36	0.259
	5	A2	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4383.18	0.292
	6		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3839.04	0.256
	7		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3994.86	0.266
	8		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3864.30	0.258
	9	A3	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4230.71	0.282
	10		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3891.36	0.259
	11		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4048.98	0.270
	12		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3869.25	0.258
	13	A4	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4274.94	0.285
	14		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3855.99	0.257
	15L	E01A	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3916.82	0.261
	15W	E01A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	3952.96	0.264
	15R	E01A	E01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	3916.82	0.261
	16L	E01B	E01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	3908.62	0.261
	16W	E01B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	3941.90	0.263
	16R	E01B	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3908.62	0.261
	17	A6	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4102.66	0.274

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG /INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	18		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3941.13	0.263
	19	A7	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4208.68	0.281
	20		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3996.30	0.266
	21		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4181.73	0.279
	22		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4056.93	0.270
	23	A8	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4079.25	0.272
	24		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3909.02	0.261
	25		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3962.04	0.264
	26		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4374.48	0.292
	27	1	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	5145.82	0.343
	28		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4243.94	0.283
	29L	C01A	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4019.30	0.268
	29W	C01A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4091.30	0.273
	29R	C01A	C01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4019.30	0.268
	30L	C01B	C01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4070.63	0.271
	30W	C01B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4160.61	0.277
	30R	C01B	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4070.63	0.271
	31	2	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4215.98	0.281
	32L	C02A	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4184.71	0.279
	32W	C02A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4314.62	0.288

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
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WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SUP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	32R	C02A	C02	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4184.71	0.279
	33L	C02B	C02	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4158.70	0.277
	33W	C02B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4279.50	0.285
	33R	C02B	3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4158.70	0.277
	34		3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4116.21	0.274
	35L	C03A	3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4437.38	0.296
	35W	C03A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4655.72	0.310
	35R	C03A	C03	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4437.38	0.296
	36L	C03B	C03	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4582.80	0.306
	36W	C03B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4852.C4	0.323
	36R	C03B	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4582.80	0.308
	37	3	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4584.23	0.306
	38		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4408.19	0.294
	39		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4232.35	0.282
	40		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4057.12	0.270
	41		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3887.02	0.259
	42	4	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3930.22	0.262
	43	5	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3949.07	0.263
	44	6	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3987.08	0.266
	45		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4024.24	0.268

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SUP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	46		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4061.53	0.271
	47	6A	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4098.88	0.273
	48L	C04A	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4101.04	0.273
	48W	C04A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4201.65	0.280
	48R	C04A	C04	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4101.04	0.273
	49L	C04B	C04	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4450.58	0.297
	49W	C04B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4673.54	0.312
	49R	C04B	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4450.58	0.297
	50	7	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4917.47	0.328
	51		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4022.57	0.268
	52		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4047.63	0.270
	53		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4017.06	0.268
	54	8	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4121.06	0.275
	55L	C05A	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3938.76	0.263
	55W	C05A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	3982.58	0.266
	55R	C05A	C05	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	3938.76	0.263
	56L	C05B	C05	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	3890.37	0.259
	56W	C05B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	3917.26	0.261
	56R	C05B	6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3890.37	0.259
	57		6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4185.46	0.279

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

TRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SUP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 CONTD.)														
	58		6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4205.91	0.280
	59L	C06A	6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3940.99	0.263
	59W	C06A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	3985.59	0.266
	59R	C06A	C06	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	3940.99	0.263
	60L	C06B	C06	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	3916.75	0.261
	60W	C06B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	3952.86	0.264
	60R	C06B	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3916.75	0.261
	61	9	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4379.92	0.292
	62L	C07A	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3869.78	0.258
	62W	C07A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	3889.47	0.259
	62R	C07A	C07	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	3869.78	0.258
	63L	C07B	C07	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	3976.93	0.265
	63W	C07B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4034.12	0.269
	63R	C07B	8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	3976.93	0.265
	64		8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4312.38	0.287
	65		8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4407.31	0.294
	66L	C08A	8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4223.98	0.282
	66W	C08A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4367.63	0.291
	66R	C08A	C08	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4223.98	0.282
	67L	C08B	C08	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4126.18	0.275

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	67W	C08B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4235.60	0.282
	67R	C08B	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4126.18	0.275
	68	10	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4131.37	0.275
	69		9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4355.30	0.290
	70	11	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4586.81	0.306
	71L	C09A	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4611.94	0.307
	71W	C09A		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4891.37	0.326
	71R	C09A	C09	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4611.94	0.307
	72L	C09B	C09	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		15000.00	4619.23	0.308
	72W	C09B		AWBW	AWBW		1.800	STCK	1800.00	160.0		15000.00	4901.22	0.327
	72R	C09B	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4619.23	0.308
	73	12	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4629.39	0.309
	74		10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	4843.49	0.323
	75		10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	5441.12	0.363
	76L	13	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		15000.00	5825.71	0.388
	76W	13		AWTT	AWTT		1.900	STCK	1800.00	160.0		15000.00	6680.87	0.445
	76R	13	11	VALV	4S160	SA106 B	N/A							
	77	14	11	VALV	4S160	SA106 B	N/A							
	78L	15	11	VALV	4S160	SA106 B	N/A							
	78W	15		AWTT	AWTT		1.900	STCK	1800.00	600.0		15000.00	6027.99	0.402

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUNT (CONTD.)														
	78R	15	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0		15000.00	5367.55	0.358
	79		12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0		15000.00	4739.20	0.316
	80	16	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0		15000.00	6655.82	0.444
	81	16A	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0		15000.00	5589.13	0.373
	82L	17	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0		15000.00	4755.96	0.317
	82W	17		AWTT	AWTT		1.900	STCK	1800.00	600.0		15000.00	5156.48	0.344
	82R	17	13	VALV	4S160	SA106 B	N/A							
	83	18	13	VALV	4S160	SA106 B	N/A							
	84L	19	13	VALV	4S160	SA106 B	N/A							
	84W	19		AWTT	AWTT		1.900	STCK	1800.00	600.0		15000.00	5758.16	0.384
	84R	19	14	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4330.73	0.289
	85L	20	14	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4371.00	0.291
	85W	20		AWTT	AWTT		1.900	STCK	1400.00	600.0		15000.00	7438.09	0.496
	85R	20	15	BTEE-R	4S80	SA106 B	N/A							
	86BL	21	15	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0		15000.00	6646.13	0.443
	86BR	21	15	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0		15000.00	6354.75	0.424
	87L	22	15	BTEE-R	4S80	SA106 B	N/A							
	87W	22		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	6362.84	0.459
	87R	22	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	6310.07	0.421
	88		16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5953.37	0.397

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BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK ; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SGP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUNT (CONTD.)														
	[illegible]	24	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	6287.68	0.419
	90L	C10A	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5993.29	0.400
	90	C10A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	6435.19	0.430
	90R	C10A	C10	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	6154.16	0.410
	91L	C10B	C10	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	6241.30	0.416
	91W	C10B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	6560.05	0.437
	91R	C10B	17	BTEE-R	4S80	SA106 B	N/A							
	92BL	25	17	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0		15000.00	6114.55	0.408
	92BR	25	17	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0		15000.00	5574.83	0.372
	93L	26	17	BTEE-R	4S80	SA106 B	N/A							
	93W	26		AWTT	AWTT		1.900	STCK	1400.00	600.0		15000.00	5893.79	0.393
	93R	26	18	VALV	4S80	SA106 B	N/A							
	94	27	18	VALV	4S80	SA106 B	N/A							
	95L	28	18	VALV	4S80	SA106 B	N/A							
	95W	28		AWTT	AWTT		1.900	STCK	1400.00	600.0		15000.00	4930.92	0.329
	95R	28	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4854.18	0.324
	96	29	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5034.29	0.336
	97L	30	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5529.21	0.369
	97BL	30	74	FTEE-R	4X2-S160	SA105	3.030	STCK	1400.00	600.0		17500.00	6617.86	0.378
	97BR	30	74	FTEE-R	4X2-S160	SA105	3.030	STCK	1400.00	600.0		17500.00	6617.95	0.378

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	97R	30	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5529.26	0.369
	98	30A	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	6270.16	0.418
	99L	31	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5524.35	0.368
	99W	31		AWTT	AWTT		1.900	STCK	1400.00	600.0		15000.00	5885.92	0.392
	99R	31	20	VALV	4S80	SA106 B	N/A							
	100	32	20	VALV	4S80	SA106 B	N/A							
	101L	C11A	20	VALV	4S80	SA106 B	N/A							
	101W	C11A		AWTT	AWTT		1.900	STCK	1400.00	600.0		15000.00	5423.86	0.362
	101R	C11A	C11	BELB	4S80-FL	SA106 B	1.320	STCK	1400.00	600.0		15000.00	5200.09	0.347
	102L	C11B	C11	BELB	4S80-FL	SA106 B	1.320	STCK	1400.00	600.0		15000.00	5206.94	0.347
	102W	C11B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5393.62	0.360
	102R	C11B	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5206.94	0.347
	103	33A	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5516.55	0.368
	104L	C70A	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4845.96	0.323
	104W	C70A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	4906.29	0.327
	104R	C70A	C70	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4866.97	0.324
	105L	C70B	C70	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4784.66	0.319
	105W	C70B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	4807.25	0.320
	105R	C70B	21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4772.59	0.318
	106		21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4762.64	0.318

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	107L	C71A	21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4756.21	0.317
	107W	C71A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	4765.13	0.319
	107R	C71A	C71	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4766.28	0.318
	108L	C71B	C71	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4768.31	0.318
	108W	C71B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	4787.57	0.319
	108R	C71B	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4758.02	0.317
	109	33B	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4774.38	0.318
	110L	C72A	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4810.18	0.321
	110W	C72A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	4857.98	0.324
	110R	C72A	C72	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4826.83	0.322
	111L	C72B	C72	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4893.62	0.326
	111W	C72B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	4938.36	0.329
	111R	C72B	21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4869.71	0.325
	112		21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4853.97	0.324
	113L	C73A	21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4842.44	0.323
	113W	C73A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	4901.54	0.327
	113R	C73A	C73	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4863.02	0.324
	114L	C73B	C73	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5166.12	0.344
	114W	C73B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5266.27	0.351
	114R	C73B	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5112.61	0.341

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	115	33	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5322.91	0.355
	116	34	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5432.20	0.362
	117L	C74A	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5172.48	0.345
	117W	C74A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5347.09	0.356
	117R	C74A	C74	BE 3	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5233.29	0.349
	118L	C74B	C74	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4981.37	0.332
	118W	C74B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5043.95	0.336
	118R	C74B	21F	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4947.93	0.330
	119L	C75A	21F	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4954.39	0.330
	119W	C75A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5052.67	0.337
	119R	C75A	C75	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4968.62	0.333
	120L	C75B	C75	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	4831.00	0.322
	120W	C75B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	4863.01	0.324
	120R	C75B	21	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4813.90	0.321
	121L	C12A	21	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5174.98	0.345
	121W	C12A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5350.47	0.357
	121R	C12A	C12	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5236.10	0.349
	122L	C12B	C12	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5309.19	0.354
	122W	C12B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5438.42	0.363
	122R	C12B	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5240.13	0.349

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	123	35	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5244.94	0.350
	124L	36	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5248.77	0.350
	124BL	36	60	FTEE-R	4X2-S80	SA105	3.030	STCK	1400.00	600.0		17500.00	5980.58	0.342
	124BR	36	60	FTEE-R	4X2-S80	SA105	3.030	STCK	1400.00	600.0		17500.00	5751.35	0.329
	124R	36	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5147.89	0.343
	125L	C13A	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5237.68	0.349
	125W	C13A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5435.11	0.362
	125R	C13A	C13	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5306.43	0.354
	126L	C13B	C13	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5516.37	0.368
	126W	C13B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5687.73	0.379
	126R	C13B	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5424.80	0.362
	127	37	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5424.11	0.362
	128	38	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5423.88	0.362
	129		23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5420.96	0.361
	130L	39	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5418.26	0.361
	130W	39		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5678.89	0.379
	130R	39	24	BRCH-B	18X4-S80	SA106 B	N/A							
	131	40	24	BRCH-B	18X4-S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5356.02	0.358

MAXIMUM STRESS RATIO FOR THIS RUN = 0.496 AT SOP NO. 85W

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.OSH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN9 (CONTD.)														
	294W	C64A		FILW	FILW		2.100	STCK	1400.00	600.0		15000.00	4030.15	0.272
	294R	C64A	C64	SELB	2S80	SA105	1.786	STCK	1400.00	600.0		17500.00	4040.17	0.231
	295L	C64B	C64	SELB	2S80	SA105	1.786	STCK	1400.00	600.0		17500.00	3872.42	0.221
	295W	C64B		FILW	FILW		2.100	STCK	1400.00	600.0		15000.00	3882.86	0.259
	295R	C64B	77	STRP	2S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	3857.38	0.257
	296	93	77	STRP	2S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4876.63	0.325

MAXIMUM STRESS RATIO FOR THIS RUN = 0.325 AT SOP NO. 296

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10														
	297	25	78	BTEE-B	4S80	SA106 B	1.128	STCK	1400.00	600.0		15000.00	5269.29	0.351
	298L	C36A	78	BTEE-B	4S80	SA106 B	N/A							
	298W	C36A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5445.85	0.363
	298R	C36A	C36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5315.37	0.354
	299L	C36B	C36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5281.34	0.352
	299W	C36B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5404.91	0.360
	299R	C36B	79	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5215.31	0.348
	300L	E36A	79	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5162.25	0.345
	300W	E36A		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5360.29	0.357
	300R	E36A	E36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5244.26	0.350
	301L	E36B	E36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5226.34	0.348

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 8 (CONTD.) SUSTAINED LOADS. ALLOWABLE STRESS = 1.0SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNTO (CONTD.)														
	301W	E36B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5338.73	0.356
	301R	E36B	C37	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5226.34	0.348
	302L	C37B	C37	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		15000.00	5232.90	0.349
	302W	C37B		AWBW	AWBW		1.800	STCK	1400.00	600.0		15000.00	5346.62	0.356
	302R	C37B	80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5172.13	0.345
	303		80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5086.31	0.339
	304L	94A	80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	4964.32	0.331
	304W	94A		AWTT	AWTT		1.900	STCK	1400.00	600.0		15000.00	5087.88	0.339
	304R	94A	81	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		15000.00	3176.64	0.212
	305L	94	81	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		15000.00	3211.18	0.214
	305W	94		AWTT	AWTT		1.900	STCK	1400.00	600.0		15000.00	3315.34	0.221
	305R	94	82	NONS	4S160	SA105	N/A							
	306	95	82	NONS	4S160	SA105	N/A							
	307L	96	82	NONS	4S160	SA105	N/A							
	307W	96		AWTT	AWTT		1.900	STCK	1400.00	600.0		15000.00	3698.88	0.247
	307R	96	83	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		15000.00	3480.33	0.232
	308L	96A	83	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		15000.00	3662.68	0.244
	308W	96A		AWTT	AWTT		1.900	STCK	1400.00	600.0		15000.00	6044.28	0.403
	308R	96A	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	5635.48	0.376
	309	97	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		15000.00	6199.42	0.413

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1														
	1	A1	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	3813.56	0.212
	2		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4245.43	0.236
	3		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4280.87	0.238
	4		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	3970.16	0.221
	5	A2	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4502.87	0.250
	6		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	3940.49	0.219
	7		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4084.90	0.227
	8		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	3958.98	0.220
	9	A3	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4355.37	0.242
	10		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	3958.92	0.220
	11		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4104.97	0.228
	12		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	3933.03	0.219
	13	A4	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4339.50	0.241
	14		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.93	3924.37	0.218
	15L	E01A	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	3991.70	0.222
	15W	E01A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	4054.05	0.225
	15R	E01A	E01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	3991.70	0.222
	16L	E01B	E01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	3972.49	0.221
	16W	E01B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	4028.11	0.224
	16R	E01B	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	3972.49	0.221
	17	A6	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4207.61	0.234

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

TRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 CONTD.)														
	18		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4041.26	0.225
	19	A7	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4389.32	0.244
	20		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4121.66	0.229
	21		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4364.37	0.242
	22		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4351.10	0.242
	23	A8	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4491.61	0.250
	24		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4216.04	0.234
	25		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4521.98	0.251
	26		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5351.36	0.297
	27	1	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6504.77	0.361
	28		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5018.11	0.279
	29L	C01A	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6616.54	0.368
	29W	C01A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	7597.59	0.422
	29R	C01A	C01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	6616.54	0.368
	30L	C01B	C01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	6812.75	0.378
	30W	C01B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	7862.47	0.437
	30R	C01B	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6812.75	0.378
	31	2	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6905.54	0.384
	32L	C02A	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6797.48	0.378
	32W	C02A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	7841.85	0.436

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	32R	C02A	C02	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	6797.48	0.378
	33L	C02B	C02	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	6621.21	0.368
	33W	C02B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	7603.68	0.422
	33R	C02B	3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6621.21	0.368
	34		3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5438.95	0.302
	35L	C03A	3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4729.04	0.263
	35W	C03A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	5049.46	0.281
	35R	C03A	C03	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	4729.04	0.263
	36L	C03B	C03	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	5100.18	0.283
	36W	C03B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	5550.49	0.308
	36R	C03B	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5100.18	0.283
	37	3	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5418.18	0.301
	38		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5483.09	0.305
	39		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5390.27	0.299
	40		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4791.29	0.266
	41		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4735.94	0.263
	42	4	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5207.35	0.289
	43	5	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5226.44	0.290
	44	6	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5255.33	0.292
	45		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5063.78	0.281

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	46		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4759.64	0.264
	47	6A	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4495.25	0.250
	48L	C04A	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4470.43	0.248
	48W	C04A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	4700.34	0.261
	48R	C04A	C04	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	4470.43	0.248
	49L	C04B	C04	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	4947.71	0.275
	49W	C04B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	5344.66	0.297
	49R	C04B	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4947.71	0.275
	50	7	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5461.62	0.303
	51		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5174.44	0.287
	52		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5687.69	0.316
	53		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5897.44	0.323
	54	8	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5892.31	0.327
	55L	C05A	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5627.83	0.313
	55W	C05A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	6262.82	0.348
	55R	C05A	C05	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	5627.83	0.313
	56L	C05B	C05	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	5362.37	0.298
	56W	C05B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	5904.46	0.328
	56R	C05B	6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5362.37	0.298
	57		6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5008.43	0.278

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	58		6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4654.27	0.259
	59L	C06A	6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4277.47	0.238
	59W	C06A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	4439.84	0.247
	59R	C06A	C06	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	4277.47	0.238
	60L	C06B	C06	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	4243.22	0.236
	60W	C06B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	4393.61	0.244
	60R	C06B	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4243.22	0.236
	61	9	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5293.85	0.294
	62L	C07A	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	4654.37	0.259
	62W	C07A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	4948.66	0.275
	62R	C07A	C07	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	4654.37	0.259
	63L	C07B	C07	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	5013.64	0.279
	63W	C07B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	5433.68	0.302
	63R	C07B	8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5013.64	0.279
	64		8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5511.93	0.306
	65		8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6596.92	0.366
	66L	C08A	8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	8205.98	0.456
	66W	C08A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	9743.32	0.541
	66R	C08A	COC	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	8205.98	0.456
	67L	C08B	C08	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	7932.39	0.441

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	67W	C08B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	9373.98	0.521
	67R	C08B	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	7932.39	0.441
	68	10	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	7352.57	0.408
	69		9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	7051.36	0.392
	70	11	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6820.71	0.379
	71L	C09A	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5780.31	0.321
	71W	C09A		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	6468.68	0.359
	71R	C09A	C09	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	5780.31	0.321
	72L	C09B	C09	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0		17999.98	5695.16	0.316
	72W	C09B		AWBW	AWBW		1.800	STCK	1800.00	160.0		17999.98	6353.71	0.353
	72R	C09B	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5695.16	0.316
	73	12	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	5803.58	0.323
	74		10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6141.31	0.341
	75		10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	6936.36	0.385
	76L	13	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0		17999.98	7620.58	0.423
	76W	13		AWTT	AWTT		1.900	STCK	1800.00	160.0		17999.98	9238.56	0.513
	76R	13	11	VALV	4S160	SA106 B	N/A							
	77	14	11	VALV	4S160	SA106 B	N/A							
	78L	15	11	VALV	4S160	SA106 B	N/A							
	78W	15		AWTT	AWTT		1.900	STCK	1800.00	600.0		17999.98	8435.68	0.469

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER FUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

TRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 CONTD.)														
	78R	15	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0		17999.98	7057.16	0.392
	79		12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0		17999.98	6211.56	0.345
	80	16	12	STRP	4S160	SA106 B	1.00C	STCK	1800.00	600.0		17999.98	7944.39	0.441
	81	16A	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0		17999.98	6986.71	0.388
	82L	17	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0		17999.98	6262.34	0.348
	82W	17		AWTT	AWTT		1.900	STCK	1800.00	600.0		17999.98	7303.08	0.406
	82R	17	13	VALV	4S160	SA106 B	N/A							
	83	18	13	VALV	4S160	SA106 B	N/A							
	84L	19	13	VALV	4S160	SA106 B	N/A							
	84W	19		AWTT	AWTT		1.900	STCK	1800.00	600.0		17999.98	8838.36	0.491
	84R	19	14	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6492.28	0.361
	85L	20	14	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6577.45	0.365
	85W	20		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	11779.84	0.654
	85R	20	15	BTEE-R	4S80	SA106 B	N/A							
	86BL	21	15	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0		17999.98	9741.02	0.541
	86BR	21	15	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0		17999.98	10158.47	0.564
	87L	22	15	BTEE-R	4S80	SA106 B	N/A							
	87W	22		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	11708.11	0.650
	87R	22	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	9884.35	0.549
	88		16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7953.77	0.442

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WI-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

TRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 CONTD.)														
	89	24	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8051.67	0.447
	90L	C10A	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7694.49	0.427
	90W	C10A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8751.81	0.486
	90R	C10A	C10	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	8062.73	0.448
	91L	C10B	C10	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	8114.62	0.451
	91W	C10B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8814.25	0.490
	91R	C10B	17	BTEE-R	4S80	SA106 B	N/A							
	92BL	25	17	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0		17999.98	7860.06	0.437
	92BR	25	17	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0		17999.98	7196.22	0.400
	93L	26	17	BTEE-R	4S80	SA106 B	N/A							
	93W	26		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	8277.90	0.460
	93R	26	18	VALV	4S80	SA106 B	N/A							
	94	27	18	VALV	4S80	SA106 B	N/A							
	95L	28	18	VALV	4S80	SA106 B	N/A							
	95W	28		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	8429.79	0.468
	95R	28	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7309.52	0.406
	96	29	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7779.04	0.432
	97L	30	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8255.38	0.459
	97BL	30	74	FTEE-R	4X2-S160	SA105	3.030	STCK	1400.00	600.0		20999.98	12812.60	0.610
	97BR	30	74	FTEE-R	4X2-S160	SA105	3.030	STCK	1400.00	600.0		20999.98	12765.56	0.608

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1 TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	97R	30	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8234.68	0.457
	98	30A	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8975.41	0.499
	99L	31	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8352.44	0.464
	99W	31		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	9915.95	0.551
	99R	31	20	VALV	4S80	SA106 B	N/A							
	100	32	20	VALV	4S80	SA106 B	N/A							
	101L	C11A	20	VALV	4S80	SA106 B	N/A							
	101W	C11A		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	10086.66	0.560
	101R	C11A	C11	BELB	4S80-FL	SA106 B	1.320	STCK	1400.00	600.0		17999.98	8472.23	0.471
	102L	C11B	C11	BELB	4S80-FL	SA106 B	1.320	STCK	1400.00	600.0		17999.98	8671.10	0.482
	102W	C11B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	10070.22	0.559
	102R	C11B	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8671.10	0.482
	103	33A	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	9054.36	0.503
	104L	C70A	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7792.50	0.433
	104W	C70A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8884.11	0.494
	104R	C70A	C70	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	8172.68	0.454
	105L	C70B	C70	BELB	4S80	SA106 B	1.496	STCK	1400	600.0		17999.98	7654.91	0.425
	105W	C70B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8261.07	0.459
	105R	C70B	21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7330.98	0.407
	106		21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6485.95	0.360

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	107L	C71A	21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5718.27	0.318
	107W	C71A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6083.91	0.338
	107R	C71A	C71	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	5845.61	0.325
	108L	C71B	C71	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	6166.20	0.343
	108W	C71B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6469.68	0.359
	108R	C71B	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6004.02	0.334
	109	33B	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6170.90	0.343
	110L	C72A	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6387.32	0.355
	110W	C72A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6987.13	0.388
	110R	C72A	C72	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	6596.22	0.366
	111L	C72B	C72	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	6746.16	0.375
	111W	C72B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7167.55	0.398
	111R	C72B	21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6520.97	0.362
	112		21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6240.73	0.347
	113L	C73A	21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6782.23	0.377
	113W	C73A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7520.25	0.418
	113R	C73A	C73	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	7039.26	0.391
	114L	C73B	C73	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	7376.01	0.410
	114W	C73B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7925.46	0.440
	114R	C73B	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7082.39	0.393

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

TRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 CONTD.)														
	115	33	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7207.73	0.400
	116	34	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7282.13	0.405
	117L	C74A	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6923.33	0.385
	117W	C74A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7710.74	0.428
	117R	C74A	C74	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	7197.57	0.400
	118L	C74B	C74	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	6656.96	0.370
	118W	C74B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7060.22	0.392
	118R	C74B	21F	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6441.46	0.358
	119L	C75A	21F	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6140.21	0.341
	119W	C75A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6653.52	0.370
	119R	C75A	C75	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	6318.98	0.351
	120L	C75B	C75	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	5959.83	0.331
	120W	C75B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6221.35	0.346
	120R	C75B	21	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5820.08	0.323
	121L	C12A	21	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6695.96	0.372
	121W	C12A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7403.79	0.411
	121R	C12A	C12	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	6942.48	0.386
	122L	C12B	C12	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	7247.55	0.403
	122W	C12B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7770.88	0.432
	122R	C12B	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6967.88	0.387

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.P. ** ** ** UNIT-1 ** ** **
WI-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	123	35	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6970.60	0.387
	124L	36	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6889.95	0.383
	124BL	36	60	FTEE-R	4X2-S80	SA105	3.030	STCK	1400.00	600.0		20999.98	9709.89	0.462
	124BR	36	60	FTEE-R	4X2-S80	SA105	3.030	STCK	1400.00	600.0		20999.98	10135.09	0.483
	124R	36	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7077.07	0.393
	125L	C13A	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7144.88	0.397
	125W	C13A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8009.83	0.445
	125R	C13A	C13	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	7446.12	0.414
	126L	C13B	C13	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	7562.82	0.420
	126W	C13B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8150.25	0.453
	126R	C13B	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7248.90	0.403
	127	37	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6999.96	0.389
	128	38	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6930.05	0.385
	129		23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7217.81	0.401
	130L	39	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	9025.55	0.501
	130W	39		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	10548.73	0.586
	130R	39	24	BRCH-B	18X4-S80	SA106 B	N/A							
	131	40	24	BRCH-B	18X4-S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	9517.11	0.529

MAXIMUM STRESS RATIO FOR THIS RUN = 0.654 AT SOP NO. 85W

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C.A.F. ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN9 (CONTD.)														
	294W	C64A		FILW	FILW		2.100	STCK	1400.00	600.0		17999.98	6071.48	0.337
	294R	C64A	C64	SELB	2S80	SA105	1.786	STCK	1400.00	600.0		20999.98	5735.93	0.273
	295L	C64B	C64	SELB	2S80	SA105	1.786	STCK	1400.00	600.0		20999.98	5867.20	0.279
	295W	C64B		FILW	FILW		2.100	STCK	1400.00	600.0		17999.98	6228.87	0.346
	295R	C64B	77	STRP	2S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5346.91	0.297
	296	93	77	STRP	2S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6522.83	0.362

MAXIMUM STRESS RATIO FOR THIS RUN = 0.423 AT SOP NO. 279W

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10														
	297	25	7	BTEE-B	4S80	SA106 B	1.128	STCK	1400.00	600.0		17999.98	6291.77	0.350
	298L	C36A	78	BTEE-B	4S80	SA106 B	N/A							
	298W	C36A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6678.67	0.371
	298R	C36A	C36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	6339.88	0.352
	299L	C36B	C36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	6153.23	0.342
	299W	C36B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6454.22	0.359
	299R	C36B	79	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5992.58	0.333
	300L	E36A	79	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5825.03	0.324
	300W	E36A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6228.12	0.346
	300R	E36A	E36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	5965.46	0.331
	301L	E36B	E36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	5956.57	0.331

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO. KCD 6-30-78 AUX BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; EMDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	301W	E36B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6217.42	0.345
	301R	E36B	C37	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	5954.57	0.331
	302L	C37B	C37	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0		17999.98	6132.80	0.341
	302W	C37B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6429.49	0.357
	302R	C37B	80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5974.25	0.332
	303		80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6184.05	0.344
	304L	94A	80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6485.71	0.360
	304W	94A		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	7255.87	0.403
	304R	94A	81	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	4278.49	0.238
	305L	94	81	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	4445.02	0.247
	305W	94		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	5073.56	0.282
	305R	94	82	NONS	4S160	SA105	N/A							
	306	95	82	NONS	4S160	SA105	N/A							
	307L	96	82	NONS	4S160	SA105	N/A							
	307W	96		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	5728.81	0.318
	307R	96	83	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	4904.85	0.272
	308L	96A	83	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5160.23	0.287
	308W	96A		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	8991.11	0.500
	308R	96A	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7703.43	0.428
	309	97	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8490.49	0.472

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BOX 100 ATUL PATEL *** CHICAF30 W/ 33 HZ. *** ** ** ** C.A.F. ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO. ACD-S-30-78 AUX BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12; RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOF NO.	DEF NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNIO (CONTD.)														
	310	98	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8700.63	0.483
	311L	99	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6121.15	0.340
	311W	99		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6627.80	0.368
	311R	99	85	BRED-E	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0		17999.98	6844.94	0.380
	312L	100	85	BRED-E	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0		17999.98	6304.91	0.350
	312W	100		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6211.17	0.345
	312R	100	86	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5992.43	0.333
	313	100A	86	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6298.63	0.350
	314L	C38A	86	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6511.80	0.362
	314W	C38A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6912.32	0.384
	314R	C38A	C38	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	6777.41	0.377
	315L	C38B	C38	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	6949.57	0.386
	315W	C38B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7100.73	0.394
	315R	C38B	87	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6651.37	0.370
	316		87	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6540.35	0.363
	317L	C39A	87	STRP	6S80	SA106 B	1.000	STCK	1400.00	500.0		17999.98	6691.58	0.372
	317W	C39A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7155.0?	0.398
	317R	C39A	C39	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	6998.91	0.389
	318L	C39B	C39	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7026.53	0.390
	318W	C39B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7185.28	0.399

BOX 100 ATUL FATEL *** CHICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-39-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; EMDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SUP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	318R	C39B	88	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6714.00	0.373
	319L	C40A	88	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6713.85	0.373
	319W	C40A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7185.14	0.399
	319R	C40A	C40	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7026.41	0.390
	320L	C40B	C40	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	6936.83	0.385
	320W	C40B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7066.99	0.394
	320R	C40B	89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6641.19	0.369
	321		89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6886.21	0.383
	322	101	89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7645.16	0.425
	323L	C41A	89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7088.74	0.394
	323W	C41A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7691.19	0.427
	323R	C41A	C41	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7463.27	0.416
	324L	C41B	C41	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7545.26	0.419
	324W	C41B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7753.63	0.431
	324R	C41B	90	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7135.00	0.396
	325L	C42A	90	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7136.82	0.396
	325W	C42A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7756.08	0.431
	325R	C42A	C42	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7547.49	0.419
	326L	C42B	C42	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7641.09	0.425
	326W	C42B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7858.63	0.437

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BOX 100 ATUL PATEL *** CHICAF30-W/ 22 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-9A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA 4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	326R	C42B	91	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.93	7212.70	0.401
	327L	C43A	91	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	[illegible]	0.395
	327W	C43A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7227.24	0.429
	327R	C43A	C43	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7521.17	0.418
	328L	C43B	C43	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7683.15	0.427
	328W	C43B		AWBW	AWBW		1.000	STCK	1400.00	600.0		17999.98	7904.71	0.439
	328R	C43B	92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.93	[illegible]	0.403
	329		92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7314.60	0.409
	330	102	92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7328.50	0.407
	331L	C44A	92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7336.91	0.408
	331W	C44A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8028.9[illegible]	0.445
	331R	C44A	C44	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.93	7796.5[illegible]	[illegible]
	332L	C44B	C44	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	8000.25	0.444
	332W	C44B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8252.16	0.458
	332R	C44B	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7504.23	0.417
	333	103	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.95	7552.24	0.420
	334	104	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7620.01	[illegible]
	335	105	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7052.45	0.392
	336L	C45A	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7051.97	0.392
	336W	C45A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7641.40	0.425

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BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO. RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SUP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	336R	C45A	C45	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7442.03	0.413
	337L	C45B	C45	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7510.01	0.417
	337W	C45B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7715.02	0.429
	337R	C45B	94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7106.39	0.395
	338		94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6898.71	0.388
	339L	C46A	94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6823.79	0.379
	339W	C46A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7333.50	0.407
	339R	C46A	C46	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7161.82	0.398
	340L	C46B	C46	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7333.38	0.408
	340W	C46B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7526.96	0.418
	340R	C46B	95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6967.09	0.387
	341		95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7229.16	0.402
	342		95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7673.95	0.426
	343L	C47A	95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8271.07	0.460
	343W	C47A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	9287.32	0.516
	343R	C47A	C47	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	8943.02	0.497
	344L	C47B	C47	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	8936.98	0.497
	344W	C47B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.96	9280.71	0.516
	344R	C47B	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8266.17	0.459
	345	107	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	9190.31	0.511

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO. RCD-6-30-78 AUX-BLDG /INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNTC (CONTD.)														
	346L	108	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8825.02	0.490
	346BL	108	107	BRCH-R	6X3/4S80	SA105	1.000	STCK	1400.00	600.0		20999.98	8825.02	0.420
	3[illegible]BR	108	107	BRCH-R	6X3/4S80	SA105	1.000	STCK	1400.00	600.0		20999.98	8823.27	0.420
	346R	108	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8823.27	0.490
	347L	C48A	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	8114.50	0.451
	347W	C48A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	9075.95	0.504
	347R	C48A	C48	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	8752.11	0.486
	348L	C48B	C48	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	8312.34	0.462
	348W	C48B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8594.12	0.477
	348R	C48B	97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7757.58	0.431
	349	106	97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7681.84	0.427
	350		97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7292.62	0.405
	351		97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7133.37	0.396
	352L	C49A	97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7153.79	0.397
	352W	C49A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7779.00	0.432
	352R	C49A	C49	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7560.41	0.420
	353L	C49B	C49	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7449.02	0.414
	35[illegible]W	C49B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7648.18	0.425
	35[illegible]R	C49B	98	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7056.89	0.392
	354		98	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7183.69	0.399

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH 6; SAM-12;RSA-4; ENDL(FORC & DSEL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOF NO.	DSP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	355L	C50A	98	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7029.78	0.391
	355W	C50A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7611.59	0.423
	355R	C50A	C50	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7415.62	0.412
	356L	C50B	C50	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	7419.99	0.412
	356W	C50B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	7613.10	0.423
	356R	C50B	99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7030.90	0.391
	357	109	99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7097.20	0.394
	358		99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7321.83	0.407
	359L	C51A	99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7782.79	0.432
	359W	C51A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8620.15	0.479
	359R	C51A	C51	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	8343.41	0.464
	360L	C51B	C51	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	8548.47	0.475
	360W	C51B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	8852.83	0.492
	360R	C51B	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7949.22	0.442
	361	110	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7921.28	0.440
	362	111	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	7815.60	0.434
	363		100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6796.32	0.371
	364	112	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5851.69	0.325
	365L	C52A	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5865.23	0.326
	365W	C52A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6039.44	0.336

HONEYWELL P32K PRINTING SYSTEM- 41183-02

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PIPESTRESS [illegible] 11/15/79, AMPAHL REV.1 04/05/82 14:12:45 PAGE [illegible] 12

BOX 100 ATUL PATEL *** CHICAF30-W/ 33 HZ. *** ** ** ** C A T ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-10 ** ** ** REV-3A ** ** **
PROBLEM NO.-BCD-G-30-78 AUX BLDG./TURBINE B.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;BSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

EQN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNTO (CONTD.)														
	365R	C52A	C52	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	5980.76	0.332
	366L	C52B	C52	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	6264.85	0.349
	366W	C52B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	6372.62	0.354
	366R	C52B	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6112.03	0.340
	367	113	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6203.20	0.345
	368		101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	6024.55	0.335
	369L	114	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5866.74	0.326
	369RL	114		BRCH-R	6X2-S80	SA105	1.508	STCK	1400.00	600.0		20999.98	5932.29	0.282
	369RR	114		BRCH-R	6X2-S80	SA105	1.508	STCK	1400.00	600.0		20999.98	5929.27	0.282
	369R	114	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5863.29	0.326
	370L	C53A	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	5827.66	0.324
	370W	C53A		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	5998.72	0.333
	370R	C53A	C53	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	5934.47	0.330
	371L	C53B	C53	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0		17999.98	5623.28	0.312
	371W	C53B		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	5647.76	0.314
	371R	C53B	102	BRED-R	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0		17999.98	5679.50	0.315
	372L	115	102	BRED-R	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0		17999.98	[illegible]	[illegible]
	372W	115		AWTT	AWTT		1.900	STCK	1400.00	600.0		17999.98	7035.63	0.391
	372R	115	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	4160.47	0.231
	373	116	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	4385.61	0.244

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BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	RATIO
RN10 (CONTD.)														
	374L	117	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	4283.16	0.238
	374BL	117	120	BRCH-R	4X3/4160	SA105	1.000	STCK	1400.00	600.0		20999.98	4283.16	0.204
	374BR	117	120	BRCH-R	4X3/4160	SA105	1.000	STCK	1400.00	600.0		20999.98	4284.43	0.204
	374R	117	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	4284.43	0.238
	375L	118	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0		17999.98	4171.87	0.232
	375W	118		AWBW	AWBW		1.800	STCK	1400.00	600.0		17999.98	4593.89	0.255
	375R	118	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0		19079.98	4171.87	0.219
	376	119	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0		19079.98	4005.61	0.210
	377L	120	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0		19079.98	3880.47	0.203
	377W	120		AWBW	AWBW		1.800	STCK	1400.00	600.0		19079.98	4200.50	0.220
	377R	120	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0		19079.98	3880.47	0.203
	378		104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0		19079.98	3070.17	0.161
	379		104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0		19079.98	3419.31	0.179
	380		104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0		19079.98	3415.40	0.179
	381	121	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0		19079.98	2980.14	0.156
	382	122	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0		19079.98	2966.10	0.155
	382W	122		AWBW	AWBW		1.800	STCK	1400.00	600.0		19079.98	2966.10	0.155

MAXIMUM STRESS RATIO FOR THIS RUN = 0.516 AT SOP NO. 343W

BOX 100 ATUL PATEL *** CHICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-C-20-79 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-G; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 9 (CONTD.) OCCASIONAL LOADS. ALLOWABLE STRESS = 1.2SH UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN11														
	383	119	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0		17999.98	248.23	0.014
	384	123	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0		17999.98	277.17	0.015
	385		105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0		17999.98	342.19	0.019
	386L	124	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0		17999.98	432.76	0.024
	386R	124	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0		17999.98	1359.74	0.076
	387	125	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0		17999.98	661.93	0.037
	388		105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0		17999.98	305.45	0.017
	389L	126	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0		17999.98	37.22	0.002
	389R	126	106	FLXC	FLEX-CON		N/A							
	390	121	106	FLXC	FLEX-CON		N/A							

MAXIMUM STRESS RATIO FOR THIS RUN = 0.076 AT SOP NO. 386R

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN12														
	391	108	107	BRCH-B	6X3/4S80	SA105	1.000	STCK	1400.00	600.0		20999.98	9707.79	0.462
	392L	127	107	BRCH-B	6X3/4S80	SA105	N/A							
	392W	127		FILW	FILW		2.100	STCK	1400.00	600.0		17999.98	14020.47	0.779
	392R	127	108	STRP	3/4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	9772.45	0.543
	393L	128	108	STRP	3/4S80	SA106 B	1.000	STCK	1400.00	600.0		17999.98	9268.62	0.515
	393W	128		FILW	FILW		2.100	STCK	1400.00	600.0		17999.98	13225.92	0.735
	393R	128	109	SRED-E	1X3/4S80	SA105	2.250	STCK	1400.00	600.0		20999.98	14000.18	0.667
	394L	C54A	109	SRED-E	1X3/4S80	SA105	2.250	STCK	1400.00	600.0		20999.98	8529.28	0.406

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.P. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC.& DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

TRESSES FOR EQUATION 10 THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1														
	1	A1	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	0.00	0.000
	2		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	29.76	0.001
	3		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	59.51	0.003
	4		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	89.27	0.004
	5	A2	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	119.02	0.005
	6		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	30.53	0.001
	7		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	180.09	0.008
	8		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	329.65	0.015
	9	A3	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	479.21	0.021
	10		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	93.18	0.004
	11		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	665.57	0.030
	12		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1237.96	0.055
	13	A4	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1810.34	0.080
	14		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	605.73	0.027
	15L	E01A	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	3011.78	0.134
	15W	E01A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	5421.20	0.241
	15R	E01A	E01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	3122.02	0.139
	16L	E01B	E01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	3344.79	0.149
	16W	E01B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	5808.01	0.258
	16R	E01B	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	3226.67	0.143
	17	A6	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1631.10	0.072

BOX 100 ATUL PATEL *** CN1CAF30-W, 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	18		1	STRP	4S160-NI	SA106 B'	1.000	STCK	1800.00	160.0	70.0	22499.98	376.36	0.017
	19	A7	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	2247.00	0.100
	20		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1587.65	0.071
	21		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	935.23	0.042
	22		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	340.71	0.015
	23	A8	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	489.60	0.022
	24		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	496.33	0.022
	25		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	584.50	0.026
	26		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	724.68	0.032
	27	1	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	892.68	0.040
	28		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	341.78	0.015
	29L	C01A	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	375.92	0.017
	29W	C01A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	676.66	0.030
	29R	C01A	C01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	389.69	0.017
	30L	C01B	C01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	443.89	0.020
	30W	C01B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	770.79	0.034
	30R	C01B	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	428.22	0.019
	31	2	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	613.90	0.027
	32L	C02A	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	927.06	0.041
	32W	C02A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	1668.70	0.074

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	32R	C02A	C02	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	960.99	0.043
	33L	C02B	C02	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	1003.47	0.045
	33W	C02B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	1742.45	0.077
	33R	C02B	3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	968.03	0.043
	34		3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1124.91	0.050
	35L	C03A	3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1377.75	0.061
	35W	C03A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	2479.95	0.110
	35R	C03A	C03	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	1428.19	0.063
	36L	C03B	C03	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	1414.14	0.063
	36W	C03B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	2455.56	0.109
	36R	C03B	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1364.20	0.061
	37	3	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1270.40	0.056
	38		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	899.43	0.040
	39		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	580.57	0.026
	40		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	445.39	0.020
	41		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	626.63	0.028
	42	4	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	959.36	0.043
	43	5	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	861.74	0.038
	44	6	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	671.28	0.030
	45		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	497.60	0.022

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	46		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	352.21	0.016
	47	6A	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	283.12	0.013
	48L	C04A	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	254.30	0.011
	48W	C04A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	457.73	0.020
	48R	C04A	C04	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	263.60	0.012
	49L	C04B	C04	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	304.51	0.014
	49W	C04B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	528.77	0.024
	49R	C04B	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	293.76	0.013
	50	7	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	314.81	0.014
	51		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	708.38	0.031
	52		5	STRP	4S160-NI	SA10C B	1.000	STCK	1800.00	160.0	70.0	22499.98	1567.87	0.070
	53		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	2443.02	0.109
	54	8	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	3321.48	0.148
	55L	C05A	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	3545.95	0.158
	55W	C05A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	6382.71	0.284
	55R	C05A	C05	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	3675.76	0.163
	56L	C05B	C05	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	3663.87	0.163
	56W	C05B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	6362.07	0.283
	56R	C05B	6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	3534.49	0.157
	57		6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	2791.56	0.124

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG /INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 CONTD.)														
	58		6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	2048.64	0.091
	59L	C06A	6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1305.73	0.058
	59W	C06A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	2350.32	0.104
	59R	C06A	C06	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	1353.53	0.060
	60L	C06B	C06	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	1341.66	0.060
	60W	C06B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	2329.70	0.104
	60R	C06B	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1294.28	0.058
	61	9	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1818.10	0.081
	62L	C07A	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	535.52	0.024
	62W	C07A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	963.94	0.043
	62R	C07A	C07	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	555.13	0.025
	63L	C07B	C07	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	638.20	0.031
	63W	C07B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	1212.37	0.054
	63R	C07B	8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	673.54	0.030
	64		8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	370.02	0.016
	65		8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1061.11	0.048
	66L	C08A	8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1818.16	0.081
	66W	C08A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	3272.69	0.145
	66R	C08A	C08	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	1884.72	0.084
	67L	C08B	C08	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	1501.30	0.067

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	67W	C08B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	2606.91	0.116
	67R	C08B	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1448.29	0.064
	68	10	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	929.33	0.041
	69		9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	1345.75	0.060
	70	11	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	3605.34	0.160
	71L	C09A	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	4137.12	0.184
	71W	C09A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	7446.82	0.331
	71R	C09A	C09	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	4288.57	0.191
	72L	C09B	C09	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	22499.98	5006.61	0.223
	72W	C09B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	22499.98	8693.65	0.386
	72R	C09B	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	4829.80	0.215
	73	12	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	5098.37	0.227
	74		10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	4191.59	0.186
	75		10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	3286.72	0.146
	76L	13	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	22499.98	2385.55	0.106
	76W	13		AWTT	AWTT		1.900	STCK	1800.00	160.0	70.0	22499.98	4532.54	0.201
	76R	13	11	VALV	4S160	SA106 B	N/A							
	77	14	11	VALV	4S160	SA106 B	N/A							
	78L	15	11	VALV	4S160	SA106 B	N/A							
	78W	15		AWTT	AWTT		1.900	STCK	1800.00	600.0	70.0	22500.00	3693.83	0.164

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

ESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN AME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
UNT NTD.)														
	78R	15	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	22500.00	1944.12	0.086
	79		12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	22500.00	1081.96	0.048
	80	16	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	22500.00	656.96	0.029
	81	16A	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	22500.00	852.78	0.038
	82L	17	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	22500.00	1149.01	0.051
	82W	17		AWTT	AWTT		1.900	STCK	1800.00	600.0	70.0	22500.00	2183.13	0.097
	82R	17	13	VALV	4S160	SA106 B	N/A							
	83	18	13	VALV	4S160	SA106 B	N/A							
	84L	19	13	VALV	4S160	SA106 B	N/A							
	84W	19		AWTT	AWTT		1.900	STCK	1800.00	600.0	70.0	22500.00	3228.43	0.143
	84R	19	14	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1699.18	0.076
	85L	20	14	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1917.81	0.085
	85W	20		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	5031.70	0.224
	85R	20	15	BTEE-R	4S80	SA106 B	N/A							
	86BL	21	15	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	22500.00	3223.15	0.143
	86BR	21	15	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	22500.00	2427.85	0.108
	87L	22	15	BTEE-R	4S80	SA106 B	N/A							
	87W	22		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	3586.05	0.159
	87R	22	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1992.25	0.089
	88		16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1023.30	0.045

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV 3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	89	24	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1664.08	0.074
	90L	C10A	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2065.67	0.093
	90W	C10A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	3754.22	0.167
	90R	C10A	C10	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	3119.88	0.139
	91L	C10B	C10	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	2910.61	0.129
	91W	C10B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	3502.40	0.156
	91R	C10B	17	BTEE-R	4S80	SA106 B	N/A							
	92BL	25	17	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	22500.00	2979.89	0.132
	92BR	25	17	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	22500.00	2453.37	0.109
	93L	25	17	BTEE-R	4S80	SA106 B	N/A							
	93W	26		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	4314.00	0.192
	93R	26	18	VALV	4S80	SA106 B	N/A							
	94	27	18	VALV	4S80	SA106 B	N/A							
	95L	28	18	VALV	4S80	SA106 B	N/A							
	95W	28		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	9196.46	0.409
	95R	28	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4840.24	0.215
	96	29	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5665.81	0.252
	97L	30	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4697.18	0.209
	97BL	30	74	FTEE-R	4X2-S160	SA105	3.030	STCK	1400.00	600.0	70.0	26250.00	14231.38	0.542
	97BR	30	74	FTEE-R	4X2-S160	SA105	3.030	STCK	1400.00	600.0	70.0	26250.00	14151.40	0.539

BOX 100 ATUL PATEL *** CNICAF30-W 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 CONTD.)														
	97R	30	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4670.79	0.208
	98	30A	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4900.94	0.218
	99L	31	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4651.64	0.207
	99W	31		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	8838.12	0.393
	99R	31	20	VALV	4S80	SA106 B	N/A							
	100	32	20	VALV	4S80	SA106 B	N/A							
	101L	C11A	20	VALV	4S80	SA106 B	N/A							
	101W	C11A		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	9826.80	0.437
	101R	C11A	C11	BELB	4S80-FL	SA106 B	1.320	STCK	1400.00	600.0	70.0	22500.00	6627.05	0.303
	102L	C11B	C11	BELB	4S80-FL	SA106 B	1.320	STCK	1400.00	600.0	70.0	22500.00	7688.88	0.342
	102W	C11B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10484.84	0.466
	102R	C11B	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5824.91	0.259
	103	33A	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	6016.26	0.267
	104L	C70A	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4176.37	0.186
	104W	C70A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	7517.47	0.334
	104R	C70A	C70	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	6247.28	0.278
	105L	C70B	C70	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	4978.36	0.221
	105W	C70B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	5990.56	0.266
	105R	C70B	21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3328.09	0.148
	106		21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3238.56	0.144

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	107L	C71A	21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5710.56	0.254
	107W	C71A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10279.02	0.457
	107R	C71A	C71	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	8542.22	0.380
	108L	C71B	C71	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	9774.29	0.434
	108W	C71B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	11761.60	0.523
	108R	C71B	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	6534.22	0.290
	109	33B	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	6540.32	0.291
	110L	C72A	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	6570.99	0.292
	110W	C72A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	11827.79	0.526
	110R	C72A	C72	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	9829.30	0.437
	111L	C72B	C72	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	8504.27	0.378
	111W	C72B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10233.56	0.455
	111R	C72B	21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5685.19	0.253
	112		21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1305.80	0.058
	113L	C73A	21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5043.04	0.224
	113W	C73A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	9081.07	0.404
	113R	C73A	C73	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	7545.68	0.335
	114L	C73B	C73	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	8686.05	0.386
	114W	C73B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10452.09	0.465
	114R	C73B	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5806.72	0.258

11/15/79, AMDAHL REV.1

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

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QUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
33	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5705.05	0.254
34	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5671.27	0.252
C74A	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5598.45	0.249
C74A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10077.21	0.448
C74A	C74	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	8374.50	0.372
C74B	C74	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	6947.11	0.309
J C74B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	8359.60	0.372
R C74B	21F	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4644.22	0.206
L C75A	21F	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2874.90	0.128
W C75A		AWB'J	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	5174.83	0.230
9R C75A	C75	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	4300.46	0.191
0L C75B	C75	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	3507.49	0.156
0W C75B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	4220.64	0.188
20R C75B	21	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2344.80	0.104
21L C12A	21	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4388.36	0.195
21W C12A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	7899.06	0.351
121R C12A	C12	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	6564.39	0.292
122L C12B	C12	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	7886.14	0.350
122W C12B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	9489.55	0.422
122R C12B	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5271.96	0.234

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 CONTD.)														
	123	35	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5454.06	0.242
	124L	36	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5638.30	0.251
	124BL	36	60	FTEE-R	4X2-S80	SA105	3.030	STCK	1400.00	600.0	70.0	26250.00	17082.74	0.651
	124BR	36	60	FTEE-R	4X2-S80	SA105	3.030	STCK	1400.00	600.0	70.0	26250.00	13670.46	0.521
	124R	36	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4512.05	0.201
	125L	C13A	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5915.99	0.263
	125W	C13A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10648.78	0.473
	125R	C13A	C13	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	8849.50	0.393
	126L	C13B	C13	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	9957.33	0.443
	126W	C13B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	11981.86	0.533
	126R	C13B	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	6656.59	0.296
	127	37	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	6650.75	0.296
	128	38	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	6654.99	0.296
	129		23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	7619.95	0.339
	130L	39	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	10215.53	0.454
	130W	39		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	18387.96	0.817
	130R	39	24	BRCH-B	18X4-S80	SA106 B	N/A							
	131	40	24	BRCH-B	18X4-S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	10726.29	0.477

MAXIMUM STRESS RATIO FOR THIS RUN = 0.817 AT SOP NO. 130W

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN9 (CONTD.)														
	294W	C64A		FILW	FILW		2.100	STCK	1400.00	600.0	70.0	22500.00	3908.01	0.174
	294R	C64A	C64	SELB	2S80	SA105	1.786	STCK	1400.00	600.0	70.0	26250.00	3395.17	0.129
	295L	C64B	C64	SELB	2S80	SA105	1.786	STCK	1400.00	600.0	70.0	26250.00	3972.67	0.151
	295W	C64B		FILW	FILW		2.100	STCK	1400.00	600.0	70.0	22500.00	4672.13	0.208
	295R	C64B	77	STRP	2S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2172.10	0.097
	296	93	77	STRP	2S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2706.86	0.120

MAXIMUM STRESS RATIO FOR THIS RUN = 0.535 AT SOP NO. 279W

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10														
	297	25	78	BTEE-B	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	22500.00	3420.22	0.152
	298L	C36A	78	BTEE-B	4S80	SA106 B	N/A							
	298W	C36A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	5245.98	0.233
	298R	C36A	C36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	4359.59	0.194
	299L	C36B	C36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	4197.95	0.187
	299W	C36B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	5051.48	0.225
	299R	C36B	79	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2806.38	0.125
	300L	E36A	79	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2318.62	0.103
	300W	E36A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	4173.52	0.185
	300R	E36A	E36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	3468.34	0.154
	301L	E36B	E36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	2667.96	0.119

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	301W	E36B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	3210.41	0.143
	301R	E36B	C37	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	2457.38	0.109
	302L	C37B	C37	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	22500.00	2435.47	0.108
	302W	C37B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2930.65	0.130
	302R	C37B	80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1628.14	0.072
	303		80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1695.34	0.075
	304L	94A	80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2304.62	0.102
	304W	94A		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	4378.78	0.195
	304R	94A	81	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1668.95	0.074
	305L	94	81	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1393.72	0.084
	305W	94		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	3598.07	0.160
	305R	94	82	NONS	4S160	SA105	N/A							
	306	95	82	NONS	4S160	SA105	N/A							
	307L	96	82	NONS	4S160	SA105	N/A							
	307W	96		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	4409.33	0.196
	307R	96	83	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2249.73	0.100
	308L	96A	83	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2388.84	0.106
	308W	96A		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	6267.54	0.279
	308R	96A	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3298.71	0.147
	309	97	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3702.99	0.165

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	310	98	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4011.43	0.178
	311L	99	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1677.07	0.075
	311W	99		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	3018.72	0.134
	311R	99	85	BRED-E	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0	70.0	22500.00	3354.13	0.149
	312L	100	85	BRED-E	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0	70.0	22500.00	1296.02	0.058
	312W	100		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	1166.42	0.052
	312R	100	86	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	648.01	0.029
	313	100A	86	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	950.23	0.042
	314L	C38A	86	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1247.26	0.055
	314W	C38A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2245.06	0.100
	314R	C38A	C38	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2049.01	0.091
	315L	C38B	C38	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2139.77	0.095
	315W	C38B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2344.51	0.104
	315R	C38B	87	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1302.51	0.058
	316		87	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	829.19	0.037
	317L	C39A	87	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1030.11	0.046
	317W	C39A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	1854.20	0.082
	317R	C39A	C39	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	1692.28	0.075
	318L	C39B	C39	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	1608.59	0.071
	318W	C39B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	1762.51	0.078

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	318R	C39B	88	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	979.17	0.044
	319L	C40A	88	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	976.40	0.043
	319W	C40A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	1757.52	0.078
	319R	C40A	C40	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	1604.04	0.071
	320L	C40B	C40	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	923.38	0.041
	320W	C40B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	1011.73	0.045
	320R	C40B	89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	562.07	0.025
	321		89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	467.46	0.021
	322	101	89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1215.11	0.054
	323L	C41A	89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1039.56	0.046
	323W	C41A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	1871.21	0.083
	323R	C41A	C41	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	1707.80	0.076
	324L	C41B	C41	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2134.10	0.095
	324W	C41B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2338.29	0.104
	324R	C41B	90	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1299.05	0.058
	325L	C42A	90	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1302.87	0.058
	325W	C42A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2345.17	0.104
	325R	C42A	C42	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2140.37	0.095
	326L	C42B	C42	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2683.41	0.128
	326W	C42B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	3159.30	0.140

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	326R	C42B	91	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1755.17	0.078
	327L	C43A	91	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2764.22	0.123
	327W	C43A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	4975.60	0.221
	327R	C43A	C43	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	4541.09	0.202
	328L	C43B	C43	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	4906.09	0.218
	328W	C43B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	5375.52	0.239
	328R	C43B	92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2986.40	0.133
	329		92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2839.86	0.126
	330	102	92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2962.05	0.127
	331L	C44A	92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2859.01	0.127
	331W	C44A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	5146.23	0.229
	331R	C44A	C44	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	4696.82	0.209
	332L	C44B	C44	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	4161.05	0.185
	332W	C44B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	4559.20	0.203
	332R	C44B	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2532.89	0.113
	333	103	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2429.83	0.108
	334	104	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2125.47	0.094
	335	105	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1460.81	0.065
	336L	C45A	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1427.48	0.063
	336W	C45A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2569.47	0.114

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNTO (CONTD.)														
	336R	C45A	C45	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2345.08	0.104
	337L	C45B	C45	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2209.84	0.098
	337W	C45B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2421.29	0.108
	337R	C45B	94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1345.16	0.060
	338		94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1390.81	0.062
	339L	C46A	94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1532.84	0.068
	339W	C46A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2759.12	0.123
	339R	C46A	C46	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2518.18	0.112
	340L	C46B	C46	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2169.27	0.096
	340W	C46B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2376.83	0.106
	340R	C46B	95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1320.46	0.059
	341		95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	796.32	0.035
	342		95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1173.69	0.052
	343L	C47A	95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2013.87	0.090
	343W	C47A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	3624.97	0.161
	343R	C47A	C47	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	3308.41	0.147
	344L	C47B	C47	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	3922.53	0.174
	344W	C47B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	4297.85	0.191
	344R	C47B	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2387.69	0.106
	345	107	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2723.89	0.121

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNTO (CONTD.)														
	336R	C45A	C45	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2345.08	0.104
	337L	C45B	C45	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2209.84	0.098
	337W	C45B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2421.29	0.108
	337R	C45B	94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1345.16	0.060
	338		94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1390.81	0.062
	339L	C46A	94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1532.84	0.068
	339W	C46A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2759.12	0.123
	339R	C46A	C46	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2518.18	0.112
	340L	C46B	C46	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	2169.27	0.096
	340W	C46B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	2376.83	0.106
	340R	C46B	95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1320.46	0.059
	341		95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	796.32	0.035
	342		95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	1173.69	0.052
	343L	C47A	95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2013.87	0.090
	343W	C47A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	3624.97	0.161
	343R	C47A	C47	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	3303.41	0.147
	344L	C47B	C47	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	3922.53	0.174
	344W	C47B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	4297.85	0.191
	344R	C47B	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2387.69	0.106
	345	107	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2723.89	0.121

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

RESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 CONTD.)														
	346L	108	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3040.27	0.135
	346BL	108	107	BRCH-R	6X3/4S80	SA105	1.000	STCK	1400.00	600.0	70.0	26250.00	3040.27	0.116
	346BR	108	107	BRCH-R	6X3/4S80	SA105	1.000	STCK	1400.00	600.0	70.0	26250.00	3040.27	0.116
	346R	108	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3040.27	0.135
	347L	C48A	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4252.32	0.189
	347W	C48A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	7654.18	0.340
	347R	C48A	C48	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	6935.76	0.310
	348L	C48B	C48	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	8033.80	0.357
	348W	C48B	-	AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	8802.50	0.391
	348R	C48B	97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4890.28	0.217
	349	106	97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4819.24	0.214
	350		97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3417.4.	0.152
	351		97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3611.88	0.161
	352L	C49A	97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5156.68	0.229
	352W	C49A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	9282.04	0.413
	352R	C49A	C49	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	8471.46	0.377
	353L	C49B	C49	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	8172.12	0.363
	353W	C49B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	8954.05	0.398
	353R	C49B	98	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4974.48	0.221
	354		98	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3657.25	0.163

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SUP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNIO (CONTD.)														
	355L	C50A	98	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5704.00	0.254
	355W	C50A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10267.21	0.456
	355R	C50A	C50	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	9370.60	0.416
	356L	C50B	C50	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	9819.21	0.436
	356W	C50B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10758.75	0.478
	356R	C50B	99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5977.08	0.266
	357	109	99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5601.25	0.249
	358		99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4871.24	0.216
	359L	C51A	99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5771.56	0.257
	359W	C51A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10388.82	0.462
	359R	C51A	C51	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	9481.59	0.421
	360L	C51B	C51	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	9744.73	0.433
	360W	C51B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	10677.14	0.475
	360R	C51B	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5931.74	0.264
	361	110	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5822.27	0.259
	362	111	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5595.62	0.249
	363		100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4220.06	0.188
	364	112	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4586.01	0.204
	365L	C52A	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4728.18	0.210
	365W	C52A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	8510.72	0.378

BOX 100 ATUL PATEL ** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	365R	C52A	C52	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	7767.51	0.345
	366L	C52B	C52	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	8396.21	0.373
	366W	C52B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	9199.59	0.409
	366R	C52B	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5110.88	0.227
	367	113	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5069.54	0.225
	368		101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2432.89	0.108
	369L	114	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2936.19	0.130
	369BL	114		BRCH-R	6X2-S80	SA105	1.508	STCK	1400.00	600.0	70.0	26250.00	4428.90	0.169
	369BR	114		BRCH-R	6X2-S80	SA105	1.508	STCK	1400.00	600.0	70.0	26250.00	3636.18	0.139
	369R	114	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	2410.64	0.107
	370L	C53A	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	3241.95	0.144
	370W	C53A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	5835.51	0.259
	370R	C53A	C53	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	5307.57	0.236
	371L	C53B	C53	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	22500.00	5347.22	0.238
	371W	C53B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	5858.86	0.260
	371R	C53B	102	BRED-R	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0	70.0	22500.00	6509.84	0.289
	372L	115	102	BRED-R	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0	70.0	22500.00	15423.65	0.685
	372W	115		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	22500.00	14652.46	0.651
	372R	115	103	STRP	4S160	SA106 3	1.000	STCK	1400.00	600.0	70.0	22500.00	5584.71	0.248
	373	116	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	5298.46	0.235

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TC STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION. ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 CONTD.)														
	374L	117	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4939.11	0.220
	374BL	117	120	BRCH-R	4X3/4160	SA105	1.000	STCK	1400.00	600.0	70.0	26250.00	4939.11	0.188
	374BR	117	120	BRCH-R	4X3/4160	SA105	1.000	STCK	1400.00	600.0	70.0	26250.00	4944.90	0.188
	374R	117	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4944.90	0.220
	375L	118	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	4536.29	0.202
	375W	118		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	22500.00	8165.33	0.363
	375R	118	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	27474.99	4655.68	0.169
	376L	119	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	27474.99	4176.13	0.152
	376R	119	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	27474.99	426.79	0.016
	377L	120	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	27474.99	403.62	0.015
	377W	120		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	27474.99	726.52	0.026
	377R	120	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	27474.99	403.62	0.015
	378		104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	27474.99	302.67	0.011
	379		104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	27474.99	201.71	0.007
	380		104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	2747-.99	100.76	0.004
	381	121	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	27474.99	0.20	0.000
	382	122	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	27474.99	0.00	0.000
	382W	122		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	27474.99	0.00	0.000

MAXIMUM STRESS RATIO FOR THIS RUN = 0.685 AT SOP NO. 372L

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT 1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 10 (CONTD.) THERMAL EXPANSION ALLOWABLE STRESS = 1.0SA UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN11														
	383	119	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	22500.00	601.88	0.027
	384	123	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	22500.00	599.30	0.027
	385		105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	22500.00	999.93	0.044
	386L	124	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	22500.00	1622.70	0.072
	386R	124	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	22500.00	38.96	0.002
	387	125	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	22500.00	23.77	0.001
	388		105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	22500.00	11.90	0.001
	389L	126	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	22500.00	0.03	0.000
	389R	126	106	FLXC	FLEX-CON		N/A							
	390	121	106	FLXC	FLEX-CON		N/A							

MAXIMUM STRESS RATIO FOR THIS RUN = 0.072 AT SOP NO. 386L

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN12														
	391	108	107	BRCH-B	6X3/4S80	SA105	1.000	STCK	1400.00	600.0	70.0	26250.00	0.00	0.000
	392L	127	107	BRCH-B	6X3/4S80	SA105	N/A							
	392W	127		FILW	FILW		2.100	STCK	1400.00	600.0	70.0	22500.00	0.00	0.000
	392R	127	108	STRP	3/4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	0.00	0.000
	393L	128	108	STRP	3/4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	22500.00	0.00	0.000
	393W	128		FILW	FILW		2.100	STCK	1400.00	600.0	70.0	22500.00	0.00	0.000
	393R	128	109	SRED-E	1X3/4S80	SA105	2.250	STCK	1400.00	600.0	70.0	26250.00	0.00	0.000
	394L	C54A	109	SRED-E	1X3/4S80	SA105	2.250	STCK	1400.00	600.0	70.0	26250.00	0.00	0.000

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SUP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	STF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1														
	1	A1	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	3813.56	0.102
	2		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4206.93	0.112
	3		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4262.95	0.114
	4		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	3981.63	0.106
	5	A2	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4502.20	0.120
	6		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	3869.57	0.103
	7		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4174.95	0.111
	8		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4193.95	0.112
	9	A3	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4709.92	0.126
	10		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	3984.54	0.106
	11		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4714.53	0.126
	12		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5107.21	0.136
	13	A4	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	6085.28	0.162
	14		A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4461.72	0.119
	15L	E01A	A1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	6928.60	0.185
	15W	E01A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	9374.16	0.250
	15R	E01A	E01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	7038.85	0.188
	16L	E01B	E01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	7253.41	0.193
	16W	E01B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	9749.90	0.260
	16R	E01B	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	7135.29	0.190
	17	A6	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5733.75	0.153

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SGP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	18		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4317.48	0.115
	19	A7	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	6455.68	0.172
	20		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5583.95	0.149
	21		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5120.96	0.137
	22		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4397.64	0.117
	23	A8	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4568.85	0.122
	24		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4405.35	0.117
	25		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4546.54	0.121
	26		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5099.16	0.136
	27	1	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	6038.51	0.161
	28		1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4585.72	0.122
	29L	C01A	1	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4395.22	0.117
	29W	C01A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	4767.97	0.127
	29R	C01A	C01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	4408.98	0.118
	30L	C01B	C01	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	4514.52	0.120
	30W	C01B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	4931.40	0.132
	30R	C01B	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4498.85	0.120
	31	2	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4829.88	0.129
	32L	C02A	2	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5111.77	0.136
	32W	C02A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	5983.32	0.160

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	32R	C02A	C02	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	5145.71	0.137
	33L	C02B	C02	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	5162.17	0.138
	33W	C02B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	6021.96	0.161
	33R	C02B	3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5126.73	0.137
	34		3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5241.12	0.140
	35L	C03A	3	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5815.13	0.155
	35W	C03A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	7135.67	0.190
	35R	C03A	C03	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	5865.57	0.156
	36L	C03B	C03	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	5996.94	0.160
	36W	C03B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	7307.60	0.195
	36R	C03B	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5947.00	0.159
	37	3	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5854.63	0.156
	38		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5307.62	0.142
	39		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4812.92	0.128
	40		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4502.51	0.120
	41		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4513.65	0.120
	42	4	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4889.58	0.130
	43	5	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4610.81	0.128
	44	6	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4658.36	0.124
	45		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4521.84	0.121

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SUP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	46		4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4413.73	0.118
	47	6A	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4382.00	0.117
	48L	C04A	4	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4355.33	0.116
	48W	C04A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	4659.38	0.124
	48R	C04A	C04	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	4364.64	0.116
	49L	C04B	C04	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	4755.09	0.127
	49W	C04B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	5202.31	0.139
	49R	C04B	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4744.34	0.127
	50	7	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5232.27	0.140
	51		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4730.95	0.126
	52		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5615.50	0.150
	53		5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	6460.07	0.172
	54	8	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	7442.54	0.198
	55L	C05A	5	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	7484.71	0.200
	55W	C05A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	10365.30	0.276
	55R	C05A	C05	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	7614.52	0.203
	56L	C05B	C05	BELE	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	7554.24	0.201
	56W	C05B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	10279.34	0.274
	56R	C05B	6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	7424.86	0.198
	57		6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	6977.02	0.186

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SUP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	58		6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	6254.55	0.167
	59L	C06A	6	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5246.72	0.140
	59W	C06A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	6335.91	0.169
	59R	C06A	C06	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	5294.52	0.141
	60L	C06B	C06	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	5258.40	0.140
	60W	C06B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	6282.56	0.168
	60R	C06B	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5211.02	0.139
	61	9	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	6198.02	0.165
	62L	C07A	7	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4405.31	0.117
	62W	C07A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	4853.41	0.129
	62R	C07A	C07	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	4424.91	0.118
	63L	C07B	C07	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	4675.12	0.125
	63W	C07B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	5246.48	0.140
	63R	C07B	8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4650.47	0.124
	64		8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	4682.41	0.125
	65		8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5488.41	0.146
	66L	C08A	8	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	6042.14	0.161
	66W	C08A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	7640.32	0.204
	66R	C08A	C08	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	6108.70	0.163
	67L	C08B	C08	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	5627.48	0.150

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	67W	C08B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	6842.52	0.182
	67R	C08B	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5574.46	0.149
	68	10	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5060.70	0.135
	69		9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	5701.05	0.152
	70	11	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	8192.15	0.218
	71L	C09A	9	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	8749.06	0.233
	71W	C09A		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	12338.20	0.329
	71R	C09A	C09	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	8900.51	0.237
	72L	C09B	C09	BELB	4S160-NI	SA106 B	1.037	STCK	1800.00	160.0	70.0	37499.98	9625.84	0.257
	72W	C09B		AWBW	AWBW		1.800	STCK	1800.00	160.0	70.0	37499.98	13594.87	0.363
	72R	C09B	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	9449.04	0.252
	73	12	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	9727.77	0.259
	74		10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	9035.08	0.241
	75		10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	8727.84	0.233
	76L	13	10	STRP	4S160-NI	SA106 B	1.000	STCK	1800.00	160.0	70.0	37499.98	8211.25	0.219
	76W	13		AWTT	AWTT		1.900	STCK	1800.00	160.0	70.0	37499.98	11213.40	0.299
	76R	13	11	VALV	4S160	SA106 B	N/A							
	77	14	11	VALV	4S160	SA106 B	N/A							
	78L	15	11	VALV	4S160	SA106 B	N/A							
	78W	15		AWTT	AWTT		1.900	STCK	1800.00	600.0	70.0	37500.00	9721.83	0.259

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	78R	15	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	37500.00	7311.67	0.195
	79		12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	37500.00	5821.15	0.155
	80	16	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	37500.00	7312.79	0.195
	81	16A	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	37500.00	6441.91	0.172
	82L	17	12	STRP	4S160	SA106 B	1.000	STCK	1800.00	600.0	70.0	37500.00	5904.98	0.157
	82W	17		AWTT	AWTT		1.900	STCK	1800.00	600.0	70.0	37500.00	7339.61	0.196
	82R	17	13	VALV	4S160	SA106 B	N/A							
	83	18	13	VALV	4S160	SA106 B	N/A							
	84L	19	13	VALV	4S160	SA106 B	N/A							
	84W	19		AWTT	AWTT		1.900	STCK	1800.00	600.0	70.0	37500.00	8986.59	0.240
	84R	19	14	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500,00	6029.91	0.161
	85L	20	14	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6288.81	0.168
	85W	20		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	12469.79	0.333
	85R	20	15	BTEE-R	4S80	SA106 B	N/A							
	86BL	21	15	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	37500.00	9869.28	0.263
	86BR	21	15	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	37500.00	8782.60	0.234
	87L	22	15	BTEE-R	4S80	SA106 B	N/A							
	87W	22		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10468.89	0.279
	87R	22	16	STRP	4S80	SA106 B	1.000	STCK	140C.00	600.0	70.0	37500.00	8302.32	0.221
	88		16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6976.68	0.186

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

JATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

)CP AME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
24	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7951.76	0.212
IOA	16	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8078.97	0.215
IOA		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10209.41	0.272
IOA	C10	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	9274.04	0.247
IOB	C10	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	9151.92	0.244
IOB		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10062.45	0.268
OB	17	BTEE-R	4S80	SA106 B	N/A							
25	17	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	37500.00	9094.45	0.243
25	17	BTEE-R	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	37500.00	8028.20	0.214
26	17	BTEE-R	4S80	SA106 B	N/A							
26		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	10207.79	0.272
26	18	VALV	4S80	SA106 B	N/A							
27	18	VALV	4S80	SA106 B	N/A							
28	18	VALV	4S80	SA106 B	N/A							
28		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	14127.39	0.377
28	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9694.42	0.259
29	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10700.10	0.285
30	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10226.40	0.273
30	74	FTEE-R	4X2-S160	SA105	3.030	STCK	1400.00	600.0	70.0	43750.00	20849.24	0.477
30	74	FTEE-R	4X2-S160	SA105	3.030	STCK	1400.00	600.0	70.0	43750.00	20769.36	0.475

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	97R	30	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10200.05	0.272
	98	30A	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11171.09	0.298
	99L	31	19	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10175.99	0.271
	99W	31		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	14724.04	0.393
	99R	31	20	VALV	4S80	SA106 B	N/A							
	100	32	20	VALV	4S80	SA106 B	N/A							
	101L	C11A	20	VALV	4S80	SA106 B	N/A							
	101W	C11A		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	15250.67	0.407
	101R	C11A	C11	BELB	4S80-FL	SA106 B	1.320	STCK	1400.00	600.0	70.0	37500.00	12027.15	0.321
	102L	C11B	C11	BELB	4S80-FL	SA106 B	1.320	STCK	1400.00	600.0	70.0	37500.00	12895.83	0.344
	102W	C11B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	15878.46	0.423
	102R	C11B	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11031.86	0.294
	103	33A	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11532.82	0.308
	104L	C70A	21A	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9022.33	0.241
	104W	C70A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	12423.77	0.331
	104R	C70A	C70	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	11114.25	0.296
	105L	C70B	C70	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	9763.03	0.260
	105W	C70B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10797.82	0.288
	105R	C70B	21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8100.69	0.216
	106		21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8001.20	0.213

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	107L	C71A	21B	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10466.78	0.279
	107W	C71A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	15064.15	0.402
	107R	C71A	C71	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	13308.50	0.355
	108L	C71B	C71	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	14542.60	0.388
	108W	C71B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	16549.17	0.441
	108R	C71B	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11292.24	0.301
	109	33B	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11314.71	0.302
	110L	C72A	21C	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11381.18	0.303
	110W	C72A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	16685.78	0.445
	110R	C72A	C72	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	14656.12	0.391
	111L	C72B	C72	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	13397.89	0.357
	111W	C72B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	15171.72	0.405
	111R	C72B	21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10554.91	0.281
	112		21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6159.87	0.164
	113L	C73A	21D	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9887.48	0.264
	113W	C73A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	13982.61	0.373
	113R	C73A	C73	BELB	4S80	SA106 B	1.436	STCK	1400.00	600.0	70.0	37500.00	12409.70	0.331
	114L	C73B	C73	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	13852.18	0.369
	114W	C73B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	15718.36	0.419
	114R	C73B	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10919.33	0.291

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO. RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

TRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 CONTD.)														
	115	33	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11027.96	0.294
	116	34	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11103.48	0.296
	117L	C74A	21E	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10770.93	0.287
	117W	C74A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	15424.31	0.411
	117R	C74A	C74	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	13607.80	0.363
	118L	C74B	C74	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	11928.49	0.318
	118W	C74B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	13403.55	0.357
	118R	C74B	21F	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9592.15	0.256
	119L	C75A	21F	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7829.30	0.209
	119W	C75A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10227.50	0.273
	119R	C75A	C75	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	9289.08	0.248
	120L	C75B	C75	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	8338.50	0.222
	120W	C75B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	9083.65	0.242
	120R	C75B	21	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7158.70	0.191
	121L	C12A	21	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9563.35	0.255
	121W	C12A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	13249.53	0.353
	121R	C12A	C12	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	11800.48	0.315
	122L	C12B	C12	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	13195.33	0.352
	122W	C12B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	14927.97	0.398
	122R	C12B	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10512.10	0.280

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN1 (CONTD.)														
	123	35	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10699.00	0.285
	124L	36	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10887.06	0.290
	124BL	36	60	FTEE-R	4X2-S80	SA105	3.030	STCK	1400.00	600.0	70.0	43750.00	23063.33	0.527
	124BR	36	60	FTEE-R	4X2-S80	SA105	3.030	STCK	1400.00	600.0	70.0	43750.00	19421.82	0.444
	124R	36	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9659.94	0.258
	125L	C13A	22	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11153.67	0.297
	125W	C13A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	16083.89	0.429
	125R	C13A	C13	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	14155.94	0.377
	126L	C13B	C13	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	15473.71	0.413
	126W	C13B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	17669.59	0.471
	126R	C13B	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	12061.39	0.322
	127	37	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	12074.86	0.322
	128	38	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	12078.87	0.322
	129		23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	13040.91	0.348
	130L	39	23	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	15633.79	0.417
	130W	39		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	24066.86	0.642
	130R	39	24	BRCH-B	18X4-S80	SA106 B	N/A							
	131	40	24	BRCH-B	18X4-S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	16092.31	0.429

MAXIMUM STRESS RATIO FOR THIS RUN = 0.642 AT SOP NO. 130W

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RUN9 (CONTD.)														
	294W	C64A		FILW	FILW		2.100	STCK	1400.00	600.0	70.0	37500.00	7988.16	0.213
	294R	C64A	C64	SELB	2S80	SA105	1.786	STCK	1400.00	600.0	70.0	43750.00	7435.34	0.170
	295L	C64B	C64	SELB	2S80	SA105	1.786	STCK	1400.00	600.0	70.0	43750.00	7845.09	0.179
	295W	C64B		FILW	FILW		2.100	STCK	1400.00	600.0	70.0	37500.00	8555.00	0.228
	295R	C64B	77	STRP	2S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6029.48	0.161
	296	93	77	STRP	2S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7583.49	0.202

MAXIMUM STRESS RATIO FOR THIS RUN = 0.433 AT SOP NO. 279W

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10														
	297	25	78	BTEE-B	4S80	SA106 B	1.128	STCK	1400.00	600.0	70.0	37500.00	8689.51	0.232
	298L	C36A	78	BTEE-B	4S80	SA106 B	N/A							
	298W	C36A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10691.84	0.285
	298R	C36A	C36	BELB	4S80	SA106 B	1.436	STCK	1400.00	600.0	70.0	37500.00	9674.96	0.258
	299L	C36B	C36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	9479.30	0.253
	299W	C36B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10456.40	0.279
	299R	C36B	79	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8021.69	0.214
	300L	E36A	79	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7500.88	0.200
	300W	E36A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	9533.81	0.254
	300R	E36A	E36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	8712.60	0.232
	301L	E36B	E36	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	7894.30	0.211

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNIO (CONTD.)														
	301W	E36B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8549.13	0.228
	301R	E36B	C37	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	7683.72	0.205
	302L	C37B	C37	BELB	4S80	SA106 B	1.496	STCK	1400.00	600.0	70.0	37500.00	7668.37	0.204
	302W	C37B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8277.27	0.221
	302R	C37B	80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6800.27	0.181
	303		80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6781.65	0.181
	304L	94A	80	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7268.94	0.194
	304W	94A		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	9466.66	0.252
	304R	94A	81	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	4845.59	0.129
	305L	94	81	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	5104.90	0.136
	305W	94		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	6913.41	0.184
	305R	94	82	NONS	4S160	SA105	N/A							
	306	95	82	NONS	4S160	SA105	N/A							
	307L	96	82	NONS	4S160	SA105	N/A							
	307W	96		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	8108.21	0.216
	307R	96	83	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	5730.06	0.153
	308L	96A	83	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6051.52	0.161
	308W	96A		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	12311.82	0.328
	308R	96A	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8934.18	0.238
	309	97	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9902.41	0.264

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	CONP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNIO (CONTD.)														
	310	98	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10661.29	0.284
	311L	99	84	STRP	4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6916.46	0.184
	311W	99		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8456.14	0.225
	311R	99	85	BRED-E	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0	70.0	37500.00	8876.43	0.237
	312L	100	85	BRED-E	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0	70.0	37500.00	7073.00	0.189
	312W	100		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	6902.45	0.184
	312R	100	86	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6288.49	0.168
	313	100A	86	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6761.82	0.180
	314L	C38A	86	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7159.01	0.191
	314W	C38A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8347.31	0.223
	314R	C38A	C38	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	8087.09	0.216
	315L	C38B	C38	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	8231.59	0.220
	315W	C38B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8505.64	0.227
	315R	C38B	87	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7257.87	0.194
	316		87	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6722.84	0.179
	317L	C39A	87	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6872.98	0.183
	317W	C39A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	7863.46	0.210
	317R	C39A	C39	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	7645.49	0.204
	318L	C39B	C39	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	7504.90	0.200
	318W	C39B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	7709.41	0.206

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNIO (CONTD.)														
	318R	C39B	88	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6775.86	0.181
	319L	C40A	88	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6772.82	0.181
	319W	C40A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	7704.07	0.205
	319R	C40A	C40	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	7500.03	0.200
	320L	C40B	C40	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	6705.70	0.179
	320W	C40B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	6833.74	0.182
	320R	C40B	89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6266.24	0.167
	321		89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6315.96	0.168
	322	101	89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7708.90	0.206
	323L	C41A	89	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6779.96	0.181
	323W	C41A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	7742.14	0.206
	323R	C41A	C41	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	7534.76	0.201
	324L	C41B	C41	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	7975.96	0.213
	324W	C41B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8225.55	0.219
	324R	C41B	90	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7051.55	0.188
	325L	C42A	90	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7058.35	0.188
	325W	C42A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8236.45	0.220
	325R	C42A	C42	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	7985.91	0.213
	326L	C42B	C42	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	8947.80	0.239
	326W	C42B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	9290.37	0.248

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNIO (CONTD.)														
	326R	C42B	91	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7688.27	0.205
	327L	C43A	91	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8554.63	0.228
	327W	C43A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10914.04	0.291
	327R	C43A	C43	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	10429.67	0.278
	328L	C43B	C43	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	10819.76	0.289
	328W	C43B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	11341.46	0.302
	328R	C43B	92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8797.18	0.235
	329		92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8715.10	0.232
	330	102	92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8647.43	0.231
	331L	C44A	92	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8626.69	0.230
	331W	C44A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	11053.97	0.295
	331R	C44A	C44	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	10557.39	0.282
	332L	C44B	C44	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	10126.50	0.270
	332W	C44B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10581.86	0.282
	332R	C44B	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8385.68	0.224
	333	103	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8332.95	0.222
	334	104	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8204.15	0.219
	335	105	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6918.31	0.184
	336L	C45A	93	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6848.06	0.183
	336W	C45A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8008.64	0.214

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; EMDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNIO (CONTD.)														
	336R	C45A	C45	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	7777.99	0.207
	337L	C45B	C45	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37530.00	7720.97	0.206
	337W	C45B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	7946.16	0.212
	337R	C45B	94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6829.23	0.182
	338		94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6955.35	0.185
	339L	C46A	94	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7052.04	0.188
	339W	C46A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8331.41	0.222
	339R	C46A	C46	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	8072.58	0.215
	340L	C46B	C46	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	7818.56	0.208
	340W	C46B		AWCW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	8053.09	0.215
	340R	C46B	95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6916.66	0.184
	341		95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6374.70	0.170
	342		95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	6789.55	0.181
	343L	C47A	95	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7703.80	0.205
	343W	C47A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	9427.75	0.251
	343R	C47A	C47	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	9073.18	0.242
	344L	C47B	C47	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	9598.05	0.256
	344W	C47B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	10002.84	0.267
	344R	C47B	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8005.18	0.213
	345	107	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9521.97	0.254

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNTO (CONTD.)														
	346L	108	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9508.97	0.254
	346BL	108	107	BRCH-R	6X3/4S80	SA105	1.000	STCK	1400.00	600.0	70.0	43750.00	9508.97	0.217
	346BR	108	107	BRCH-R	6X3/4S80	SA105	1.000	STCK	1400.00	600.0	70.0	43750.00	9493.64	0.217
	346R	108	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9493.64	0.253
	347L	C48A	96	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9982.27	0.266
	347W	C48A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	13511.00	0.360
	347R	C48A	C48	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	12799.84	0.341
	348L	C48B	C48	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	13600.76	0.363
	348W	C48B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	14388.54	0.384
	348R	C48B	97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10419.65	0.278
	349	106	97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10344.32	0.276
	350		97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8924.05	0.238
	351		97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9100.05	0.243
	352L	C49A	97	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10626.60	0.283
	352W	C49A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	14787.80	0.394
	352R	C49A	C49	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	13965.15	0.372
	353L	C49B	C49	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	13601.85	0.363
	353W	C49B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	14389.74	0.384
	353R	C49B	98	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10392.47	0.277
	354		98	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9237.76	0.246

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; FNDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	355L	C50A	98	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11165.18	0.298
	355W	C50A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	15761.19	0.420
	355R	C50A	C50	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	14853.53	0.396
	356L	C50B	C50	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	15277.67	0.407
	356W	C50B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	16225.90	0.433
	356R	C50B	99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11418.39	0.304
	357	109	99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11130.44	0.297
	358		99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10283.55	0.274
	359L	C51A	99	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11183.37	0.298
	359W	C51A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	15616.14	0.422
	359R	C51A	C51	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	14903.69	0.397
	360L	C51B	C51	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	15211.52	0.406
	360W	C51B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	16153.42	0.431
	360R	C51B	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11379.81	0.303
	361	110	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11292.17	0.301
	362	111	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	11092.50	0.296
	363		100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9698.68	0.259
	364	112	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10065.66	0.268
	365L	C52A	100	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10190.96	0.272
	365W	C52A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	14006.86	0.374

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; FNDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SGP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN10 (CONTD.)														
	365R	C52A	C52	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	13252.41	0.353
	366L	C52B	C52	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	13778.48	0.367
	366W	C52B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	14583.27	0.389
	366R	C52B	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10490.36	0.280
	367	113	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	10442.73	0.278
	368		101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	7928.51	0.211
	369L	114	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8558.00	0.228
	369BL	114		BRCH-R	6X2-S80	SA105	1.508	STCK	1400.00	600.0	70.0	43750.00	10084.10	0.230
	369BR	114		BRCH-R	6X2-S80	SA105	1.508	STCK	1400.00	600.0	70.0	43750.00	9289.80	0.212
	369R	114	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8031.06	0.214
	370L	C53A	101	STRP	6S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8896.32	0.237
	370W	C53A		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	11590.29	0.309
	370R	C53A	C53	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	11028.53	0.294
	371L	C53B	C53	BELB	6S80	SA106 B	1.643	STCK	1400.00	600.0	70.0	37500.00	10835.18	0.289
	371W	C53B		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	11358.34	0.303
	371R	C53B	102	BRED-R	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0	70.0	37500.00	12024.00	0.321
	372L	115	102	BRED-R	6X4-S80	SA106 B	2.000	STCK	1400.00	600.0	70.0	37500.00	21693.41	0.578
	372W	115		AWTT	AWTT		1.900	STCK	1400.00	600.0	70.0	37500.00	20842.41	0.556
	372R	115	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9321.42	0.249
	373	116	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	9193.61	0.245

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RNTO (CONTD.)														
	374L	117	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8697.55	0.232
	374BL	117	120	BRCH-R	4X3/4160	SA105	1.000	STCK	1400.00	600.0	70.0	43750.00	8697.55	0.199
	374BR	117	120	BRCH-R	4X3/4160	SA105	1.000	STCK	1400.00	600.0	70.0	43750.00	8703.23	0.199
	374R	117	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8703.23	0.232
	375L	118	103	STRP	4S160	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	8119.43	0.217
	375W	118		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	37500.00	11964.44	0.319
	375R	118	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	8238.82	0.190
	376L	119	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	7431.58	0.171
	376R	119	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	4338.71	0.100
	377L	120	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	4097.54	0.094
	377W	120		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	43374.98	4675.17	0.108
	377R	120	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	4097.54	0.094
	378		104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	3273.79	0.075
	379		104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	3527.42	0.081
	380		104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	3423.47	0.079
	381	121	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	2977.14	0.069
	382	122	104	STRP	4-PROCES	SA376 TP304	1.000	STCK	1400.00	600.0	70.0	43374.98	2966.10	0.068
	382W	122		AWBW	AWBW		1.800	STCK	1400.00	600.0	70.0	43374.98	2966.10	0.068

MAXIMUM STRESS RATIO FOR THIS RUN = 0.578 AT SOP NO. 372L

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-76 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

STRESSES FOR EQUATION 11 (CONTD.) SUSTAINED LOADS AND THERMAL EXPANSION. ALLOWABLE STRESS = 1.0(SH+SA) UNLESS MODIFIED

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN11														
	383	119	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	37500.00	743.21	0.020
	384	123	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	37500.00	744.94	0.020
	385		105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	37500.00	1107.09	0.030
	386L	124	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	37500.00	1716.87	0.046
	386R	124	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	37500.00	1142.95	0.030
	387	125	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	37500.00	540.07	0.014
	388		105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	37500.00	244.50	0.007
	389L	126	105	STRP	8-GUARD	SA106 B	1.000	STCK	15.00	300.0	70.0	37500.00	37.19	0.001
	389R	126	106	FLXC	FLEX-CON		N/A							
	390	121	106	FLXC	FLEX-CON		N/A							

MAXIMUM STRESS RATIO FOR THIS RUN = 0.046 AT SOP NO. 386L

RUN NAME	SOP NO.	DCP NAME	COMP NAME	COMP TYPE	SECTION NAME	MATERIAL NAME	SIF	LOAD SET	PRESS (PSI)	SH TEMP	SC TEMP	ALLOW. STRESS (PSI)	COMPUTED STRESS (PSI)	STRESS RATIO
RN12														
	391	108	107	BRCH-B	6X3/4S80	SA105	1.000	STCK	1400.00	600.0	70.0	43750.00	4337.22	0.099
	392L	127	107	BRCH-B	6X3/4S80	SA105	N/A							
	392W	127		FILW	FILW		2.100	STCK	1400.00	600.0	70.0	37500.00	5883.76	0.157
	392R	127	108	STRP	3/4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	4606.93	0.123
	393L	128	108	STRP	3/4S80	SA106 B	1.000	STCK	1400.00	600.0	70.0	37500.00	4606.93	0.123
	393W	128		FILW	FILW		2.100	STCK	1400.00	600.0	70.0	37500.00	5883.76	0.157
	393R	128	109	SRED-E	1X3/4S80	SA105	2.250	STCK	1400.00	600.0	70.0	43750.00	6133.58	0.140
	394L	C54A	109	SRED-E	1X3/4S80	SA105	2.250	STCK	1400.00	600.0	70.0	43750.00	4561.41	0.104

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK., RUPTURE AND SUPP.SUMM.

SUPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
CF1 (CONTD.)												
				MOMT	(LB.FT)	GLOB	290.33	FLTD(M+)	110.74	FLTD(M+)	45.00	FLTD(M+)
							205.91	UPST	89.59	UPST	33.87	UPST
							180.90	S^E	65.43	HOT.	23.84	SSE
							109.43	[illegible]	45.31	SSE	21.15	HOT.
							64.76	C D	0.22	COLD	-1.56	COLD
							-68.51	HOT.	-45.31	SSE	-23.84	SSE
							-164.99	UPST	-61.17	HOT.	-36.75	HOT.
							-180.90	SSE	-85.33	UPST	-49.47	UPST
							-249.41	FLTD(M-)	-106.48	FLTD(M-)	-60.60	FLTD(M-)
				DISP	(IN)	GLOB						NEGLIGIBLE
				ROTN	(RAD)	GLOB						NEGLIGIBLE
97X	97	SNUB	X	FORC	(LB)	GLOB	632.27	SSE(M+)				
							632.27	FLTD				
							337.21	UPST				
							-337.21	UPST				
							-632.27	FLTD				
							-632.27	SSE(M-)				
				DISP	(IN)	GLOB	0.054	COLD(M+)	0.009	FLTD(M+)	0.417	FLTD(M+)
							0.054	HOT.	0.007	UPST	0.409	UPST
							0.054	UPST	0.005	HOT.	0.399	HOT.
							0.054	FLTD	0.004	SSE	0.018	SSE
											0.003	COLD
											0.003	HOT.
							-0.367	HOT.	-0.001	UPST	-0.006	UPST
							-0.367	FLTD	-0.003	FLTD	-0.015	FLTD
							-0.367	UPST(M-)	-0.004	SSE(M-)	-0.018	SSE(M-)
98Y	98	SNGL	Y	FORC	(LB)	GLOB			319.50	SSE(M+)		
									-319.50	SSE		
									-321.03	FLTD		
									-470.13	UPST		
									-640.53	COLD		
									-640.53	HOT.		

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

SUPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
98Y (CONTD.)									-1275.19	HOT.		
									-1445.59	UPST		
									-1594.69	FLTD(M-)		
				DISP	(IN)	GLOB	0.067	FLTD(M+)			0.441	FLTD(M+)
							0.063	UPST			0.432	UPST
							0.057	COLD			0.422	HOT.
							0.057	HOT.			0.018	SSE
							0.010	SSE			0.003	COLD
							-0.010	SSE			0.003	HOT.
							-0.366	HOT.			-0.006	UPST
							-0.371	UPST			-0.015	FLTD
							-0.376	FLTD(M-)			-0.018	SSE(M-)
101X	101	SNGL	X	FORC	(LB)	GLOB	360.85	SSE(M+)				
							273.04	FLTD				
							104.64	UPST				
							-87.81	HOT.				
							-87.81	COLD				
							-236.92	HOT.				
							-360.85	SSE				
							-429.37	UPST				
							-597.77	FLTD(M-)				
				DISP	(IN)	GLOB					0.999	FLTD(M+)
											0.984	UPST
											0.966	HOT.
											0.032	SSE
											0.007	COLD
											0.007	HOT.
											-0.011	UPST
											-0.026	FLTD
											-0.032	SSE(M-)
101Y	101	SNGL	Y	FORC	(LB)	GLOB			507.53	SSE(M+)		
									190.67	FLTD		
									-46.18	UPST		
									-316.87	HOT.		

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

SUPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
Y												
([illegible])									-507.53	SSE		
									-938.07	HOT.		
									-938.07	COLD		
									-1208.75	UPST		
									-1445.60	FLTD(M-)		
				DISP	(IN)	GLOB					0.999	FLTD(M+)
											0.984	UPST
											0.966	HOT.
											0.032	SSE
											0.007	COLD
											0.007	HOT.
											-0.011	UPST
											-0.026	FLTD
											-0.032	SSE(M-)
102X	102	SNGL	X									
				FORC	(LB)	GLOB	767.39	FLTD(M+)				
							593.44	SSE				
							490.45	UPST				
							173.94	HOT.				
							92.52	COLD				
							92.52	HOT.				
							-223.98	UPST				
							-500.92	FLTD				
							-593.44	SSE(M-)				
				DISP	(IN)	GLOB			0.134	SSE(M+)	1.440	FLTD(M+)
									0.124	FLTD	1.403	UPST
									0.061	UPST	1.361	HOT.
									-0.011	HOT.	0.079	SSE
									-0.011	COLD	-0.004	COLD
									-0.029	HOT.	-0.004	HOT.
									-0.101	UPST	-0.046	UPST
									-0.134	SSE	-0.079	SSE
									-0.163	FLTD(M-)	-0.083	FLTD(M-)

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

SUPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
103Z	103	SNUB	Z									
				FORC	(LB)	GLOB					771.57	SSE(M+)
											771.57	FLTD
											411.50	UPST
											-411.50	UPST
											-771.57	FLTD
											-771.57	SSE(M-)
				DISP	(IN)	GLOB	0.168	FLTD(M+)	0.063	FLTD(M+)	1.351	HOT.(M+)
							0.134	UPST	0.051	SSE	1.351	UPST
							0.096	HOT.	0.039	UPST	1.351	FLTD
							0.073	SSE	0.011	HOT.	0.002	HOT.
							-0.007	COLD	-0.002	COLD	0.002	COLD
							-0.007	HOT.	-0.002	HOT.	0.002	FLTD
							-0.045	UPST	-0.030	UPST	0.002	UPST
							-0.073	SSE	-0.051	SSE		
							-0.079	FLTD(M-)	-0.054	FLTD(M-)		
104Y	104	SNGL	Y									
				FORC	(LB)	GLOB			230.86	SSE(M+)		
									-230.86	SSE		
									-337.76	FLTD		
									-445.49	UPST		
									-568.62	COLD		
									-568.62	HOT.		
									-751.38	HOT.		
									-874.50	UPST		
									-982.23	FLTD(M-)		
				DISP	(IN)	GLOB	0.203	FLTD(M+)			1.367	FLTD(M+)
							0.169	UPST			1.337	UPST
							0.130	HOT.			1.303	HOT.
							0.073	SSE			0.064	SSE
							-0.007	COLD			0.006	COLD
							-0.007	HOT.			0.006	HOT.
							-0.045	UPST			-0.028	UPST
							-0.073	SSE			-0.058	FLTD
							-0.079	FLTD(M-)			-0.064	SSE(M-)

BOX 100 ATUL PATEL *** CNICAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

SUPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
106X	106	SNGL	X									
				FORC	(LB)	GLOB	389.64	SSE(M+)				
							363.77	FLTD				
							181.93	UPST				
							-25.87	HOT.				
							-25.87	COLD				
							-389.64	SSE				
							-823.88	HOT.				
							-1031.69	UPST				
							-1213.52	FLTD(M-)				
				DISP	(IN)	GLOB			0.160	FLTD(M+)	0.092	FLTD(M+)
									0.159	SSE	0.090	SSE
									0.086	UPST	0.030	UPST
											0.003	HOT.
											0.003	COLD
									-0.047	HOT.	-0.090	SSE
									-0.132	UPST	-0.106	HOT.
									-0.159	SSE	-0.154	UPST
									-0.206	FLTD(M-)	-0.196	FLTD(M-)
107Y	107	SNGL	Y									
				FORC	(LB)	GLOB			378.98	SSE(M+)		
									174.82	FLTD		
									-2.04	UPST		
									-204.16	HOT.		
									-378.98	SSE		
									-1386.05	HOT.		
									-1386.05	COLD		
									-1588.18	UPST		
									-1765.03	FLTD(M-)		
				DISP	(IN)	GLOB	0.062	FLTD(M+)				
							0.062	SSE				
							0.034	UPST				
							-0.062	SSE				
							-0.100	HOT.				
							-0.133	UPST				
							-0.161	FLTD(M-)				

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

:UPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
107Z	107	SNGL	Z									
				FORC	(LB)	GLOB					595.79	FLTD(M+)
											562.40	SSE
											333.33	UPST
											33.39	HOT.
											33.39	COLD
											-260.82	HOT.
											-560.77	UPST
											-562.40	SSE
											-823.23	FLTD(M-)
				DISP	(IN)	GLOB	0.062	FLTD(M+)				
							0.062	SSE				
							0.034	UPST				
							-0.062	SSE				
							-0.100	HOT.				
							-0.133	UPST				
							-0.161	FLTD(M-)				
109Y	109	SNGL	Y									
				FORC	(LB)	GLOB			329.92	SSE(M+)		
									-10.11	FLTD		
									-164.08	UPST		
									-329.92	SSE		
									-340.04	COLD		
									-340.04	HOT.		
									-381.83	HOT.		
									-557.79	UPST		
									-711.75	FLTD(M-)		
				DISP	(IN)	GLOB	0.021	FLTD(M+)			0.667	FLTD(M+)
							0.021	SSE			0.542	UPST
							0.011	UPST			0.398	HOT.
											0.269	SSE
											0.002	COLD
							-0.021	SSE			0.002	HOT.
							-0.222	HOT.			-0.141	UPST
							-0.233	UPST			-0.267	FLTD
							-0.243	FLTD(M-)			-0.269	SSE(M-)

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP SUMM.

SUPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
110X	110	SNGL	X									
				FORC	(LB)	GLOB	2228.57	FLTD(M+)				
							1840.69	UPST				
							1397.40	HOT.				
							831.16	SSE				
							15.77	COLD				
							15.77	HOT.				
							-427.52	UPST				
							-815.39	FLTD				
							-831.16	SSE(M-)				
				DISP	(IN)	GLOB			0.259	FLTD(M+)	0.287	FLTD(M+)
									0.223	UPST	0.282	UPST
									0.181	HOT.	0.276	HOT.
									0.078	SSE	0.010	SSE
									-0.042	UPST	-0.006	UPST
									-0.078	FLTD	-0.010	FLTD
									-0.078	SSE(M-)	-0.010	SSE(M-)
111Y	111	CONF	Y									
				FORC	(LB)	GLOB			-297.40	HOT.		
									-297.40	COLD		
									-297.40	HOT.		
									-297.40	UPST		
									-297.40	UPST		
									-297.40	FLTD		
									-297.40	FLTD(M-)		
				DISP	(IN)	GLOB	0.002	SSE(M+)	0.264	FLTD(M+)	0.275	FLTD(M+)
							0.002	FLTD	0.229	UPST	0.270	UPST
							0.001	UPST	0.189	HOT.	0.265	HOT.
							-0.001	HOT.	0.075	SSE	0.010	SSE
							-0.002	SSE	-0.040	UPST	-0.006	UPST
							-0.002	UPST	-0.075	FLTD	-0.010	FLTD
							-0.004	FLTD(M-)	-0.075	SSE(M-)	-0.010	SSE(M-)
111S	111	CONF	Y									
				FORC	(LB)	GLOB			16.62	FLTD(M+)		
									14.41	UPST		
									11.88	HOT.		

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** **
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** **
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

ORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
111S ONTD.)												
									4.74	SSE		
									-2.53	UPST		
									-4.74	FLTD		
									-4.74	SSE(M-)		
				DISP	(IN)	GLOB	0.002	SSE(M+)	0.264	FLTD(M+)	0.275	FLTD(M+)
							0.002	FLTD	0.229	UPST	0.270	UPST
							0.001	UPST	0.189	HOT.	0.265	HOT.
									0.075	SSE	0.010	SSE
							-0.001	HOT.				
							-0.002	SSE	-0.040	UPST	-0.006	UPST
							-0.002	UPST	-0.075	FLTD	-0.010	FLTD
							-0.004	FLTD(M-)	-0.075	SSE(M-)	-0.010	SSE(M-)
112X	112	SNGL	X	FORC	(LB)	GLOB	955.29	SSE(M+)				
							888.09	FLTD				
							442.29	UPST				
							-67.20	HOT.				
							-67.20	COLD				
							-955.29	SSE				
							-1603.90	HOT.				
							-2113.39	UPST				
							-2559.19	FLTD(M-)				
				DISP	(IN)	GLOB			0.356	FLTD(M+)	0.075	FLTD(M+)
									0.349	UPST	0.070	UPST
									0.341	HOT.	0.065	HOT.
									0.015	SSE	0.010	SSE
									-0.003	COLD		
									-0.003	HOT.		
									-0.011	UPST	-0.005	UPST
									-0.015	SSE	-0.010	FLTD
									-0.018	FLTD(M-)	-0.010	SSE(M-)
113Z	113	SNGL	Z	FORC	(LB)	GLOB					2458.58	FLTD(M+)
											1916.58	UPST
											1297.15	HOT.
											1161.43	SSE

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SUPERPIPE VERS. 11/15/79, AMDAHL REV.1

BOX 100 ATUL PATEL *** CN1CAF30-W/ 33 HZ. *** ** ** ** C A F ** ** ** 04/05/82 PAGE1735
AUXILIARY FEED WATER PUMPS TO STEAM GENERATOR-1D ** ** ** REV-3A ** ** ** 14:19:46
PROBLEM NO.-RCD-6-30-78 AUX-BLDG./INSIDE D.H. ** ** ** UNIT-1 ** ** **
WT-1; TH-6; SAM-12;RSA-4; ENDL(FORC & DSPL); ST.CK.; RUPTURE AND SUPP.SUMM.

SUPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
113Z (CONTD.)												
											-5.77	COLD
											-5.77	HOT.
											-625.20	UPST
											-1161.43	SSE
											-1167.20	FLTD(M-)
				DISP	(IN)	GLOB	0.002	SSE(M+)	0.326	FLTD(M+)		
							0.002	FLTD	0.325	UPST		
							-0.002	SSE	0.323	HOT.		
							-0.036	HOT.	0.002	SSE		
							-0.038	UPST	-0.002	SSE		
							-0.039	FLTD(M-)	-0.003	HOT.		
									-0.003	COLD		
									-0.004	UPST		
									-0.005	FLTD(M-)		
116Y	116	SNGL	Y	FORC	(LB)	GLOB			522.71	SSE(M+)		
									-389.11	FLTD		
									-522.71	SSE		
									-633.04	UPST		
									-911.82	COLD		
									-911.82	HOT.		
									-1406.79	HOT.		
									-1685.57	UPST		
									-1929.50	FLTD(M-)		
				DISP	(IN)	GLOB	0.002	FLTD(M+)			0.037	FLTD(M+)
							0.002	SSE			0.032	UPST
							-0.002	SSE			0.027	HOT.
							-0.268	HOT.			0.010	SSE
							-0.269	UPST			-0.005	UPST
							-0.269	FLTD(M-)			-0.010	FLTD
											-0.010	SSE(M-)
M457	124	ANCH	GLOB	FORC	(LB)	GLOB	2227.26	FLTD(M+)	201.24	SSE(M+)	475.76	FLTD(M+)
							1815.73	UPST	-201.24	SSE	473.67	SSE
							1345.42	HOT.	-895.21	FLTD	254.71	UPST

Item 55 - 3.7.3.8.3, page 3.7-32 and Table 3.7.3-1

Provide a detailed example of the "Alternate Analysis of Flexible Piping" including the evaluation of Seismic Anchor Motion. Explain the use of the 15/8 factor and the 2g and 3g limits on page 3.7-33.

Response:

A presentation during the meeting explained Alternate Analysis Criteria design basis and user actions to the satisfaction of the staff. The 15/8 factor is the ratio of Safe Shutdown earthquake acceleration value of .15g to the Operating Basis earthquake acceleration value of .08g. These values were chosen for the foundation at Catawba as provided for in 10CFR Part 100, Appendix A and explained in Section 2.5.2.6 of the FSAR. The .08g value for OBE is conservative and is slightly more than 1/2 the SSE.

Concentrated weights within the Alternate Criteria are assumed to be mechanical equipment, particularly valves. In Section 3.9.22, the seismic qualification by analysis of safety related mechanical equipment, including its supports, includes the consideration of two mutually orthogonal components of horizontal seismic motion occuring simultaneously with the vertical motion as recommended in Reg. Guide 1.92. The 2g and 3g SSE acceleration limits were used in the Westinghouse Pump and Valve Operability Program (Section 3.9.3.2) for static shaft deflection analysis of pump rotors and static valve qualification. It also required the piping designer to maintain the acceleration to these limits. The 3g and 2g limits are conservative and the Alternate Criteria has taken these limits and conservatively applied them to determine spans and loading regardless of the type of concentrated weight of class of pipe.

This item was closed.

Item 56 - 3.7.3.9, page 3.7-33

The method for analyzing multiply-supported components is unacceptable. The appropriate method was either a response spectrum that envelopes the response spectra at all support elevations or multiple response spectra inputs. Provide a commitment to this method of analysis.

Response:

We will revise page 3.7-33 (as attached) to provide the following information:

3.7.3.9 Multiply - Supported Equipment Components with Distinct Inputs

For seismic piping (other than NSSS), analysis includes earthquake loads represented by horizontal earthquake response spectra at the various floor elevations in the Category I structures.

For a piping system spanning between two or more elevations (spectra) the response spectrum analysis is performed using an envelope of all appropriate floor response spectras through which the pipe passes. The spectrum used to represent the vertical seismic accelerations is two-thirds of the horizontal ground spectrum where no vertical floor spectra is developed.

For the evaluation of relative support motions in the seismic analysis of piping systems interconnecting two or more primary structures, the maximum relative movement between structures is assumed, and the piping system is subjected to these movements through the piping system supports and restraints using a static analysis. Separate cases for N-S earthquake and E-W earthquake are considered. Support movements are based on the maximum of the floor movements immediately above and below the support location, with the interpolation optional. The stresses in the piping resulting from these imposed restraint movements are considered to act concurrently with other seismic and thermal stresses; however, these stresses are considered to be secondary stresses and as such are combined directly with the stresses resulting from thermally induced movement.

56

No separate evaluation is made for the stress requirement of the Faulted Condition because it is covered by the stress requirement of the Upset Condition if only pressure, gravity and earthquake loadings are considered as they were in the subject analysis. For the Faulted Condition only the seismic (SSE) contribution to the total stress is increased over the seismic (OBE) contribution to the total stress for the Upset Condition with the gravity and pressure stresses being equivalent for both design conditions. The stress (displacement, reaction) effect of a SSE is taken to be 15/8 that of the corresponding OBE. Since the allowable stress for the Faulted Condition is double that of the Upset Condition, the evaluation of earthquake stress limit is based on the Upset Condition only.

Spans with concentrated weights are evaluated against the displacement and stress criteria described above; in addition, acceleration limits are imposed assuming that concentrated weights are usually valves. The limits are 2 g (SSE) in the vertical direction and 3 g (SSE) in each of two mutually perpendicular horizontal directions. All three of these acceleration components may occur simultaneously, but resultant combinations of these components are not used as acceleration limits. The limits are independent of the orientation of a valve.

3.7.3.9 <u>Multiply - Supported Equipment Components with Distinct Inputs</u>

For seismic piping (other than NSSS), analysis includes earthquake loads represented by horizontal earthquake response spectra at the various floor elevations in the Category I structures. For a piping system spanning between two or more elevations (spectra), ~~the spectrum curve associated with the elevation closest to, or higher than, the center of mass of the piping system is used. In establishing the response spectra used for a particular analysis problem the underlying philosophy is that the spectrum selected is representative of the input motion to which the major portion of the pipe is subjected. This generally corresponds to the spectrum associated with the elevation of the center of mass of the pipe. Each analysis problem is evaluated individually to assure that the input spectrum used is equal to or more conservative than the spectrum associated with the elevation of the major portion of the pipe.~~ The spectrum used to represent the vertical seismic accelerations is two-thirds of the horizontal ground spectrum where no vertical floor spectra is developed.

For the evaluation of relative support motions in the seismic analysis of piping systems interconnecting two or more primary structures, the maximum relative movement between structures is assumed, and the piping system is subjected to these movements through the piping system supports and restraints using a static analysis. Separate cases for N-S earthquake and E-W earthquake are considered. Support movements are based on the maximum of the floor movements immediately above and below the support location, with the interpolation optional. The stresses in the piping resulting from these imposed restraint movements are considered to act concurrently with other seismic and thermal stresses; however, these stresses are considered to be secondary stresses and as such are combined directly with the stresses resulting from thermally induced movement.

the response spectrum analysis is performed using an envelope of all appropriate floor response spectras through which the pipe passes.

Item 57 - 3.7.3.9, page 3.7-34

The stresses caused by differential seismic motion of piping are secondary stresses for piping, but are primary stresses for pipe supports. They are not secondary stresses as noted. Provide a commitment that your analysis reflects this.

Response:

Duke will revise FSAR page 3.7-34 (as attached) so that the third sentence of the third paragraph will read as follows:

> Per ASME Code rules, the stress caused by differential seismic motion is clearly secondary for piping (NB-3650).

Additionally a sentence will be added at the end of section 3.7.3.9 as follows:

> All analyzed piping stresses are considered primary stresses for the purpose of pipe support design.

This item was closed.

When response spectrum methods are used to evaluate Reactor Coolant System primary components interconnected between floors, the procedures of the following paragraphs are used. There are no components in Westinghouse scope of analysis which are connected between buildings. The primary components of the Reactor Coolant System are supported at no more than two floor elevations.

A dynamic response spectrum analysis is first made assuming no relative displacement between support points. The response spectra used in this analysis is the most severe floor response spectra.

Secondly, the effect of differential seismic movement of components interconnected between floors is considered statically in the integrated system analysis and in the detailed component analysis. The results of the building analysis are reviewed on a mode-by-mode basis to determine the differential motion in each mode. Per ASME Code rules, the stress caused by differential seismic motion is clearly secondary for piping (NB-3650). ~~and component supports (NF-3231).~~ For components, the differential motion will be evaluated as a free end displacement, since, per NB-3213.19, examples of a free end displacement are motions "that would occur because of relative thermal expansion of piping, equipment, and equipment supports, or because of rotations imposed upon the equipment by sources other than the piping". The effect of the differential motion is to impose a rotation on the component from the building. This motion, then, being a free end displacement and being similar to thermal expansion loads, will cause stresses which will be evaluated with ASME Code methods including the rules of NB-3227.5 used for stresses originating from restrained free end displacements. All analysed piping stresses are considered primary stresses for pipe support design.

The results of these two steps, the dynamic inertia analysis and the static differential motion analysis, are combined absolutely with due consideration for the ASME classification of the stresses.

3.7.3.10 Use of Constant Vertical Static Factors

For seismic piping subsystems, the simultaneous three-directional excitation used in the analysis does not involve constant vertical static factors.

3.7.3.11 Torsional Effects of Eccentric Masses

For seismic piping, significant masses offset from the pipe centerline are specifically included in the seismic math model. Therefore, any forces or moments, including torsion, due to these eccentric masses appear in the results of the analysis. Typical examples of such masses are remote-actuated valve operators and local bypass piping.

3.7.3.12 Buried Seismic Category I Piping Systems and Tunnels

The Nuclear Service Water System includes buried seismic piping connecting various safety-related structures. Due to its early position in the procurement and erection schedules, the Nuclear Service Water System piping is designed in accordance with the 1971 (rather than 1974) edition of the ASME Code. The seismic analysis performed on this pipe considers:

Item 58 - 3.7.3.13, page 3.7-55

Provide an example of how the seismic boundary is protected in cases where the seismic and non-seismic piping connect.

Response:

When an anchor is used to separate a seismic boundary non-seismic boundary, a plastic hinge calculation is performed. All the non-seismic supports are assumed to fail and a plastic hinge is formed. The loads developed are absolute summed with the seismic analyzed side. As per Regulatory Guide 1.29, the interface between seismic Category I and non-seismic system is designated as seismic Category I. An example of a plastic hinge calculated for anchor 1-R-BW-1547, shown in figure 3.9.3-1, is attached.

Form 184 (5-76)

Dev./Station CATAWBA — Attachment: Item 58

Subject LOADS ON ANCHOR AT SEISMIC & NON-SEISMIC PIPING INTERFACE FOR PROBLEM - CAF & BWB — Unit 1 — File No.

Sheet No. 18 of 40 — Problem No. RCD-6-30-78 — By ACP. — Date 12-20-80.

Checked By AND — Date 12-29-80

THIS PAGE ADDED @ REV-2

PURPOSE :-

TO DETERMINE THE MAX. FORCES & MOMENTS REQUIRED TO DESIGN AN ANCHOR WHICH INTERFACE SEISMIC (RIGOROUS) AND NON-SEISMIC (NON-RIGOROUS) PIPING.

ASSUMPTIONS :-

(1) ASSUME THAT FAILURE OF NON-RIGOROUS PIPING (SEISMICLY NOT-SUPPORTED) WILL BE BY MOMENT AND TORSIONAL LOADS ONLY.

(2) ASSUME THAT DESIGN STRESS IN PIPE WILL BE YIELD STRESS.

(3) IT IS ASSUMED THAT EACH DIRECTIONAL MOMENT AND TORSION INDEPENDENTLY CAUSES YIELDING OF COMPLETE CROSS-SECTION OF THE NON-RIGOROUS PIPING AT AN ANCHOR.

REFERENCE :-

(1) PROBLEM - CAC ; UNIT-1 ; REV-2 . SH.# 30 to 39 OF 50.

(2) R.J. ROARK & W.C. YOUNG. FORMULAS FOR STRESS & STRAIN ; 5TH EDITION

(3) AISC MANUAL OF STEEL CONSTRUCTION ; 7TH EDITION

THEORY :-

CALCULATE THE REQUIRED FORCES AND MOMENTS TO FORM A PLASTIC HINGE AT THE ANCHOR POINT ON THE NON-SEISMIC PIPING. THIS IS DONE TO ENSURE THAT DURING SEISMIC EVENT THE PIPING ON THE NON-SEISMIC SIDE OF THE ANCHOR WILL YIELD BEFORE IT CAN SIGNIFICANTLY AFFECT THE ANCHOR AND RIGOROUS PIPING.

Form 184 (5-76)

Dev./Station CATAWBA Unit 1 File No.

Subject LOADS ON ANCHOR AT SEISMIC & NON-SEISMIC PIPING INTERFACE FOR PROBLEM-CAF & 3WB By ACP Date 12-20-80

Sheet No. 19 of 40 Problem No. RCD-6-30-78. Checked By KVD Date 12-29-80

THIS PAGE ADDED @ REV-2

$M_P = \sigma_Y Z/12$ (FT-LBS)	REF-2 PAGE NO.-199 & 202
$T = \sigma_Y J/24R_i$ (FT-LBS)	REF-1 PAGE NO.-

WHERE:

M_P = PLASTIC MOMENT. MOMENT REQUIRED TO PRODUCE YIELDING OF THE COMPLETE SECTION OF PIPE (FT-LBS)

σ_Y = YIELD STRESS
= 35000 PSI FOR SA-106, GRD-B

Z = PLASTIC SECTION OF MODULUS (in^3)
$= 1/6(OD^3 - ID^3)\ in^3$

OD = OUT-SIDE DIA. OF PIPE (in)

ID = INSIDE DIA. OF PIPE (in)

T = TORTIONAL MOMENT (FT.-LBS)

J = POLAR MOMENT OF INARTIA (in^4)
$= \pi/32(OD^4 - ID^4) = .098175(OD^4 - ID^4)$

FOR 2" SCH.-40 ; SA-106 GRD-B

OD = 2.375" ; ID = 2.067" ; Ri = 1.0335

$M_P = \sigma_Y Z/12 =$

$Z = 1/6(2.375^3 - 2.067^3) = .7609$

$= 35000 * .7609/12$

= 2219. FT-LBS.

$T = \sigma_Y J/24 R_i$

$J = \pi/32(2.375^4 - 2.067^4) = 1.3315$

$= 35000 * 1.3315/24 * 1.0335$

$= 1878.8 \approx 1879.$

Form 184 (5-76)

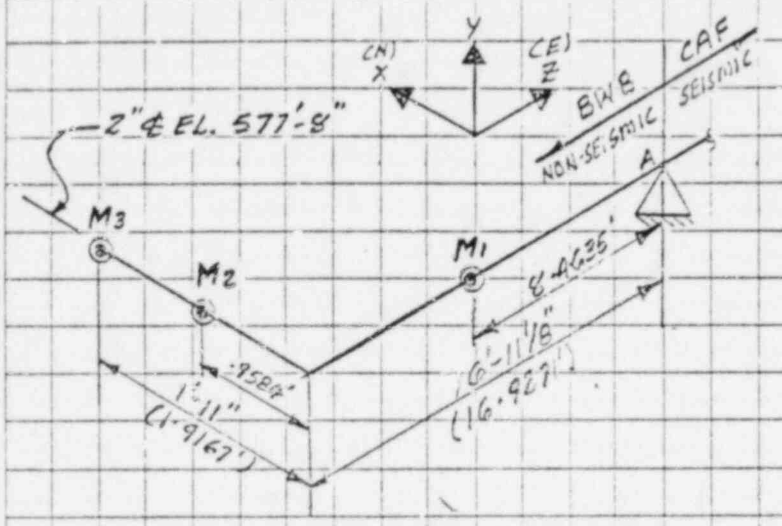
Dov./Station CATAWBA Unit 1 File No.

Subject LOADS ON ANCHOR AT SEISMIC & NON-SEISMIC PIPING INTERFACE FOR PROBLEM - CAF & BWB By AeP. Date 12.20.80

Sheet No. 20 of 40 Problem No. RCD-6-30-70 Checked By [illegible] Date 12.29.80

THIS PAGE ADDED @ REV-2

REF DWG. CN-1491-BW013 REV-5



WT. OF 2" SCH-40 PIPE WITH WATER IS 5.11 lbs/Ft.

∴ $M_1 = 16.9271 * 5.11 \cong 87.$ lbsm

$M_2 = 1.9167 * 5.11 \cong 10.$ lbsm

USING RESPONCE SPECTRA @ 577.0' AUX. BLD. AND 595.0' R.B. WALL AND VERT. R.S. (ALL 1% DMP) THE MAX. ACCELERATION USED ARE AS FOLLO

$A_x = X\,(N-S) = 2.165\,g.$

$A_y = Y\,(VERT) = 0.41\,g.$

$A_z = Z\,(E-W) = 2.165\,g.$

$F = M * A$

$F_{1x} = M_1 * A_x = 87 * 2.165 = 188. = F_{1z}$; $F_{1y} = M_1 * A_y = 87 * .41 \cong 36.0$

$F_{2x} = M_2 * A_x = 10 * 2.165 = 22. = F_{2z}$; $F_{2y} = M_2 * A_y = 10 * .41 \cong 4.0$

CALCULATION OF F_{Ax} ANCHOR FORCE

$\Sigma M_y = 0 = F_{1x} * 8.4635 + F_{2x} * 16.9271 + M_3 * A_x * 16.9271 - M_P$

∴ $M_3 = (M_P - 1591. - 372.4) / A_x * 16.9271$

∴ $M_3 = 6.97$

$\Sigma F_x = 0$ ∴ $F_{Ax} = F_{1x} + F_{2x} + M_3 * A_x = 188 + 22 + 15 = 225.$ lbs F

CALCULATION OF F_{Az} ANCHOR FORCE.

$\Sigma M_y = 0 = F_{1z} * 0 + F_{2z} * .9584 + F_{3z} * 1.9167 - M_P$

∴ $F_{3z} = (2219 - 22) / 1.9167 = 1146$ lbs F

$\Sigma F_z = 0$ ∴ $F_{Az} = F_{2z} + F_{3z} = 22 + 1146 = 1168.$ lbs.F

CALCULATION OF F_{Ay} ANCHOR FORCE.

$\Sigma M_x = 0 = F_{1y} * 8.4635 + F_{2y} * 16.9271 + F_{3y} * 16.9271 - M_P$

∴ $F_{3y} = (2219 - 305 - 68) / 16.9271 = 108.6 \simeq 109$

$\Sigma F_y = 0$ ∴ $F_{Ay} = F_{1y} + F_{2y} + F_{3y} = 37 + 4 + 109 = 150$

$\Sigma M_z = 0 = F_{2y} * .9584 + F_{3y} * 1.9167 - 1879$

∴ $F_{3y} = (1879 - 3.8) / 1.9167 = 978.$

$\Sigma F_y = 0$ ∴ $F_{Ay} = F_{2y} + F_{3y} = 4 + 978 = 982.$

∴ $F_{Ay} = 982$ lbs F (∵ 982 > 150)

SO LOADS FOR ANCHOR ON NON-SEISMIC SIDE OF THE ANCHOR ARE

F_{Ax} = 225 lbs.

F_{Ay} = 982. lbs.

F_{Az} = 1168 lbs.

$M_{Ax} = M_P$ = 2219 ft-lbs.

$M_{Ay} = M_P$ = 2219 ft-lbs.

$M_{Az} = T$ = 1879 ft-lbs.

Dev./Station CATAWBA Catawba Unit ___ File No. ___

Subject ANCHOR LOAD SUMMARY

PROBLEM- CAF & BWB By — Date —

Sheet No. 21 of 40 Problem No. RCD-6-30-78 Checked By — Date —

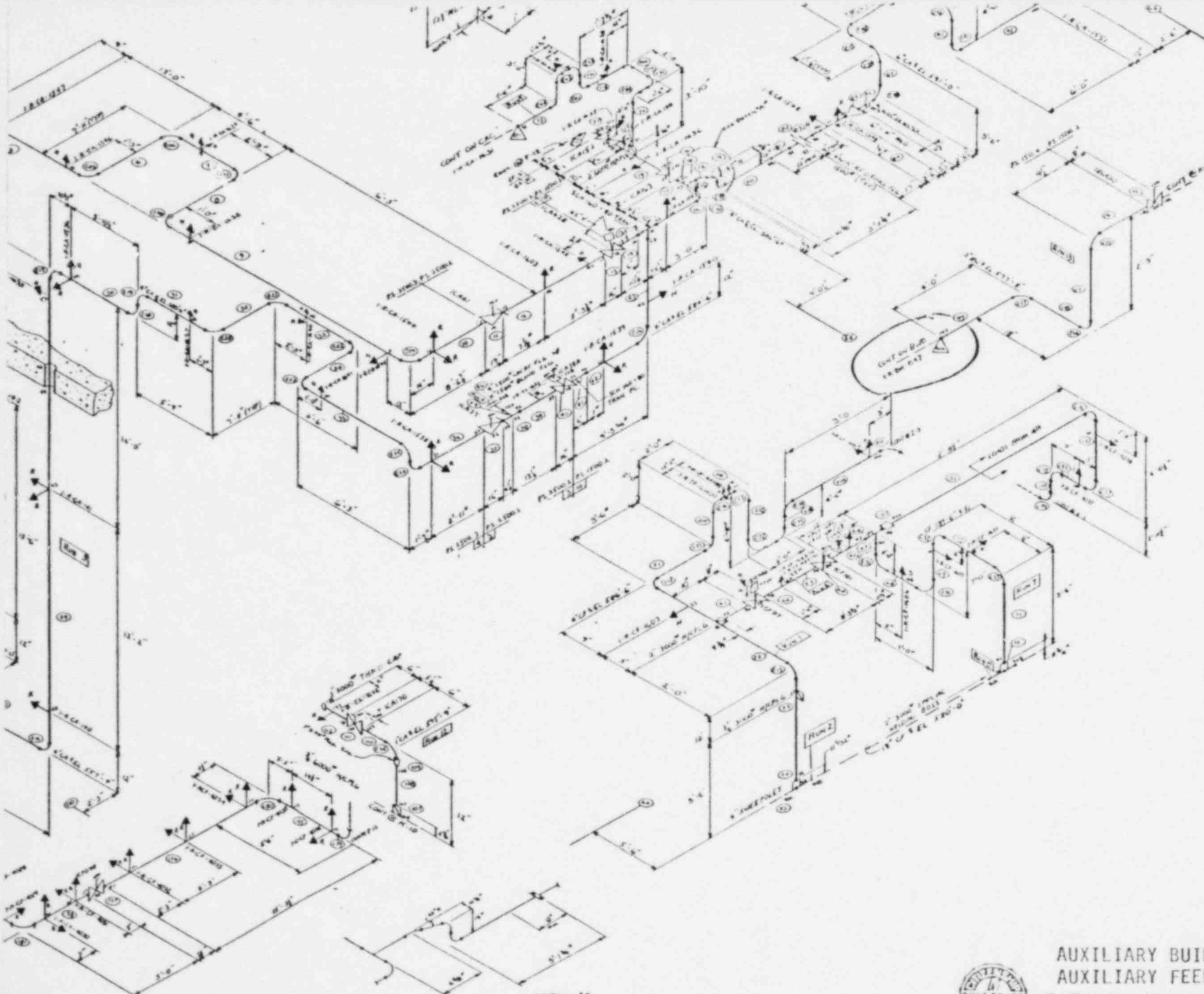
SUPPORT (ANCHOR) NO. 1-R-BW-1547 PIPE SIZE & SCH.- 2" SCH 40

LOAD NO.	PROBLEM NAME	DCP. NO.	COMPUTER OUTPUT ID NO.
1	BWB	49	3-3-81; 21:8:36
2	BWB	49	SEE CALCULATED LOADS ON SH #20
3	CAF	140	4-16-81; 14:08:51

Design temp. of the pipe = 275 °F

LOAD CONDITION	LOAD ID. NO.	Fx	Fy	Fz	Mx	My	Mz
		LOADS (LBS) AND MOMENTS IN GLOBLE COORDINATES					
COLD	1	0.	-46	-2	-117	-4	-45
	3	-6.	-33	12	49	-9	-3
	TOTAL	-6	-79	10	-68	-13	-48
HOT (+)	1	0.	-46	83.	-117	185.	-44
	3	-6	149	262	49	-9	34
	TOTAL	0	149	345	49	185	34
HOT (-)	1	-12	-46	-2	-117	-4	-45
	3	-254	-33	-2	-365	-641	-3
	TOTAL	-266	-79	-4	-482	-645	-48
UPSET (+)	2	225	982	1168.	2219	2219	1879
	3	8	159	286	67	15	39
	TOTAL	233	1141	1454	2286	2234	1918
UPSET (-)	2	-225.	-982	-1168	-2219	-2219	-1879
	3	-267	-42	-25	-383	-665	-8
	TOTAL	-492	-1024	-1193	-2602	-2884	-1887
FAULTED (+)	2	225	982	1168	2219	2219	1879
	3	20	167	306	82	37	44
	TOTAL	245	1149	1474	2301	2256	1923
FAULTED (-)	2	-225	-982	-1168	-2219	-2219	-1879
	3	-279	-50	-45	-399	-687	-13
	TOTAL	-504	-1032	-1213	-2618	-2906	-1892
SSE (±)	2	± 225	± 982	± 1168	± 2219	± 2219	± 1879
	3	± 26	± 17	± 43	± 34	± 46	± 10
	TOTAL	± 251	± 999	± 1211	± 2253	± 2265	± 1889

No.	Revision	By/Date		Ckd/Date	
3	This page supersedes Rev-2 page	ACP.	4/17/81	CEP	4/21/81



AUXILIARY BUILDING
AUXILIARY FEEDWATER SYSTEM
CATAWBA NUCLEAR STATION
Figure 3.9.3-1
Rev. 2

Item 59 - 3.7.3.4, page 3.7-29

The applicant states that rigid equipment/support systems have natural frequencies greater than 33 Hz as noted in Section 3.7.3.1. Is this a correct reference?

Response:
Page 3.7-29 will be revised (as attached) to read as follows:

> Also, rigid equipment/support systems have natural frequencies greater than 33 Hz.

Attachment item 59

In all cases, equipment under earthquake loadings is designed to be within code allowable stresses.

Also, ~~as noted in Section 3.7.3.1~~, rigid equipment/support systems have natural frequencies greater than 33 Hz.

3.7.3.5 Use of Equivalent Static Load Method of Analysis

For seismic piping, the equivalent static load method involves the multiplication of the total weight of the equipment or component member by the specified seismic acceleration coeeficient. The magnitude of the seismic acceleration coefficient is established on the basis of the expected dynamic response characteristics of the component. Components within Westinghouse scope which can be adequately characterized as a single degree of freedom systems are considered to have a modal participation factor of one. Seismic acceleration coefficients for multi-degree of freedom systems which may be in the resonance region of the amplified response spectra curves are increased by 50 percent to account conservatively for the increased modal participation.

3.7.3.6 Three Components of Earthquake Motion

Methods used to account for three components of earthquake motion for Westinghouse subsystems are given in Section 3.7.2.6.

For seismic piping other than NSSS, analysis is performed using simultaneous three-direction excitation. Directional responses are combined into a total response by taking the square root of the sum of the squares (SRSS) of individual responses. This method conforms fully to the recommendations of Regulatory Guide 1.92.

3.7.3.7 Combination of Modal Responses

Methods used to combine modal responses for subsystems in Westinghouse's scope of responsibility are given in Section 3.7.2.7.

For seismic piping other than the NSSS, modal responses are combined into a total response by taking the square root of the sum of the squares (SRSS) of individual responses. The responses from groups of closely spaced modes, defined as having frequencies between the lowest frequency in the group and a frequency ten percent higher, are combined by absolute summation; the resulting response for each group is then combined by SRSS with the remaining responses from the modes which are not closely spaced. This method conforms fully to the recommendations of Regulatory Guide 1.92.

3.7.3.8 Analytical Procedures for Piping

The criteria for determining which piping is to be seismic are discussed in Section 3.2.1. All seismic piping is classified Seismic Category I. The specific analytical procedures used in qualifying the pipe depend on its size, temperature, structural frequency, and other factors as discussed in this section.

Item 60 - 3.9.1.1, page 3.9-1

Emergency conditions are omitted here. Does this mean that the Small Steam Break and Small LOCA in Tabel 3.9.1-1 (page 2) are evaluated using faulted limits?

Response:

The design basis for the Catawba plant did not include emergency limits. Specifically, the ASME Code and internal Westinghouse design requirements did not address emergency conditions in the design basis. Consequently, it is not necessary to define emergency conditions in Section 3.9.1.

The definition of a small LOCA and a small steamline break as emergency conditions in Table 3.9.1-1 was also discussed. It was pointed out that these transients were inappropriately identified as emergency conditions for the Catawba plant and should be deleted from Table 3.9.1-1. Small break design transients for the Catawba plant are enveloped by upset and faulted condition limits. Specifically, fatigue considerations for small breaks are enveloped by upset condition transients. Structurally, small breaks are enveloped by large breaks considered under faulted condition limits.

Based on the above discussion and the attached revision to Table 3.9.1-1, this item was resolved.

ATTACHMENT TO ITEM 60

Table 3.9.1-1 (page 2)

Design Transients for ASME Code Cla. 1 Piping

(1) SIGN TRANSIENTS	(2) CONDITION	(3) OCCURRENCES	(4) RESIDUAL HEAT REMOVAL SYSTEM	SAFETY INJECTION SYSTEM	CHEMICAL AND VOLUME CONTROL SYSTEM	PRESSURIZER SURGE LINE	PRESSURIZER RELIEF	PRESSURIZER SPRAY	RTD BYPASS	REACTOR COOLANT DRAIN LINES	UPPER HEAD INJECTION LINES
ss of Load without Immediate Turbine or Reactor Trip	Upset	80	X	X	X	X	X NOTES 4, 5	X	X	X	X
ss of Flow in One Loop	Upset	80	X	X	X		X	X	X	X	X
actor Trip with Cooldown and Inadvertent SIS Actuation	Upset	10	X	X	X	X	X	X	X	X	X
advertent RCS Depressuri-zation	Upset	20	X	X	X	X	X	X	X	X	X
advertent SI Accumulator Blowdown during Plant Cooldown	Upset	4	-	X	-	-	-	-	-	-	-
gh Head Safety Injection	Upset	22	-	X	-	-	-	-	-	-	-
ron Injection	Upset	48	-	X	-	-	-	-	-	-	-
~~all Steam Break~~	~~Emergency~~	5									X
~~all LOCA~~	~~Emergency~~	6									X
ge Steam Break	Faulted	1	X	X	X	X	X	X	X	X	X
ge LOCA	Faulted	1	X	X	X	X	X	X	X	X	X
h Head Safety Injection	Faulted	2	-	X	-	-	-	-	-	-	-
on Injection	Faulted	2	-	X	-	-	-	-	-	-	-
ine Roll Test	Test	10	X	X	X	X	X	X	X	X	X
ostatic Test	Test	5	X	X	X	X	X	X	X	X	X
ary Side Leak Test	Test	50	X	X	X	X	X	X	X	X	X
vertent Auxiliary Spray	Test	1	-	-	X NOTE 12	-	-	X NOTE 1b	-	-	-

S:

Portion of piping analyzed for 10 upset occurrences, remainder for 9 upset and 1 test occurrences.
Piping analyzed for 9 upset and 1 test condition.

ressurizer surge line is analyzed for 80 occurrences of transient C-7, the final cooldown spray.

ressurizer surge line is analyzed for 150,000 initial fluctuations and 3,000,000 random fluctuations.

ese transients are conditions which can cause the PORV's to open. Although a total of 320 such transients are shown, the PORV inlet lines e analyzed for 100 such occurrances.

r analysis of the safety valves 40 occurrences were assumed.

ber of occurrences is 20,000,000.

N 16
Duke item Catawba - 60

Item 61 - 3.9.1.1, page 3.9-7

How many cycles of OBE earthquake are used in the analysis?

Response:

See Items 49 and 51 for a discussion of the duration of the OBE. Based on Items 49 and 51, this item was resolved.

Item 62 - 3.9.1.1, page 3.9-8

The first paragrpah lists conservative assumptions. Assumption a) is that "the reactor is initially in a hot, zero-power condition." Is this actually conservative?

Response:

For a steamline break transient the hot, zero power condition is a conservative assumption relative to thermal transients and control of the reactor coolant system. It was also noted that this assumption does not apply to structural and pipe break considerations for the main steamline and associated accident analyses(e.g., containment temperature).

Based on the above discussion, this item was resolved.

Item 64 - 3.9.1.2.1, page 3.9-9

This section states that "analyses must be in accordance with the functional and structural analysis requirements set forth in the applicable Duke specifications." Provide an example of the functional and structural analysis requirements set forth in applicable Duke specifications.

Response:

Duke will revise FSAR page 3.9-9 as attached. This item was closed.

psig coincident with steam generator secondary side pressure of 0 psig. The RCS is designed for 5 cycles of these hydrostatic tests, which are performed prior to plant startup. The number of cycles is independent of other operating transients.

Additional hydrostatic tests will be performed to meet the inservice inspection requirements of ASME Section XI Subarticle IS5-20. A total of four such tests is expected. The increase in the fatigue usage factor caused by these tests is easily covered by the conservative number (50) of primary side leakage tests that are considered for design.

3. Primary Side Leakage Test

Subsequent to each time the primary system has been opened, a leakage test will be performed. During this test the primary system pressure is, for design purposes, raised to 2500 psia, with the system temperature above the minimum temperature imposed by reactor vessel material ductility requirements, while the system is checked for leaks. In actual practice, the primary system is pressurized to approximately 2400 psia as measured at the pressurizer, to prevent the pressurizer safety valves from lifting during the test.

During this leakage test, the secondary side of the steam generator must be pressurized so that the pressure differential across the tube sheet does not exceed 1600 psi. This is accomplished with the steam, feedwater, and blowdown lines closed off. For design purposes, it is assumed that 50 cycles of this test will occur during the 40 year life of the plant.

3.9.1.2 Computer Programs Used in Analysis

3.9.1.2.1 Components and Equipment

In the qualification of specific components or equipment provided to Duke, vendors may use computer methods of analysis. These ~~analyses~~ must be in accordance with the functional and structural ~~analysis requirements~~ set forth in the applicable Duke specification.

3.9.1.2.2 Piping Systems

Static and dynamic analyses of Catawba piping systems are performed using the computer program SUPERPIPE which is owned and maintained by EDS Nuclear, Inc., 220 Montgomery Street, San Francisco, California 94104.

SUPERPIPE is a general purpose piping program which performs comprehensive structural analyses of linear elastic piping systems for dead weight, thermal expansion, seismic spectra or time history, arbitrary force time history and other loading conditions. Analyses are performed to ASME requirements for Class 1, 2 and 3 systems.

A piping system is ideali[illegible] a mathematical model consisting of lumped masses connected by mass[illegible]lastic members. The location of lumped masses is chosen to accurately [illegible]sent the dynamic characteristics of the system for a dynamic analys[illegible] adequately represent the weight distribution of

Item 65 - 3.9.1.4.3, page 3.9-14

The applicant states that "The component upper and lower lateral supports are inactive during plant heatup, cooldown and normal plant operating conditions. However, these restraints become active when the plant is at power and under the rapid motions of the reactor coolant loop components that occur from the dynamic loadings and are represented by stiffness matrices and/or individual tension or compression spring members in the dynamic model. The analyses are performed at the full power condition."

What component does this paragraph refer to? Is the full power condition a normal operating condition?

Response:

It was pointed out that the subject paragraph refers to the steam generator supports. Clarification was provided for the subject FSAR paragraph by pointing out that inactive refers to the fact that these supports are not in contact with the steam generator during normal heatup. During power operation the supports are shimmed to zero gap and become active relative to dynamic loading conditions such as LOCA and SSE. It was agreed that the FSAR should be revised to clarify the subject paragraph. The clarification to FSAR Section 3.9.1.4.3 is attached.

Based on the above discussion and the attached FSAR revision, this item was resolved.

ATTACHMENT TO ITEM 65

CNS

After all the sections have been defined in this matter, the overall stiffness matrix and associated load vector to suppress the deflection of all the network points is determined. By inverting the stiffness matrix, the flexibility matrix is determined. The flexibility matrix is multiplied by the negative of the load vector to determine the network point deflections due to the thermal and boundary force effects. Using the general transfer relationship, the deflections and interr.' forces are then determined at all node points in the system.

The static solutions for deadweight, thermal, and general pressure loading conditions are obtained by using the WESTDYN-7 computer program. The derivation of the hydraulic loads for the loss of coolant accident analysis of the loop is covered in Section 3.6.2.

Seismic

The model used in the static analysis is modified for the dynamic analysis by including the mass characteristics of the piping and equipment. The effect of the equipment motion on the reactor coolant loop/supports system is obtained by modeling the mass and the stiffness characteristics of the equipment in the overall system model.

The steam generator is represented by three discrete masses. The lower mass is located at the intersection of the centerlines of the inlet and outlet nozzles of the steam generator. The middle mass is located at the steam generator upper support elevation and the third mass is located at the top of the steam generator.

The reactor coolant pump is represented by a two discrete mass model. The lower mass is located at the intersection of the centerlines of the pump suction and discharge nozzles. The upper mass is located near the center of gravity of the motor.

The reactor vessel and core internals are represented by approximately 13 discrete masses. The masses are lumped at various locations along the length of the vessel and along the length of the representation of the core internals.

STEAM GENERATOR

The ~~component~~ upper and lower lateral supports are inactive (i.e. do not provide support) during plant heatup, cooldown and normal plant operating conditions. ~~However~~, these restraints become active (i.e. provide support only) when the plant is at power and ~~under the rapid motions of the reactor coolant loop components that occur from the dynamic loadings and are~~ subject to dynamic loads from events such as a LOCA ... They represented by stiffness matrices and/or individual tension or compression spring members in the dynamic model. The analyses are performed at the full power condition.

The response spectra method employs the lumped mass technique, linear elastic properties, and the principle of modal superposition. Floor response spectra are generated for two perpendicular horizontal directions and the vertical direction. The floor response spectra are applied along each horizontal axis simultaneously with the vertical axis.

subject to dynamic loads from events such as a LOCA

Item 66 - 3.9.1.4.3, page 3.9-15

The applicant states that "The modal amplitudes are then converted to displacements in the global coordinate system and applied to the corresponding mass point. From these data the forces, moments, deflections, rotations, support reactions and piping stresses are calculated for all significant modes." What criteria is used to determine the significant modes?

Response:

For the reactor coolant system Westinghouse indicated that all modes with a corresponding displacement greater than 0.001 inch are considered in the analysis up to a frequency of 200 cps.

Based on the above discussion, this item was resolved.

Item 67 - 3.9.1.4.3, page 3.9-15

Justify the use of 4% critical damping for the loss of coolant accident?

Response:

Westinghouse utilizes 4% critical damping for the evaluation of the reactor coolant system for a loss of coolant accident. Justification of this damping value is provided in WCAP 7921AR which has been approved by the NRC. This topical report has been included in the FSAR and added to the list of references contained in Section 3.9. Based on the above discussion and the attached FSAR revision, this item was resolved.

ATTACHMENT TO ITEM 67

CNS

From the mathematical description of the system, the overall stiffness matrix K is developed from the individual element stiffness matrices using the transfer matrix method. After deleting the rows and columns representing rigid restraints, the stiffness matrix is revised to obtain a reduced stiffness matrix (K_R associated with mass degrees of freedom only. From the mass matrix and the reduced stiffness matrix, the natural frequencies and the normal modes are determined. The modal participation factor matrix is computed and combined with the appropriate response spectra value to give the modal amplitude for each mode. The total modal amplitude is obtained by computing the absolute sum of the contributions for each direction.

The modal amplitudes are then converted to displacements in the global coordinate system and applied to the corresponding mass point. From these data the forces, moments, deflections, rotations, support reactions and piping stresses are calculated for all significant modes.

The total seismic response is computed by combining the contributions of the significant modes by using the methods described in Section 3.7.

Loss of Coolant Accident

The mathematical model used in the static analyses is modified for the loss of coolant accident analyses to represent the severance of the reactor coolant loop piping at the postulated break location. Modifications include addition of the mass characteristic of the piping and equipment. To obtain the proper dynamic solution, two masses, each containing six dynamic degrees of freedom and located on each side of the break, are included in the mathematical model. The natural frequencies and eigenvectors are determined from this broken loop model.

The dynamic structural solution for the loss of coolant accident is obtained by using a modified-predictor-corrector-integration technique and normal mode theory.

When elements of the system can be represented as single acting members (tension or compression members), they are modelled as nonlinear elements, which are represented mathematically by the combination of a gap, a spring, and a viscous damper. The force in this nonlinear element is treated as an externally applied force in the overall normal mode solution. Multiple non-linear elements can be applied at the same node, if necessary.

The time-history solution is performed in subprogram FIXFM3. The input to this subprogram consists of the natural frequencies, normal modes, applied forces and nonlinear elements. The natural frequencies and normal modes for the modified reactor coolant loop dynamic model are determined with the WESTDYN-7 program. To properly simulate the release of the strain energy in the pipe, the internal forces in the system at the postul?ed break location due to the initial steady-state hydraulic forces, therm? rces, and weight forces are determined. The release of the strain ene? s accounted for by applying the negative of these internal forces as a step function loading. The initial conditions are equal to zero because the solution is only for the transient problem (the dynamic response to the system from the static equilibrium position). The time history displacement solution of all dynamic degrees of freedom is obtained using subprogram FIXFM3 and employing 4 percent critical damping. (DAMPING VALUES — REF 1H)

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ATTACHMENT TO ITEM 67

CNS

REFERENCES FOR SECTION 3.9

1. "Documentation of Selected Westinghouse Structural Analysis Computer Codes," WCAP-8252, Revision 1, May 1977.

2. "Benchmark Problem Solutions Employed for Verification of WECAN Computer Program," WCAP-8929, June 1977.

3. "Sample Analysis of a Class 1 Nuclear Piping System," prepared by ASME Working Group on Piping, AMSE Publication, 1972.

4. Witt, F.J., Bamford, W.H., Esselman, T.C., "Integrity of Primary Piping Systems of Westinghouse Nuclear Power Plants During Postulated Seismic Events," WCAP-9283, March 1978.

5. Bogard, W.T., Esselman, T.C., "Combination of Safe Shutdown Earthquake and Loss-of-Coolant Accident Responses for Faulted Condition Evaluation of Nuclear Power Plants," WCAP-9279, March 1978.

6. Bloyd, C.N., Ciarametars, W., and Singleton, N.R., "Verification of Neutron Pad and 17 x 17 Guide Tube Designs by Preoperational Tests on the Trojan I Power Plant," WCAP-8780, May 1976.

7. Lee, H., "Prediction of the Flow-Induced Vibration of Reactor Internals by Scale Model Test", WCAP-8317-A, July 1975.

8. Bloyd, C.N., Singleton, N.R., "UHI Plant Internals Vibration Measurement Program and Pre- and Post-Hot Functional Examinations", WCAP-8517, March 1975.

9. Bohm, G.J. and LaFaille, J.P., "Reactor Internals Response Under a Blowdown Accident", First Intl. Conf. on Structural Mechanics in Reactor Technology, Berlin, September 20-24, 1971.

10. "Documentation of Selected Westinghouse Structural Analysis Computer Codes", WCAP-8252, April 1974, Section VI.

11. Cooper, F.W., Jr., "17 x 17 Drive Line Components Tests - Phase IB II, III, D-Loop-Droop and Deflection", WCAP-8446 (Westinghouse Proprietary Class 2), WCAP-8449 (Westinghouse Non-Proprietary) December, 1974.

12. Kraus, S., "Neutron Shielding Pads", WCAP-7870, May, 1972.

13. "MULTIFLEX, A FORTRAN IV Computer Program for Analyzing Thermal-Hydraulic Structures System Dynamics," WCAP-8709, February 1976 (Proprietary), and WCAP-8709, February 1976 (Non-Proprietary).

14 CLOUD, R.L., "DAMPING VALUES OF NUCLEAR PLANT COMPONENTS", WCAP-7921-AR- MAY 1974

Item 68 - 3.9.1.4.3, page 3.9-16

The last paragrpah refers to Figure 3.9.1-2. Provide this figure.

Response:

The figure is already provided.

Item 69 - 3.9.1.4.4, page 3.9-19

The third paragraph says that seismic analyses are performed individually for the reactor coolant pump, the pressurizer and the steam generator. How is the connected piping handled for these components?

Response:

Westinghouse discussed how RCS piping effects are included in the analysis of the steam generator, reactor coolant pump, and pressurizer. Details of this discussion for each component is as follows:

- Steam Generator - A generic analysis of this component is performed taking into account the upper and lower bound stiffness of the component supports and the stiffness of the RCS piping. Several combinations of stiffnesses are analyzed. This generic analysis envelopes the Catawba plant.
- Reactor Coolant Pump - For this component a specific plant analysis was performed taking into account the stiffness of the supports and piping for the Catawba plant.
- Pressurizer - The effects of piping on the pressurizer are negligible and the piping stiffness is ignored. The pressurizer analysis is controlled by the support stiffness. The pressurizer nozzle is qualified to generic loads. These nozzle allowables are provided to Duke for consideration in their piping analysis.

Based on the above discussions, this item was resolved.

Item 70 - 3.9.1.4.4, page 3.9-19

The last sentence of the third paragraph says that qualification of the reactor pressure vessel is by a "static stress analysis based on loads that have been derived from dynamic analysis." Provide details of this analysis and justify its use.

Response:

The discussion focused on the reference to the static stress analyses for the reactor vessel. It was pointed out that this reference was only intended to cover inertial loads. It was pointed out that the Westinghouse RV vendor performs a static stress analysis utilizing generic loads specified by Westinghouse. Such loads include nozzle loads and internal loads on the vessel. The generic loads specified by Westinghouse are generated from dynamic systems analysis. Westinghouse also indicated that the RV vendor also performs transient analysis on the vessel but the subject FSAR paragraph was not intended to address this analysis. It was agreed that the methods discussed by Westinghouse were acceptable but the subject FSAR paragraph required clarification. The clarification to Section 3.9.1.4.4 has been made consistent with the above discussion.

Based upon the above discussion and the attached revision to the FSAR, this item was resolved.

ATTACHMENT TO ITEM 70

CNS

3.9.1.4.4 Analysis of Primary Components

Equipment which serves as part of the pressure boundary in the reactor coolant loop include the steam generators, the reactor coolant pumps, the pressurizer, and the reactor vessel. This equipment is ANS Safety Class 1 and the pressure boundary meets the requirements of the ASME Boiler and Pressure Vessel Code, Section III, Subsection NB. This equipment is evaluated for the loading combinations outlined in Table 3.9.1-2. The equipment is analyzed for 1) the normal loads of dead-weight, pressure and thermal, 2) mechanical transients of OBE, SSE, and pipe ruptures, including the effects of asymmetric pressurization, and 3) pressure and temperature transients outlined in Section 3.9.1.1.

The results of the reactor coolant loop analysis are used to determine the loads acting on the equipment nozzles and the support/component interface locations. These loads are supplied for all loading conditions on an "umbrella" load basis. That is, on the basis of previous plant analyses, a set of loads are determined which should be larger than those seen in any single plant analysis. The umbrella loads represent a conservative means of allowing detailed component analysis prior to the completion of the system analysis. Upon completion of the system analysis, conformance is demonstrated between the actual plant loads and the loads used in the analyses of the components. Any deviations where the actual load is larger than the umbrella load will be handled by individualized analysis.

Seismic analyses are performed individually for the reactor coolant pump, the pressurizer, and the steam generator. Detailed and complex dynamic models are used for the dynamic analyses. The response spectra corresponding to the building elevation at the highest component/building attachment elevation is used for the component analysis. Seismic analyses for the steam generator and pressurizer are performed using 2 percent damping for the OBE and 4 percent damping for the SSE. The analysis of the reactor coolant pump for determination of loads on the motor, main flange, and pump internals is performed using the damping for bolted steel structures, that is, 2 percent for the OBE and 5 percent for the SSE (0.5 percent for OBE and 1.0 percent for SSE is used in the system analysis). This damping is applicable to the reactor coolant pump since the main flange, motor stand, and motor are all bolted assemblies (See Section 5.4). The reactor pressure vessel is (seismically) qualified by ~~static stress analysis based on loads that have been derived from dynamic analysis.~~ the reactor vessel vendor in accordance with the ASME Code.

The pressure boundary portions of Class 1 valves in the RCS are designed and analyzed according to the requirements of NB-3500 of ASME III.

Valves in sample lines connected to the RCS are not considered to be ANS Safety Class 1 nor ASME Class 1. This is because the nozzles where the line connect to the primary system piping are orificed to a 3/8 inch hole. This hole restricts the flow such that loss through a severence of one of these lines can be made up by normal charging flow.

[The loadings used in this analyses are supplied by Westinghouse and are based on loads generated by a dynamic systems analysis.]

Item 71 - 3.9.1.4.4, page 3.9-19

In the third paragraph, the applicant states that the "Seismic analyses for the steam generator and pressurizer are performed using 2 percent damping for the OBE and 4 percent damping for the SSE." Justify the use of 4% critical damping for the SSE.

Response:

Westinghouse utilizes 4% damping in the analysis of primary components for the SSE. Justification for the 4% damping is provides in WCAP 7921AR which has been approved by the NRC. As identified in Item 67, revisions have been made to the FSAR to incorporate this topical report as Reference 14. Additionally, reference has been made in Section 3.9.1.4.4 to WCAP 7921AR.

Based upon the above discussion, Item 67, and the attached FSAR change, this item is resolved.

ATTACHMENT TO ITEM 71

CNS

3.9.1.4.4 Analysis of Primary Components

Equipment which serves as part of the pressure boundary in the reactor coolant loop include the steam generators, the reactor coolant pumps, the pressurizer, and the reactor vessel. This equipment is ANS Safety Class 1 and the pressure boundary meets the requirements of the ASME Boiler and Pressure Vessel Code, Section III, Subsection NB. This equipment is evaluated for the loading combinations outlined in Table 3.9.1-2. The equipment is analyzed for 1) the normal loads of dead-weight, pressure and thermal, 2) mechanical transients of OBE, SSE, and pipe ruptures, including the effects of asymmetric pressurization, and 3) pressure and temperature transients outlined in Section 3.9.1.1.

The results of the reactor coolant loop analysis are used to determine the loads acting on the equipment nozzles and the support/component interface locations. These loads are supplied for all loading conditions on an "umbrella" load basis. That is, on the basis of previous plant analyses, a set of loads are determined which should be larger than those seen in any single plant analysis. The umbrella loads represent a conservative means of allowing detailed component analysis prior to the completion of the system analysis. Upon completion of the system analysis, conformance is demonstrated between the actual plant loads and the loads used in the analyses of the components. Any deviations where the actual load is larger than the umbrella load will be handled by individualized analysis.

(REFERENCE 14) Seismic analyses are performed individually for the reactor coolant pump, the pressurizer, and the steam generator. Detailed and complex dynamic models are used for the dynamic analyses. The response spectra corresponding to the building elevation at the highest component/building attachment elevation is used for the component analysis. Seismic analyses for the steam generator and pressurizer are performed using 2 percent damping for the OBE and 4 percent damping for the SSE. The analysis of the reactor coolant pump for determination of loads on the motor, main flange, and pump internals is performed using the damping for bolted steel structures, that is, 2 percent for the OBE and 5 percent for the SSE (0.5 percent for OBE and 1.0 percent for SSE is used in the system analysis). This damping is applicable to the reactor coolant pump since the main flange, motor stand, and motor are all bolted assemblies (See Section 5.4). The reactor pressure vessel is qualified by static stress analysis based on loads that have been derived from dynamic analysis.

The pressure boundary portions of Class 1 valves in the RCS are designed and analyzed according to the requirements of NB-3500 of ASME III.

Valves in sample lines connected to the RCS are not considered to be ANS Safety Class 1 nor ASME Class 1. This is because the nozzles where the line connect to the primary system piping are orificed to a 3/8 inch hole. This hole restricts the flow such that loss through a severence of one of these lines can be made up by normal charging flow.

Item 72 - 3.9.1.4.5, page 3.9-20

The applicant states "Pipe displacement restraints installed in the primary shield wall limit the break opening area of the vessel nozzle pipe breaks. An upper bound break area of 85 square inches was determined, taking into account the primary shield wall pipe restraints and vessel and pipe relative motions from similar plant analyses. Detailed studies have shown that pipe breaks at the hot or cold leg reactor vessel nozzles, even with a limited break area, would give the highest reactor vessel support loads and the highest vessel displacements, primarily due to the influence of reactor cavity pressurization."

Provide supporting evidence for an upper bound break area of 85 square inches. Were the detailed studies which showed that pipe breaks at reactor vessel nozzles give highest vessel support loads and displacement performed for the Catawba plant? If performed for a similar plant, show that they are indeed similar to Catawba.

Response:

As discussed in Item 12 and 14, analyses were performed to demonstrate that the break opening area of 85 square inches is conservative. Westinghouse has performed specific plant analyses for plants such as SNUPPS (Callaway, Wolf Creek) as well as generic analyses which demonstrate that breaks at the RV nozzles result in the highest loads and displacements on the vessel supports. Although no such comparative analysis was performed for Catawba, previous analysis results apply because of the similarities in Westinghouse plant designs. The major similarity is the configuration of the reactor cavity annulus which is the governing factor in determining RV support loads and displacements.

Based on the above discussion and the information provided for Item 12, this item was resolved.

Item 73 - 3.9.1.4.6, page 3.9-23

The first paragraph of item 1 identifies stress limit criteria which are not in compliance with Appendix F of the ASME Code. Provide a commitment to the stress limit criteria of Appendix F of the ASME Code.

Response:

Westinghouse indicated that this method was only used for the reactor coolant pump feet. A generic analysis was used to qualify the pump feet, however, the specific stresses were not available. Westinghouse indicated that the analysis did demonstrate compliance with the 90% ultimate stress as specified in the FSAR. It was agreed that the subject paragraph in the FSAR would satisfy Appendix F requirements if the 90% criteria were deleted. Westinghouse indicated that they would review the analysis further to determine if Appendix F criteria could be satisfied. Based on this review, it has been determined that Appendix F criteria have been satisfied for the reactor coolant pump feet. As a result of this review, the 90% criteria has been deleted from the FSAR.

Based on the above information and the attached FSAR revision, this item is resolved.

ATTACHMENT TO ITEM 73

even though the time history results show that these loads occur neither simultaneously nor on the same support.

The largest vertical loads are produced on the support, opposite the broken nozzle. The largest horizontal loads are produced on the supports which are perpendicular to the broken nozzle horizontal centerline. Note that the peak loads are conservative values since the break opening area for the vessel inlet nozzle break (as obtained from the dynamic loop analysis) is acutally less than the estimated 85 square inch area used to generate the applied loads. If additional analysis was performed using the lower break opening area, the loads would be considerably reduced.

3.9.1.4.6 Stress Criteria for Class 1 Components and Component Supports

All Class 1 components and supports are designed and analyzed for the design, normal, and upset conditions to the rules and requirements of the ASME Code Section III. The design analysis or test methods and associated stress or load allowable limits that will be used in evaluation of faulted conditions are those that are defined in Appendix F of the ASME Code with supplementary options outlined below:

1. Elastic System Analysis and Component Inelastic analysis

   This is an acceptable method of evaluation for Faulted Conditions if primary stress limits for components are taken as greater of 0.70 S_u or $S_y + 1/3 (S_u - S_y)$ for membrane stress and greater of 0.70 S_{ut} or $S_y + 1/3 (S_{ut} - S_y)$ for membrane plus-bending stress, where material properties are taken at appropriate temperature. ~~and the maximum stress is limited to $\pm$ 90% of the material stress.~~

   If plastic component analysis is used with elastic system analysis or with plastic system analysis, the deformations and displacements of the individual system members will be shown to be no larger than those which can be properly calculated by the analytical methods used for the system analysis.

2. Elastic/Inelastic System Analysis and Component/Test Load Method

   The test load method given in F-1370(d) is an acceptable method of qualifying components in lieu of satisfying the stress/load limits established for the component analysis.

   If the component/test load method is used with elastic or plastic system analysis, the deformations and displacements of the individual component members taken from the test load method data at the loads resulting from the system analysis will be shown to be no larger than those which can be properly calculated by the analytical methods used for the system analysis.

   A list of seismic Category I equipment and the method of qualification used is provided in Table 3.2.1-1, 3.2.1-2, 3.2.2-2, and 3.2.3.-1.

Item 74 - 3.9.1.4.6, page 3.9-23

The applicant states "If plastic component analysis is used with elastic system analysis or with plastic system analysis, the deformations and displacements of the individual system members will be shown to be no larger than those which can be properly calculated by the analytical methods used for the system analysis." Indicate when this has been used.

Response:

The test load method is used by Westinghosue for the reactor vessel pads. This item has been discussed in other meetings and has been justified based on one-eighth scale model tests.

Based on the above discussions, this item was resolved.

Item 75 - 3.9.1.4.7, page 3.9-24

The first paragraph indicates that elastically determined stresses will be compared against inelastic limits. This approach is not one of the methods listed in Appendix F of the ASME Code. Provide an example of the analyses and provide assurance that this method is at least as conservative as those in Appendix F.

Editorial Comment

The applicant states "Dynamic Seismic analysis for the SSE is performed on this piping utilizing the "response spectrum method in accordance with USNRC Regulatory Guide 1.92." Is this a correct reference?

Response:

Page 3.9-24 will be revised (as attached).

Attachment item 75

CNS

Loading combinations and allowable stresses for ASME III Class 1 components and supports are given in Tables 3.9.1-2 and 3.9.1-3. For Faulted condition evaluations, the effects of the safe shutdown earthquake (SSE) and loss-of-coolant accident (LOCA) are combined using the square root of the sum of the squares (SRSS) method. Justification for this method of load combination is contained in References 4 and 5. The responses to other loading combinations defined in Table 3.9.1-2 are combined using the absolute sum method.

3.9.1.4.7 Balance-of-Plant Components, Piping and Supports

Seismic category I piping other than NSSS is analyzed for the faulted condition utilizing elastically-determined stresses compared against ~~inelastic limits.~~ allowables provided in Table F-1322.2-1 of Appendix F of the ASME Code Section III. This is in accordance with applicable sections of the ASME Code or ANSI B31.1 as appropriate. Load combinations and allowable stresses for faulted and other plant conditions are discussed in Section 3.9.3.

Dynamic seismic analysis for the SSE is performed on this piping utilizing the ~~response spectrum~~ model combination method in accordance with USNRC Regulatory Guide 1.92.

All seismic Category 1 supports are designed and analyzed for the Normal, Upset, Faulted and Test Conditions. The stress limits for normal and upset conditions are as presented in ASME III Subsection NF and Subsection NA Appendix XVII for the portion of the support within the NF boundary. The stress limit for the faulted load combination is as specified in Subsection NF with the exception that to avoid column buckling in compression, for members subject to local instability associated with compression flange buckling in flexural members and web buckling in plate guides, the allowable stress has been limited to 2/3 of the critical buckling stress. For support design there is no inelastic analysis. Temperature effects for material properties are considered. For the portion of the support not within the NF boundary and for supports for B31.1 piping, stress limits are as provided in MSC-SP58 or the AISC Manual.

For integral attachments to the pressure boundary the rules of ASME Section III, Subsection NB, NC, ND are used as applicable.

3.9.2 DYNAMIC TESTING AND ANALYSIS

3.9.2.1 <u>System Operational Test Program</u>

3.9.2.1.1 System Vibration Testing

ASME III requires that piping design minimize vibration and that piping systems be observed under startup or initial operating conditions to insure that steady state vibration in piping systems is not excessive. As part of the preoperational test program described in Chapter 14, steady state piping vibration and transient response of piping due to valve closures, pump starts, and other changing configurations are observed. Details of the tests are given in Table 14.2.12-1.

Duke Class A, B, C, and F systems satisfy the criteria of Regulatory Guide 1.68, Revision 2 for systems to be included in the vibration test program. Systems

Item 76 - 3.9.1.4.7, page 3.9-24

Provide your interpretation of jurisdictional boundaries as they pertain to NF supports. Justify your position.

Response:

Subsection NF of the ASME Boiler and Pressure Vessel Code defines requirements for structural elements for both component supports and piping supports. In reviewing application of this subsection to structural elements of pipe supports Duke Power Company has defined jurisdictional boundaries to be within the scope of subsection NF when the ASME code provisions are clearly applicable and result in rational structural requirements for design and construction. Many aspects of structural steel design have a long and established history of adequate and reasonable application by structural engineers. For this reason, Duke Power Company uses applicable codes and standards other than ASME standards for the majority of structrual steel design associated with pipe supports. Boundaries between items designed and fabricated to Subsection NF and those designed and fabricated to codes and standards applicable to building structural items are clearly designated on all drawings released for construction. Guidelines for defining these standard boundaries are provided in Duke specification CNS-1206.00-04-0001 Design Specification For Nuclear Safety Related Component Supports (QA Condition 1). A copy of this document has been previously provided to NRC representatives.

As justification for our position we have been asked by the staff to show approximate equivalence across jurisdictional boundaries for several specific items.

1. Presence of clearly defined structural requirements on both sides of the jurisdictional boundary.

   The Design Specification clearly defines design criteria to be followed on both sides of the NF boundary. For both normal and upset conditions, structural steel is designed to normal allowable limits per AISC requirements, regardless of boundary. For the faulted condition, additional conservatism over and above that required by Appendix F is provided by limiting steel stress to 1.33 x AISC allowables within the NF boundary and to 1.5 x AISC allowables outside the NF boundary. This is consistent with allowable values used for building structural steel. Limiting stresses under faulted conditions to the elastic stress range as provided by these measures provides that the structure performs as predicted by elastic analysis procedures that are well documented and provides a degree of conservatism due to additional capacity in the inelastic range of materials which is not utilized.

2. Consideration of the relevance of buckling as a factor in support design.

   For normal and upset conditions, use of AISC allowable stresses results in appropriate safety factors against buckling for these conditions.

   Use of the 1.5 factor on AISC allowable stresses for the faulted condition subsequently reduces the safety factor against buckling but maintains adequate margins for this condition. In the region of "short column" buckling (for fy=36, $\frac{kl}{r} \leq 126$)formulas presented by AISC and use of the 1.5 factor allows values of allowable stress to approach 0.9 x yield strength. Critical buckling as presented by the Euler approach is not the predominant failure mode in this region. For KL/r values above the critical buckling coefficient, AISC limits stresses to 12/23 x critical buckling stress. Use of the 1.5 for faulted loading increases this limit to 18/23 x critical buckling stress. This value is slightly higher than the 2/3 value proposed by the staff.

In actuality, buckling strength is seldom the controling factor in structural steel for pipe support design. Bending and shear forces are the predominant limiting stress considerations. Coupling these limits with deflection limitations imposed on the supports, required to make the supports relatively stiff compared to the piping for stress analysis validation, removes most consideration of buckling from the analytical approach to pipe support design. Predomanance of tube steel in support design, primarily due to superior properties for torsional resistance, provides relatively low L/r ratios for design, further obviating the need for a stringent review of buckling as a critical factor. However, changing the design specification to account for a 2/3 factor on buckling rather than 18/23 would require individual review of each of more than 20,000 calculations already completed for Nuclear Safety Related pipe supports at the Catawba Station. In short, we feel the slight difference in buckling limits has little, if any, relevance in support design and the methods and allowable stresses used for Catawba present a safe and adequate situation.

3. Use of initial overdesign as an added conservatism.

Beginning in December 1979, new support designs initiated for Catawba Nuclear Station were conservatively designed by incorporation of an additional 25% of piping loads supplied into design loads for the support. Rational for this conservatism included reduction of changes due to revised loadings by reanalysis and increased margin available when field conditions would not allow all elements of the design drawing to be fabricated per drawing requirements. Although such changes have resulted in encrouchment into the margin in many cases, for an even greater number of cases, the margin is now increased as piping loads have decreased. Coupled with the fact that the full capacity of a member is seldom used when structural engineers provide a design which is limited only by a maximum criteria, pipe support designs for the Catawba Station are certainly conservative and provide high confidence that adequate structures for pipe supports are produced.

4. Materials control and mill test certification reports.

Materials purchased for Catawba Nuclear Station are classified on site as either safety related or non-safety related. Materials used within the NF jurisdictional boundary which are not "bulk stock" items, such as component standard supports are purchased from an authorized supplier per Subsection NA-3700 and NCA-3800. Certified mill test reports in accordance with NF-2130(a) are obtained showing compliance with Section III Subsection NF requirements for Class I materials. Traceability of component standard supports are maintained for Class A supports. Bulk stock items, such as miscellaneous steel are received on site with certified mill test reports. Tube steel inside the NF boundary is purchased to requirements of Code Case N-71-8.

Design drawings define materials specifications inside the NF jurisdictional boundary as SA/A showing that the appropriate ASTM specification and ASME specification are equivalent. Tube steel furnished per Design drawings reference Code Case N-71-8. Material furnished on Design drawings outside the NF boundary reference the appropriate ASTM specification. Both material inside and outside the NF boundary for structural items other than component standard supports are furnished from Nuclear Safety Related field bulk stock and are equivalent as certified mill test reports are furnished as previously mentioned. Receipt of CMTR's are part of initial receiving inspection procedures.

5. Weld inspection and NDE requirements.

   Weld inspection inside the NF boundary is performed per Duke Power Company QA requirements for ASME Code work and meets requirements of Subsection NF, Article NF-5000. An Authorized Nuclear Inspector, independent of Duke Power Company, reviews each support package prior to fabrication. The ANI has c[illegible]ity to add inspection hold points and additional NDE requiremen[illegible]propriate.

   All welders utilized for supports on ASME Code piping are qualified for both requirements of AWS D1.1 and ASME Section IX.

   Predominant weld types on welds within and outside the NF boundary are fillet and partial penetration welds. Visual inspection is performed by qualified QC inspectors for all welds with other NDE requirements specified where appropriate.

6. Duke Power Company control of design and construction and resultant "reasonableness" of job.

   Duke Power Company designs, fabricates and erects the supports for Catawba Nuclear Station. This provides unique advantages in the enforcement of requirements both within the NF jurisdictional boundary and outside that boundary. The intent of specification requirements is maintained throughout the design and construction process through direct communication between designer, fabricator and erector. This close interface is not always possible when design, fabrication and erection are contracted to different companies.

Item 79 3.9.2.3, page 3.9-32

The first full paragraph mentions three plants which provide prototypical data. Which of the three plants --Indian Point 2, Trojan or Sequoyah 1-- is the valid prototype for Catawba?

Response:

The prototype plant for Catawba is Indian Point Unit 2. The IPP-2 plant was fully instrumented and tested during hot functional and pre-operational testing. Additionally, available test data on the Trojan 1 and Sequoyah 1 plants together with the prototype IPP-2 results can be used to characterize vibrational characteristics of 4-loop internals. The significiant differences between Catawba and IPP-2 internals are the replacement of the annular thermal shield with neutron panels, modifications resulting from the use of 17x17 fuel and the change to UHI-style inverted top hat upper internals.

Upper Internals

The upper internals of Catawba and that of the tested Sequoyah 1 unit are similar with the UHI-style inverted top hat configuration. The upper internals adequacy of Sequoyah 1 has been established by the plant tests and supplemented with the scale model tests of similar configurations. The results of testing at Sequoyah 1 show that components are excited by flow-induced and pump related excitations. Analyses of the data indicate that the instrumented components have adequate factors of safety and that the vibration behavior is well characterized. A specific comparison of the Sequoyah upper head characteristics with the Catawba plant is provided in the response to Item 80. This information demonstrates that appropriate safety margins exist for the upper internals. In summary, structural adequacy and vibratory behavior of the Catawba upper internals configuration has been establisehd by testing at the Sequoyah 1 plant.

Neutron Panels (Core Barrel)

Scale model tests indicate significantly lower vibrational levels for internals with neutron panels than for internals with annular thermal shields. Test results from Trojan 1 (neutron panels similar to Catawba) show lower vibration levels than on IPP-2. The primary source of excitation of the core barrel is flow turbulence generated at the inlet nozzles and in the downcomer. Since both Catawba and Trojan 1 have neutron panels, the vibration levels are similar. The coolant inlet temperature and flow rate of Catawba are slightly higher than Trojan 1. Scale model tests show that the core barrel vibration levels vary as the velocity raised to a small power. The differences in fluid density and flow rate result in an approximately 5.8% higher core barrel vibrations for Catawba when compared with Trojan 1. This correlation and the fact that the scale model tests and plant tests show that vibration levels are lower with neutron panels than annular thermal shields leads to the conclusion that stresses less than or approximately equal to IPP-2 will result on the Catawba internals.

17x17 Fuel

Fuel assembly masses and stiffnesses remain relatively unchanged, and so no significant change in internals vibration is expected.

With the inclusion of data relative to the Sequoyah/Catawba upper internals comparison in Item 80 and the minor revision to FSAR Section 3.9.2.3.3 (attached to Item 80), this item is resolved.

Item 80 3.9.2.3, page 3.9-33

Item 3 discusses vibration of the upper internals. The second to the last sentence says that "Applying a 5% increase in level to the high factors of safety deduced from Sequoyah 1 data results in adequate margins for Catawba upper internals." What are the margins for the upper internals?

Response:

Portions of Section 3.9.2.2.2 will be changed to read:

> ". . . The vibration of the upper internals due to flow turbulence is approximately proportional to the product of density, and velocity, V, squared (reference 8). This product is approximately 5% higher in Catawba then Sequoyah 1. By applying the 5% increase in the quantity ρV^2 (i.e., density times velocity squared) to the high factors of safety deduced from the Sequoyah 1 data, the minimum factor of safety for the Catawba upper internals is 1.80 (reference 14). The changes in the fluid . . . frequencies."

It was pointed out that the 1.8 safety factor refers to margin relative to the endurance limit. It was also noted that Reference 14 will be added to the FSAR.

Based on the above discussion and the attached FSAR change, this item was resolved.

ITEM 80

* By applying the 5% increase in the quantity ρV^2 (i.e., density times velocity squared) to high factors of safety deduced from the Sequoyah 1 data, the minimum factor of safety for the Catawba upper internals is 1.8 (Reference 14).

CNS

3. UHI Inverted Top Hat Upper Support Configuration

   The components of the upper internals are excited by turbulent forces due to axial and cross flows in the upper plenum (Reference 8) and pump speed related components. Sequoyah and Catawba have the same upper internals configuration; therefore, the general vibration behavior is not changed. Data on upper internals vibration have been obtained during hot functional testing at Sequoyah 1. A preliminary report on analysis of the data has been submitted. A final report including measurements with the core in place is in preparation. Reduction of the data and the post hot functional inspection results provide assurance of the design adequacy. The increased flow rate of Catawba with respect to Sequoyah is reflected in upper internals vibrations primarily as a change in fluid velocity. The vibration of the upper internals due to flow turbulence is approximately proportional to the product of density and velocity squared (Reference 8). This product is approximately 5% higher in Catawba than Sequoyah 1. * ~~Applying a 5% increase in level to the high factors of safety deduced from Sequoyah 1 data results in adequate margins for Catawba upper internals~~. The change in fluid density and elastic modulus due to outlet temperature differences results in a very small change in structural natural frequencies.

   Further data have been obtained during initial startup testing of Sequoyah 1. These data indicate lower vibration levels (and consequently higher factors of safety) than those deduced from hot functional data.

The original test and analysis of the four-loop configuration is augmented by (References 6, 7, and 8) to cover the effects of successive hardware modifications.

3.9.2.4 Preoperational Flow-Induced Vibration Testing of Reactor Internals

Because the Catawba reactor internals design configuration is well characterized, as was discussed in Section 3.9.2.3, it is not considered necessary to conduct instrumented tests of the Catawba plant hardware. The recommendations of Regulatory Guide 1.20 are satisfied by conducting the confirmatory pre- and post-hot functional examination for integrity. This examination will include in excess of 30 features (illustrated in Figure 3.9.2-1) with special emphasis on the following areas:

1. All major load-bearing elements of the reactor internals relied upon to retain the core structure in place.

2. The lateral, vertical and torsional restraints provided within the vessel.

3. Those locking and bolting devices whose failure could adversely affect the structural integrity of the internals.

4. Those other locations on the reactor internal components which are similar to those which are examined on the prototype designs.

5. The inside of the vessel will be inspected before and after the hot functional test, with all the internals removed, to verify that no loose

Item 81 3.9.2.4, page 3.9-33

Provide Figure 3.9.2-1.

Response:

Figure 3.9.2-1 is already provided.

Item 82 3.9.2.5, page 3.9-35

The first full paragraph states that "For faulted conditions, stresses are above yield in a few locations. For these cases only, some inelastic stress limits are applied." Define the inelastic stress limits and indicate where these limits have been applied.

Response:

As discussed in Item 7, the reactor internals were procured prior to implementation of sub-section NG of the ASME Code. However, the reactor internals for the Catawba plant satisfy ASME Code design and fabrication requirements. Additionally, faulted condition stresses satisfy the limits defined in Appendix F of the ASME Code and are combined in accordance with NUREG-0484. Seciton 3.9.2.5 of the FSAR has been revised to state that faulted condition stresses for the reactor internals satisfy limits defined in Appendix F of the ASME Code. Based on the above discussions and the attached FSAR changes, this item was resolved.

3.9.2.5 <u>Dynamic System Analysis of the Reactor Internals Under Faulted Conditions</u>

1. Loss of coolant accident (LOCA). Both cold leg and hot leg breaks are considered.

2. Safe shutdown earthquake (SSE).

Maximum stresses for SSE and LOCA are obtained and combined.

Maximum stress intensities are compared to allowable stresses for each of the above conditions. Elastic analysis is used to obtain the response of the structure and the stress analysis on each component is performed according to ASME Code approved techniques. For faulted conditions, stresses are ~~above [illegible]~~.

Compared to meet the Code allowable design limits provided in Table F-1322.2-1 of Appendix F of the ASME Code.

Item 83 3.9.2.5

Previous analysis for other nuclear plants have shown that certain reactor system components and their supports may be subjected to previously under-estimated asymmetric loads under the conditions that result from the postulation of ruptures of the reactor coolant piping at various locations.

The applicant has described the design of the reactor internals for blowdown loads only. The applicant should also provide information on asymmetric loads. It is, therefore, necessary to reassess the capability of these reactor system components to assure that the calculated dynamic asymmetric loads resulting from these postulated pipe ruptures will be within the bounds necessary to provide high assurance that the reactor can be brought safely to a cold shutdown condition. The reactor system components that require reassessment shall include:

a. Reactor pressure vessel.

b. Core supports and other reactor internals.

c. Control rod drives.

d. ECCS piping that is attached to the primary coolant piping.

e. Primary coolant piping.

f. Reactor vessel supports.

The following information should be included in the FSAR about the effects of postulated asymmetric LOCA loads on the above mentioned reactor system components and the variuos cavity structures.

1. Provide arrangement drawings of the reactor vessel support systems in sufficient detail to show the geometry of all principal elements and materials of construction.

2. If a plant-specific analysis will not be submitted for your plant, provide supporting information to demonstrate that the generic plant analysis under consideration adequately bounds the postulated accidents at your facility. Include a comparison of the geometric, structural, mechanical, and thermal-hydraulic similarities between your facility and the case analyzed. Discuss the effects of any differences.

3. Consider all postulated breaks in the reactor coolant piping system, including the following locations:
   a. Steam line nozzles to piping terminal ends.
   b. Feedwater nozzle to piping termal ends.
   c. Recirculation inlet and outlet nozzles to recirculation piping terminal ends.

4. Provide an assessment of the effects of asymmetric pressure differentials* on the systems and components listed above in combination with all external

* Blowdown jet forces at the location of the rupture (reaction forces), transient differential pressures in the annular region between the component and the wall, and transient differential pressures across the core barrel within the reactor vessel.

loadings including safe shutdown earthquake loads and other faulted condition loads for the postulated breaks described above. This assessment may utilize the following mechanistic effects as applicable:

a. Limited displacement break areas.

b. Fluid-structure interaction.

c. Actual time-dependent forcing function.

d. Reactor support stiffness.

e. Break opening times.

5. If the results of the assessment on Item 3 above indicate loads leading to inelastic actions of these systems or displacement exceeding previous design limits, provide an evaluation of the inelastic behavior (including strain hardening) of the material used in the system design and the effect of the load transmitted to the backup structures to which these systems are attached.

6. For all analyses performed, include the method of analysis, the structural and hydraulic computer codes employed, drawings of the models employed and comparisons of the calculated to allowable stresses and strains or deflections with a basis for the allowable values.

7. Demonstrate that safety-related components will retain their structural integrity when subjected to the combined loads resulting from the loss-of-coolant accident and the safe shutdown earthquake.

8. Demonstrate the functional capability of any essential piping when subjected to the combined loads resulting from the loss-of-coolant accident and the safe shutdown earthquake.

Response: (Item 83, reference Item 115)

These questions are in reference to asymmetric LOCA loads. Westinghouse, in its analyses of reactor system components and their supports, has considered asymmetric LOCA loadings. Description of the asymmetric LOCA loads is given in detail in Catawba FSAR Sections 3.9.1.4.3; 3.9.1.4.4; 3.9.1.4.5; 3.9.1.4.5.1; 3.9.1.4.5.2; 3.9.1.4.5.3; 3.9.1.4.5.4; 3.9.1.4.6; 3.9.1.4.7; 3.9.2.5; and updated sections 3.9.1.2.3; 3.9.1.4.2; 3.9.4.2; 3.9.4.3.4; 3.9.4.4.

It should also be recognized that this item was discussed on other plant dockets and that since asymmetric LOCA loadings were identified during the North Anna licensing review Westinghouse has routinely considered such loads in the design basis.

Additionally, it should be pointed out that the methods used by Westinghouse are consistent with NUREG-0609.

In performing the asymmetric LOCA load evaluation design interface information was routinely exchanged between Westinghouse and Duke. For example, Duke provided Westinghouse with cavity pressure loads which are incorporated in the Westinghouse analysis. Additionally, since Duke is responsible for the design of primary component supports information was provided across this design interface relative to support stiffnesses, gaps, and actual calculated loads. This design interface assumed that all elements of the plant design were incorporated in the asymmetric LOCA load evalution.

Based upon the above discussions and the attached FSAR changes, this item was resolved.

N34, N56

ATTACHMENT TO ITEM 83

4. STHRUST - hydraulic loads on loop components from blowdown information.

5. WECAN - finite element structural analysis.

6. DARI - WOSTAS - dynamic transient response analysis of reactor vessel and internals.

7. (see N4)

3.9.1.3 Experimental Stress Analysis

No experimental stress analysis methods have been used for the Catawba project.

3.9.1.4 Considerations for the Evaluation of the Faulted Condition

3.9.1.4.1 Loading Conditions

The reactor coolant loop piping is evaluated in accordance with the criteria of ASME III, NB-3650 and Appendix F. The loads included in the evaluation result from the SSE, deadweight, pressure, and LOCA loadings (loop hydraulic forces, asymmetric subcompartment pressurization forces, and reactor vessel motion).

The structural stress analyses performed on the reactor coolant system consider the loadings specified as shown in Table 3.9.1-2. These loads result from thermal expansion, pressure, dead weight, Operating Basis Earthquake (OBE), Safe Shutdown Earthquake (SSE), design basis loss of coolant accident, and plant operational thermal and pressure transients.

3.9.1.4.2 Analysis of the Reactor Coolant Loop

The loads used in the analysis of the reactor coolant loop piping are described in detail below.

Pressure

Pressure loading is identified as either membrane design pressure or general operating pressure, depending upon its application. The membrane design pressure is used in connection with the longitudinal pressure stress and minimum wall thickness calculations in accordance with the ASME Code.

The term operating pressure is used in connection with determination of the system deflections and support forces. The steady-state operating hydraulic forces based on the system initial pressure are applied as general operating pressure loads to the reactor coolant loop model at change in direction or flow area.

Dead Weight

A dead weight analysis is performed to meet Code requirements by applying a 1.0 g load downward on the complete piping system. The piping is assigned a distributed mass or weight as a function of its properties. This method provides a distributed loading to the piping system as a function of the weight of the pipe and contained fluid during normal operating conditions.

ATTACHMENT TO ITEM 83

CNS

Latch Assembly - Thermal Clearances

The magnetic jack has several clearances where parts made of Type 410 stainless steel fit over parts made from Type 304 stainless steel. Differential thermal expansion is therefore important. Minimum clearances of these parts at 68°F is 0.011 inches. At the maximum design temperature of 650°F minimum clearance is 0.0045 inches and at the maximum expected operating temperatures of 550°F is 0.0057 inches.

Latch Arm - Drive Rod Clearances

The control rod drive mechanism incorporates a load transfer action. The movable or stationary gripper latch are not under load during engagement, as previously explained, due to load transfer action.

Figure 3.9.4-3 shows latch clearance variation with the drive rod as a result of minimum and maximum temperatures. Figure 3.9.4-4 shows clearance variations over the design temperature range.

Coil Stack Assembly - Thermal Clearances

The assembly clearances of the coil stack assembly over the latch housing was selected so that the assembly could be removed under all anticipated conditions of thermal expansion.

At 70°F the inside diameter of the coil stack is 7.308/7.298 inches. The outside diameter of the latch housing is 7.260/7.270 inches.

Thermal expansion of the mechanism due to operating temperature of the control rod drive mechanism result in minimum inside diameter of the coil stack being 7.310 inches at 222°F and the maximum latch housing diameter being [illegible] inches at 532°F.

Under the extreme tolerance conditions listed above it is necessary to allow time for a 70°F coil housing to heat during a replacement operation.

Four coil stack assemblies were removed from four hot control rod drive mechanisms mounted on 11.035 inch centers on a 550° test loop, allowed to cool, and then placed without incident as a test to prove the preceding.

Coil Fit in Core Housing

Control rod drive mechanism and coil housing clearances are selected so that coil heat up results in a close to tight fit. This is done to facilitate thermal transfer and coil cooling in a hot control rod drive mechanism.

INSERT A →

3.9.4.4 CRDS Performance Assurance Program

Evaluation of Material's Adequacy

The ability of the pressure housing components to perform throughout the design lifetime as defined in the equipment specification is confirmed by the stress analysis report required by the ASME Boiler and Pressure Vessel Code, Section III.

ATTACHMENT TO ITEM 83

INSERT A

3.9.4.3.4 Evaluation of Control Rod Drive Mechanisms and Supports

The control rod drive mechanisms (CRDMs) and CRDM support structures are evaluated for the loading combinations outlined in Table 3.9(N)-2.

A detailed finite element model of the CRDMs and CRDM supports is constructed using the WECAN computer program with beam, pipe, and spring elements. For the LOCA analysis, nonlinearities in the structure are represented. These include RPI plate impact, tie rods, and lifting leg clevis/RPV head interface. The time history motion of the reactor vessel head, obtained from the RPV analysis described in 3.9(N).1.4.6, is input to the dynamic model. Maximum forces and moments in the CRDMs and support structure are then determined. For the seismic analysis, the structural model is linearized and the floor response spectra corresponding to the CRDM tie rod elevation is applied to determine the maximum forces and moments in the strucutre.

The bending moments calculated for the CRDMs for the various loading conditions are compared with maximum allowable moments determined from a detailed finite element stress evaluation of the CRDMs. Adequacy of the CRDM support structure is verified by comparing the calculated stresses to the criteria given in ASME III, Subsection NF.

The highest loads occur at the head adaptor, the location where the mechanisms penetrate the vessel head. The bending moments at this location are presented in Table 3.9N-20 for the longest and shortest CRDM.

ATTACHMENT TO ITEM 83

CNS

Internal components subjected to wear will withstand a minimum of 3,000,000 steps without refurbishment as confirmed by life tests (Reference 11). Latch assembly inspection is recommended after 2.5 E6 steps have been accumulated on a single control rod drive mechanism.

To confirm the mechanical adequacy of the fuel assembly, the control rod drive mechanism, and rod cluster control assembly, functional test programs have been conducted on a full scale 12 foot control rod. The 12 foot prototype assembly was tested under simulated conditions of reactor temperature, pressure, and flow for approximately 1000 hours. The prototype mechanism accumulated about 3,000,000 steps and 600 trips. At the end of the test the control rod drive mechanism was still operating satisfactorily. A correlation was developed to predict the amplitude of flow excited vibration of individual fuel rods and fuel assemblies. Inspection of the drive line components did not reveal significant fretting.

These test include verification that the trip time achieved by the full length control rod drive mechanisms meet the design requirement of 2.2 seconds from start of rod cluster control assembly motion to dashpot entry. This trip time requirement will be confirmed for each control rod drive mechanism prior to initial reactor operation and at periodic intervals after initial reactor operation as required by the proposed Technical Specifications.

There are no significant differences between the prototype control rod drive mechanisms and the production units. Design materials, critical tolerances and fabrication techniques (Section 4.2.3.3.2) are the same.

INSERT → The dynamic behavior of the reactivity control components has been studied using experimental test data and experience from operating reactors.

These tests have been reported in Reference 11.

It is expected that all control rod drive mechanisms will meet specified operating requirements for the duration of plant life with normal refurbishment. However, a technical specification pertaining to an inoperable rod cluster control assembly has been set. Latch assembly inspection is recommended after 2.5 E6 steps have been accumulated on a single control rod drive mechanism.

If a rod cluster control assembly cannot be moved by its mechanism, adjustments in the boron concentration ensure that adequate shutdown margin would be achieved following a trip. Thus, inability to move one rod cluster control assembly can be tolerated. More than one inoperable rod cluster control assembly could be tolerated, but would impose additional demands on the plant operator. Therefore, the number of inoperable rod cluster control assemblies has been limited to one as discussed in the Technical Specifications.

In order to demonstrate proper operation of the Control Rod Drive Mechanism and to ensure acceptable core power distributions during rod cluster control assembly partial-movement checks are performed on the rod cluster control assemblies. (Refer to Technical Specifications.) In addition, periodic tests of the rod cluster control assemblies are performed at each refueling shutdown to demonstrate continued ability to meet trip time requirements, to ensure core subcriticality after reactor trip, and to limit potential reactivity insertions from a hypothetical rod cluster control assembly ejection. During these tests the acceptable drop time of each assembly is not greater than 2.2 seconds, at full flow and operating temperature, from the beginning of motion to dashpot entry.

ATTACHMENT TO ITEM 83

INSERT B

In addition, dynamic testing programs have been conducted by Westinghouse and Westinghouse Licensees to demonstrate that control rod scram time is not adversely affected by postulated seismic events. Acceptable scram performance is assured by also including the effects of the allowable displacements of the driveline components in the evaluation of the test results.

ATTACHMENT TO ITEM 83

CNS

Control Rod Drive Mechanisms

The control rod drive mechanisms (CRDM's) pressure housings are Class I components designed to meet the stress requirements for normal operating conditions of Section III of the ASME Boiler and Pressure Vessel Code. Both static and alternating stress intensities are considered. The stresses originating from the required design transients are included in the analysis.

INSERT E →

A dynamic seismic analysis is required on the CRDM's when a seismic disturbance has been postulated to confirm the ability of the pressure housing to meet ASME Code, Section III allowable stresses and to confirm its ability to trip when subjected to the seismic disturbance.

Full Length Control Rod Drive Mechanism Operational Requirements

The basic operational requirements for the full length CRDM's are:

1. 5/8 inch step,
2. Approximately 144 inch,
3. 360 pound maximum load,
4. Step in or out at 45 inches/minute (72 steps/minute),
5. Electrical power interruption shall initiate release of drive rod assembly,
6. Trip delay time of less than 150 milliseconds - Free fall of drive rod assembly shall begin less than 150 milliseconds after power interruption no matter what holding or stepping action is being executed with any load and coolant temperature of 100°F to 550°F,
7. 40 year design life with normal refurbishment.

3.9.4.3 Design Loads, Stress Limits, and Allowable Deformations

3.9.4.3.1 Pressure Vessel

The pressure retaining components are analyzed for loads corresponding to normal, upset, and faulted conditions. The analysis performed depends on the mode of operation under consideration.

The scope of the analysis requires many different techniques and methods, both static and dynamic.

Some of the loads that are considered on each component where applicable are as follows:

1. Control Rod Trip (equivalent static load)
2. Differential Pressure
3. Spring Preloads

ATTACHMENT TO ITEM 83

INSERT C

The control rod drive mechanisms (CRDMs) are evaluated for the effects of postulated reactor vessel inlet nozzle and outlet nozzle limited displacement breaks. A time history analysis of the CRDMs is performed for the vessel motion discussed in Section 3.9.1.4.5. A model of the CRDMs is formulated with gaps at the upper CRDM support modeled as nonlinear elements. The CRDMs are represented by beam elements with lumped masses. The translation and rotation of the vessel head is applied to this model. The resulting loads and stresses are compared to allowables to verify the adequacy of the system.

Item 84 3.9.3, page 3.9-40 and 41

The third paragraph on page 3.9-40 and the second full paragraph on 3.9-41 refers to Section 4.5.2 for design loading conditions for core support structures. This section discussed Reactor Internals Materials. Provide the appropriate reference.

Response:

The reference to Section 4.5.2 for the design loading conditions for core support structures is incorrect. The correct reference should be FSAR Section 3.9.5.2. The FSAR has been revised to incorporate the current reference. Based on the attached FSAR change, this item was resolved.

ATTACHMENT TO ITEM 84

CNS

The results obtained from linear analyses indicate that the relative displacement between the components will close the gaps and consequently the structures will impinge on each other. Linear analysis will not provide information about the impact forces generated when components impinge on each other; however, in some instances, linear approximations can, and are applied prior to and after gap closure. The effects of the gaps that could exist between vessel and barrel, between fuel assemblies, between fuel assemblies and baffle plates, and between the control rods and their guide paths were considered in the analysis using both linear approximations and non-linear techniques. Both static and dynamic stress intensities are within acceptable limits.

Even though control rod insertion is not required for plant shutdown, this analysis shows that most of the guide tubes will deform within the limits established experimentally to assure control rod insertion. For the guide tubes deflected above the no loss of function limit, it must be assumed that the rods will not drop. However, the core will still shut down due to the negative reactivity insertion in the form of core voiding. Shutdown will be aided by the great majority of rods that do drop. Seismic deflections of the guide tubes are generally negligible by comparison with the no loss of function limit.

3.9.2.6 Correlations of Reactor Internals Vibration Tests With the Analytical Results

As stated in Section 3.9.2.3, it is not considered necessary to conduct instrumented tests of the Catawba reactor vessel internals. Adequacy of these internals will be verified by use of the Sequoyah and Trojan results.

3.9.3 ASME CODE CLASS 1, 2 AND 3 COMPONENTS, COMPONENT SUPPORTS AND CORE SUPPORT STRUCTURES

The ASME Code Class components are constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section III.

Detailed discussion of ASME Code Class 1 components is provided in Sec[illegible] 3.9.1 and 5.4.

For core support structures, design loading conditions are given in Section ~~1.5.2~~ 3.9.5.2. N35

In general, for reactor internals components and for core support structures the criteria for acceptability in regard to mechanical integrity analyses are that adequate core cooling and core shutdown must be assured. This implies that the deformation of the reactor internals must be sufficiently small so that the geometry remains substantially intact. Consequently, the limitations established on the internals are concerned principally with the maximum allowable deflections and stability of the parts in addition to a stress criterion to assure integrity of the components.

For the loss of coolant plus the safe shutdown earthquake condition, deflections of critical internal structures are limited. In a hypothesized downward vertical displacement of the internals, energy absorbing devices limit the displacement after contacting the vessel bottom head, ensuring that the geometry of the core remains intact.

The following mechanical functional performance criteria apply:

1. Following the design basis accident, the functional criterion to be met for the reactor internals is that the plant shall be shutdown and cooled in an orderly fashion so that fuel cladding temperature is kept within specified limits. This criterion implies that the deformation of critical components must be kept sufficiently small to allow core cooling.

2. For large breaks, the reduction in water density greatly reduces the reactivitiy of the core, thereby shutting down the core whether the rods are tripped or not. The subsequent refilling of the core by the Emergency Core Cooling System uses borated water to maintain the core in a subcritical state. Therefore, the main requirement is to assure effectiveness of the Emergency Core Cooling System. Insertion of the control rods, although not needed, gives further assurance of ability to shut the plant down and keep it in a safe shutdown condition.

3. The inward upper barrel deflections are controlled to insure no contacting of the nearest rod cluster control guide tube. The outward upper barrel deflections are controlled in order to maintain an adequate annulus for the coolant between the vessel inner diameter and core barrel outer diameter.

4. The rod cluster control guide tube deflections are limited to insure operability of the control rods.

5. To insure no column loading of rod cluster control guide tubes, the upper core plate deflection is limited.

Methods of analysis and testing for core support structures are discussed in Sections 3.9.2.3, 3.9.2.5, and 3.9.2.6. Stress limits ~~and deformation criteria~~ are given in Sections ~~4.5.2.~~ 3.9.5.4. Deformation criteria is given in Sections 3.9.2.5 and 3.9.5.3. N35

3.9.3.1 Loading Combinations Design Transients, and Stress Limits (For ASME Code Class 2 and 3 Components)

Design pressure, temperature, and other loading conditions that provide the bases for design of fluid systems Code Class 2 and 3 components are presented in the sections which describe the systems.

3.9.3.1.1 Design Loading Combinations and Design Stress Limits for Westinghouse Equipment

The design loading combinations for ASME Code Class 2 and 3 components and supports are given in Table 3.9.3-1. The design loading combinations are categorized with respect to Normal, Upset, Emergency, and Faulted Conditions. Stress

Item 85 - 3.9.3.1.1, page 3.9-41

The first paragraph refers to the Emergency Condition in Table 3.9.3-1 and to the stress limits for each loading combination in Tables 3.9.3-2, -3, -4, -5, and -6. The Emergency Condition is missing from Table 3.9.3-1 and no stress limits are given for the Emergency Conditions. Provide the missing information.

Response:

As discussed in Item 60, emergency conditions were not applicable for the Catawba plant. Therefore, the reference to emergency conditions in Section 3.9.3.1.1 has been deleted. Additionally, it is not appropriate to define emergency condition limits in the stress limit tables provided in Section 3.9. Based on the above discussion, the information provided in Item 60, and the attached FSAR revision, this item was resolved.

ATTACHMENT TO ITEM 85

displacement of the internals, energy absorbing devices limit the displacement after contacting the vessel bottom head, ensuring that the geometry of the core remains intact.

The following mechanical functional performance criteria apply:

1. Following the design basis accident, the functional criterion to be met for the reactor internals is that the plant shall be shutdown and cooled in an orderly fashion so that fuel cladding temperature is kept within specified limits. This criterion implies that the deformation of critical components must be kept sufficiently small to allow core cooling.

2. For large breaks, the reduction in water density greatly reduces the reactivity of the core, thereby shutting down the core whether the rods are tripped or not. The subsequent refilling of the core by the Emergency Core Cooling System uses borated water to maintain the core in a subcritical state. Therefore, the main requirement is to assure effectiveness of the Emergency Core Cooling System. Insertion of the control rods, although not needed, gives further assurance of ability to shut the plant down and keep it in a safe shutdown condition.

3. The inward upper barrel deflections are controlled to insure no contacting of the nearest rod cluster control guide tube. The outward upper barrel deflections are controlled in order to maintain an adequate annulus for the coolant between the vessel inner diameter and core barrel outer diameter.

4. The rod cluster control guide tube deflections are limited to insure operability of the control rods.

5. To insure no column loading of rod cluster control guide tubes, the upper core plate deflection is limited.

Methods of analysis and testing for core support structures are discussed in Sections 3.9.2.3, 3.9.2.5, and 3.9.2.6. Stress limits and deformation criteria are given in Sections 4.5.2.

3.9.3.1 Loading Combinations Design Transients, and Stress Limits (For ASME Code Class 2 and 3 Components)

Design pressure, temperature, and other loading conditions that provide the bases for design of fluid systems Code Class 2 and 3 components are presented in the sections which describe the systems.

3.9.3.1.1 Design Loading Combinations and Design Stress Limits for Westinghouse Equipment

The design loading combinations for ASME Code Class 2 and 3 components and supports are given in Table 3.9.3-1. The design loading combinations are categorized with respect to Normal, Upset, ~~Emergency~~, and Faulted Conditions. Stress

DELETE

Item 87 - 3.9.3.1, pages 3.9-40 to 43

This section does not cover bolts. Provide service limits for bolts.

Response:

Attached are changes to FSAR Tables 3.9.3-7 and 3.9.3-8 which address the stress limits for flange bolts.

TABLE 3.9.3-7

Stress Criteria and Load Combination Requirements for Duke Class A Piping

Condition	Load Combination	Applicable Stress Criteria
Design	Pressure +Weight +OBE	ASME III NB-3652 Σ(Primary) $\leq$ 1.5 Sm
Normal, Upset	Pressure +Weight +Thermal +Thermal transients +OBE (incl. anchor motions) +Relief Valve (as applicable) +Fluid dynamic effects	ASME III NB-3653 & 3654 Σ(Primary + Secondary) $\leq$ 3.0 Sm Σ(Primary) $\leq$ 1.5 Sm
Faulted	Pressure +Weight +SSE +Pipe Rupture +Relief Valve (as applicable) +Fluid dynamic effects	ASME III Appendix F (F-1360) Σ(Primary) $\leq$ 3.0 Sm
Faulted	Pressure +Weight +Pipe Rupture +Relief Valve (as applicable) +Fluid dynamic effects	ASME III Appendix F (F-1360) Σ(Primary) $\leq$ 3.0 SM

NOTE:
(1) Refer to Section 3.9.3.1.2 for load combination method
(2) Flange bolts are High Strength SA 193-B7. High Strength bolts SA 193-B7 meet the stress limit requirements specified in ASME SECTION III NB 3230 as verified in ORNL/Sub/2913-5

~~NOTE:~~

~~(1) Refer to Section 3.9.3.1.2 for load combination method.~~

TABLE 3.9.3-8

Stress Criteria and Load Combination Requirements for Duke Class B, C, and F Piping

Condition	Load Combination	Applicable Stress Criteria
Normal	Pressure +Weight +Thermal	ASME III NC- or ND-3652 Σ(Primary + Secondary) ≤ (Sh+Sa)
Upset	Pressure +Weight +Thermal +OBE (incl. anchor motions) +Valve thrust +Fluid dynamic effects	ASME III NC- or ND-3652 Σ(Secondary) ≤ Sa Σ(Primary) ≤ 1.2 Sh
Faulted	Pressure +Weight +SSE +Valve thrust +Fluid dynamic effects +Pipe rupture	ASME Code Case 1606 Σ(Primary) ≤ 2.4 Sh
Faulted	Pressure +Weight +Valve thrust +Fluid dynamic effects +Pipe rupture	ASME Code Case 1606 Σ(Primary) ≤ 2.4 Sh
Faulted	Pressure +Weight +Tornado	ASME Code Case 1606 Σ(Primary) ≤ 2.4 Sh

NOTE:
(1) Refer to Section 3.9.3.1-3 for load combination method
(2) Flange bolts are High Strength SA193-B7. High Strength bolts SA 193-B7 meet the stress limit requirements specified in ASME SECTION III NB 3230 as verified in ORNL/Sub/2913-3

NOTE:

~~(1) Refer to Section 3.9.3.1-3 for load combination method.~~

Item 88 - 3.9.3.1.5, page 3.9-43

The first paragraph refers to Tables 3.9.3-11 and 3.9.3-12 for load combinations for supports, restraints, anchors, and snubbers. However, these tables are indicated as only being applicable for Duke Class A, B, C, and F items. Provide the load combinations for Westinghouse items.

Response:

The load combination tables in Section 3.9 were reviewed. It was agreed that the tables were acceptable with the following exceptions:

a. Table 3.9.1-3 (attached) would be revised to delete Class 1 valves and component supports since neither type of equipment was supplied by Westinghouse. Also, the note on the test method would be clarified.

b. A table will be added for Class 2 and 3 component supports. However, as a result of investigating this time further, it was determined that a change to Section 3.9.3.4 is required in lieu of the addition of a table for Class 2 and 3 component supports. The revision to Section 3.9.3.4 is attached.

It was also noted that Westinghouse combines loads defined in the load combination tables in accordance with NUREG-0484.

Based on the above discussions and the attached FSAR changes, this item was resolved.

ATTACHMENT TO ITEM ~~88~~ 88

Table 3.9.1-3

Allowable Stresses for ASME Section III Class I Components*

Operating Condition Classification	Vessels/Tanks	Piping	Pumps	Valves	Component Supports
Normal	ASME Section III NB 3222	ASME Section III NB 3653	ASME Section III NB 3222	ASME Section III	ASME Section III Subsection NF
Upset	ASME Section III NB 3223	ASME Section III NB 3654	ASME Section III NB 3223	ASME Section III	ASME Section III Subsection NF
Faulted	ASME Section III NB 3225 F1323.1 See Section 3.9.1.4	ASME Section III NB 3652 F1360 See Section 3.9.1.4	ASME Section III NB3225 F1323.1 See Section (No active class 1 pump used)	See Note 1. ASME Section III See Section 3.9.3.2	ASME Section III Subsection NF See Section 3.9.1.[illegible]

P_e, P_m, P_b, Q_t, C_p, S_n & S_m as defined by Section III ASME Code

*A test ~~of the components may be~~ is performed in lieu of analysis. for the reactor vessel pads as discussed in Section 3.9.1.4.6.

ATTACHMENT TO ITEM 88

CNS

To assure an accurate assessment of the Pressurizer Relief System structural response during and following the actuation of the safety and relief valves, detailed thermal-hydraulic and structural dynamic time-history analyses are performed. To obtain maximum loadings during the valve discharge transients, it is assumed that all safety and relief valves commence opening simulataneously. The thermal hydraulic dynamic analyses are performed using the RELAP computer code.

The flow induced force time-histories are then used in a dynamic time-history structural analysis of the entire Pressurizer Relief System using the computer program SUPERPIPE. The structural analysis results in the determination of time-histories of displacements, stresses and support reaction forces throughout the Pressurizer Relief System. For conservatism in combination with other loading conditions, the maximum stresses and reaction forces determined from this analysis are combined without regard to sign or differences in time of occurence.

Normal operating conditions for the Pressurizer Relief System consist of internal pressure, dead weight, transient and steady state thermal loads and the system transient response to valve operation.

To assure compliance with the stress limits of the ASME Code for the Class 1 and 2 components of the Pressurizer Relief System, the following operating conditions, in addition to the normal operating conditions noted above are evaluated:

Upset Condition: Normal Condition Loads and Operating Basis Earthquake (OBE).

Faulted Conditions: Normal Condition Loads and Safe Shutdown Earthquake (SSE).

Stress computations and stress limit evaluations are performed in accordance with the ASME Code requirements. Design and analysis iterations of the Pressurizer Relief System are conducted, as necessary, to ensure compliance with the ASME Code limits.

3.9.3.4 Component Supports

Loading combinations, design transients, and stress limits for balance of plant component supports are discussed in Section 3.9.3.1. The use of these criteria provide a conservative basis for assuring no loss of structural integrity to supports and restraints, even under adverse loading conditions.

→ INSERT A

3.9.4 CONTROL ROD DRIVE SYSTEM (CRDS)

3.9.4.1 Descriptive Information of CRDS

Control Rod Drive Mechanism

Control rod drive mechanisms are located on the dome of the reactor vessel.

ATTACHMENT TO ITEM 88

Insert A

For Westinghouse supplied Class 2 and 3 component supports leading combinations are defined in Table 3.9.3-1. The stress limits applicable for Class 2 and 3 component supports are as follows:

a) Linear Supports for Tanks and Heat Exchangers

1) Normal - The allowable stresses of A.I.S.C.-69 Part 1 are employed for normal condition allowables.

2) Upset - Stress limits for upset conditions are 33 percent higher than those specified for normal conditions. This is consistent with Paragraph 1.5.6 of A.I.S.C.-69 Part 1 which permits one-third increase in allowable stresses for wind or seismic loads.

3) Faulted - Stress limits for faulted condition are the same as for the upset condition.

b) Plate and Shell Supports for Tanks and Heat Exchangers

1) Normal - Normal condition limits are those specified in ASME Sec. VIII, Division 1 or A.I.S.C.-69 Part 1.

2) Upset - Stress limits for upset condition are 33 percent higher than those specified for normal conditions. This is consistent with Paragraph 1.5.6 of A.I.S.C.-69 Part 1 which permits one-third increase in allowable stresses for wind or seismic loads.

3) Faulted - Stress limits for faulted condition are the same as for the upset condition.

ATTACHMENT TO ITEM 88

Insert - (Continued)

c) Plate and Shell Supports for Pumps - The stress limits used for ASME Code Class 2 and 3 plate and shell component supports are identical to these used for the supported component. These allowable stresses are such that the design requirements for the components and system assume that structural integrity is maintained.

Item 89 - 3.9.3-1

Sections 3.9.3.1.5 (page 3.9-43) and 3.9.3.4 (page 3.9-51), while discussing supports and restraints, do not provide sufficient information with respect to snubbers. Provide the basis for selecting the location, the required load cpacity, and the structural and mechanical performance parameters of safety-related snubbers (mechanical and hydraulic) and the method of achieving a high level of operability assurance including:

1. A description of the analytical and design methodology utilized to develop the required snubber locations and characteristics.
2. A discussion of design specification requirements to assure that required structural and mechanical performance characteristics and product quality are achieved.
3. Procedures, controls to assure correct installation of snubbers and checking and checking the hot and cold settings during plant startup tests.
4. Provisions for accessibility for inspection, testing and repair or replacement of snubbers.

Response:

Parts 1 & 2

Per discussion during the meetings snubbers are used to restrain seismic motion while allowing thermal movement based upon analysed piping during seismic events. The staff rephrased the snubber question presented to be limited to operational vibration damping. To date no snubbers have been used to mitigate operational piping vibration. If snubbers are employed in this manner in the future, the analytical and design methodology utilized, as well as design specification requirements to assure that structural and mechanical performance characteristics and product quality are achieved will be submitted for review.

Section 3.9.3.1.5 of the FSAR will be revised as attached.

Insert A

If snubbers are used to mitigate effects of operational vibration, the analytical and design methodology utilized as well as design specification requirements to assure that structural and mechanical performance characteristics and product quality are achieved will be developed and available for review.

Part 3

Refer to the attached Test Abstract for Pre-service and Pre-Operational Testing of Snubbers.

Part 4

Refer to the attached Test Abstract for Pre-service and Pre-Operational Testing of Snubbers.

A typical piping analysis problem, with representative math model, is shown in Figure 3.9.3-1. The results of this analysis are given in Table 3.9.3-10.

3.9.3.1.4 Design Loading Combinations and Design Stress Limits for Mechanical Equipment Furnished by Duke

The load combinations and corresponding stress criteria for Duke Mechanical equipment and valves are presented in Table 3.9.3-9.

3.9.3.1.5 Piping Supports and Restraints

The design loading combination associated with each component operating condition is given in Table 3.9.3-11 for supports, restraints, and anchors and in Table 3.9.3-12 for mechanical or hydraulic snubbers.

Loads for each loading combination are combined algebraically except that components which contain positive and negative values are combined to assemble the worst case load combination.

Design stress limits for each component operating condition are in accordance with Subsection NF of the ASME Boiler and Pressure Vessel Code for those portions of supports and restraints within the NF jurisdictional boundary. Stress limits for Normal and Upset Conditions are in accordance with Article XVII-2000. For Faulted Condition, design stress limits for manufacturer's standard support components are in accordance with the requirements of Appendix F. Emergency Condition stress limits, as specified in Article XVII-2000 are used for the design of all other components for Faulted Condition. Stresses for those portions of supports and restraints outside the NF jurisdictional boundary are limited to the allowable values in Table 3.9.3-11.

Snubbers are used at locations where restraints are necessary based on piping stress analysis, but thermal movement of the pipe must not be constrained. Performance selection is based on manufacturer's load capacity data and the requirement that the allowable travel of the snubber exceed the calculated pipe thermal travel. The midpoint of pipe thermal travel is set at the midpoint of the snubber travel range with hot and cold settings established accordingly. ← - INSERT A

Each snubber assembly is accessible after installation and all adjustment features are unobstructed and visable where possible. The manufacturer's figure number, size, stroke, and load rating is mounted on each snubber.

The loading combinations for Westinghouse items are given on Table 3.9.1-2.

3.9.3.2 Pump and Valve Operability Program

3.9.3.2.1 Westinghouse Pump and Valve Operability Program

Mechanical equipment classified as safety-related must be capable of performing its function under postulated plant conditions. Equipment with faulted condition

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
PROPOSED TEST ABSTRACT FOR PRE-SERVICE
AND PRE-OPERATIONAL TESTING OF SNUBBERS

1.0 SCOPE

1.1 This abstract establishes general requirements for the pre-service and pre-operational examinations of installed snubbers.

2.0 PRE-SERVICE EXAMINATION

2.1 A pre-service examination shall be made on all snubbers. This examination shall be conducted after installation, but not more than six months prior to system pre-operational testing. The examination shall verify the following:

2.1.1 There are no visible signs of damage or impaired operability as a result of storage, handling, or installation.

2.1.2 The snubber location, orientation, is in accordance with the manufacturer's specifications. Installation records verifying the snubbers were installed according to design drawings and specifications shall be acceptable.

2.1.3 Snubber is not seized, frozen, or jammed.

2.1.4 Adequate swing clearance is provided to allow snubber movement.

2.1.5 Structural connections such as pins, bearings, studs, fasteners, and other connecting hardware such as lock nuts, tabs, wire and other cotter pins are installed correctly.

2.2 If the period between the pre-service examination and system pre-operational test exceeds 6 months, due to unexpected situations, re-examination of 2.1.1 shall be performed. This reexamination may be accomplished in conjunction with 3.0.

2.3 Snubbers which fail to meet the requirements of 2.1 shall be corrected, repaired, or replaced. The corrected, repaired, or replaced snubber shall be examined in accordance with 2.1.

3.0 PRE-OPERATIONAL EXAMINATION

3.1 A pre-operational examination shall be conducted on each snubber whose system operating temperature equals or exceeds 250°F. This examination shall be conducted during system pre-operational testing. Snubber thermal movement shall be verified as follows:

3.1.1 During initial system heatup and cooldown, at specified temperature intervals for any system which attains operating temperature, verify the snubber expected thermal movement.

3.1.2 For those systems which do not attain operating temperature, verify by observation and/or calculation that the snubber will accommodate the projected thermal movement.

3.1.3 Verify the snubber swing clearance at specified heatup and cooldown plateaus.

3.2 Any discrepancies or inconsistencies between the actual and design range or thermal movement shall be evaluated to determine the cause prior to proceeding to the next specified temperature interval.

Item 90 - 3.9.3.1.5, page 3.9-43

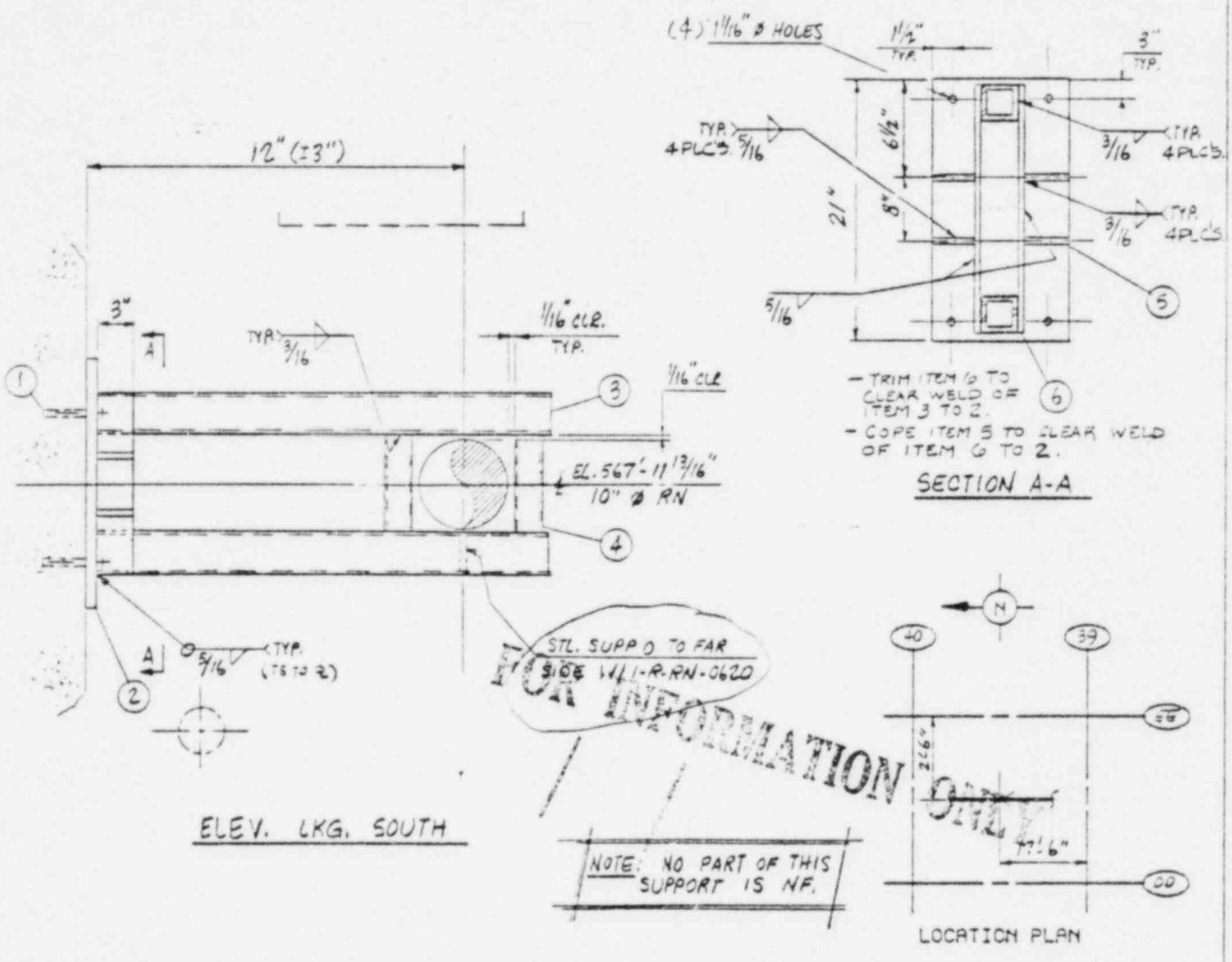
The second paragraph says that "loads for each loading combination are combined algebraically except that components which contain positive and negative values are combined to assemble the worst case load combination." Provide an example of what is done here.

Response:

The requested example is attached.

ITEM #90 Attachment

ITEM NO.	NO. REQ'D	SIZE / DESCRIPTION	ASTM	LOT NUMBER	BY
1	4	1" ø PHILLIPS CONC. FAST. CAT. # WS 10090	—		
2	1	℞ 1 x 12 x 1'-9" LG.	A36		
3	2	TS 4 x 4 x .375 x 1'-8 1/2" LG.	A500GRB		
4	2	TS 3 x 3 x .250 x 0'-10 13/16" LG.	A500GRB		
5	4	℞ 1/2 x 3 x 0'-3 1/2" LG. STIFFENER	A36		
6	2	℞ 1/2 x 3 x 1'-6 13/16" LG. STIFFENER	A36		



DIRECTION	MVMT.	HOT LD.	COLD LD.	UPSET		HYDRO	FAULTED		ALLOW LD	—
VERTICAL	0.00 / 0.00	1958# ↓	1796# ↓	— ↑	298# ↑	1796# ↓	— ↑	2220# ↑	—	—
N-S	— / —	—	—	—	—	X	—	—	—	—
E-W	0.00 / 0.00	1#E / 8#W	6#W	257#E	262#W	X	479#E	484#W	—	—

ANALYSIS PROBLEM NO. RNN 10/12/79 DATA PT. 11 CALC. NO. ——— DP. CO. CLASS C

DESIGNER/DATE [signature] 2/16/82 INSPECTED/DATE WAIVED

DRAWN/DATE [signature] 2/26/82 INSPECTED/DATE WAIVED

CHECKED/DATE [signature] 3/1/82 APPROVED/DATE [signature] 3/1/82

QA CONDITION 1

DUKE POWER COMPANY

PROJECT CATAWBA NUCLEAR STATION UNIT 1

REV.	BY	CK	DATE	INSP. ELEC.	INSP. CIVIL	DESCRIPTION	APPVD	DATE
0	TKN	[signature]	3/1/82			RELEASED FOR CONST.	VES	3/1/82

REFERENCE DRAWINGS

PIPE ISO: CN-1506-RN-001R REV. -

CIVIL CN-1231-1 REV. -

ELECT CN-1899-01 REV. -

HVAC CN-1522-04.40-00 REV. -

MARK NO. 1-R-RN-0612 REV. 0

SHEET 1 OF 1

DUNCAN-PARNELL, INC., CHARLOTTE 481

SUPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
7Y (CONTD.)											-.026	HOT
											-.032	UPST
											-.038	FLTD(M-)
7X	7	SNGL	X	FORC	(LB)	GLOB	1480.69	FLTD(M+)				
1-E-RN-611							1249.32	SSE				
							897.68	UPST				
							231.38	HOT				
							8.53	COLD				
							-568.01	HOT				
							-1234.31	UPST				
							-1249.32	SSE				
							-1817.32	FLTD(M-)				
				DISP	(IN)	GLOB					.075	FLTD(M+)
											.069	UPST
											.062	HOT
											.012	SSE
											-.003	COLD
											-.012	SSE
											-.026	HOT
											-.032	UPST
											-.038	FLTD(M-)
11Y	11	HANG	Y	FORC	(LB)	GLOB			261.78	SSE(M+)		
1-E-RN-612									-261.78	SSE		
									-1483.70	FLTD		
									-1605.86	UPST		
									-1745.48	HOT		
									-1795.64	COLD		
									-1957.82	HOT		
									-2097.43	UPST		
									-2219.59	FLTD(M-)		
				DISP	(IN)	GLOB	.044	FLTD(M+)				
							.043	UPST				
							.043	HOT				
							-.120	HOT				

CATAWBA NUCLEAR STATION UNIT-1 DUKE POWER CO.
DIESEL GENERATOR BUILDING NUCLEAR SERVICE WATER SYSTEM
PROBLEM... REV.0
STATIC , DYNAMIC ,SUPP SUM , STRESS CHECK

SUPPORT LOAD SUMMARY (CONTD.)

SUPP NAME	SUPP LOCN	SUPP TYPE	DIRN CODE	RESULT TYPE	RESULT UNIT	AXIS TYPE	X-AXIS	LOAD SET	Y-AXIS	LOAD SET	Z-AXIS	LOAD SET
11Y (CONTD.)							-.120	UPST				
							-.120	FLTD(M-)				
11Z 1-B-BN-G12	11	SNGL	Z	FORC	(LB)	GL-9					478.81	FLTD(M+)
											475.70	SSE
											256.82	UPST
											3.11	HOT
											-5.07	COLD
											-7.74	HOT
											-261.44	UPST
											-475.70	SSE
											-483.43	FLTD(M-)
				DISP	(IN)	GL03	.044	FLTD(M+)				
							.043	UPST				
							.043	HOT				
							-.120	HOT				
							-.120	UPST				
							-.120	FLTD(M-)				
13Y 1-B-BN-G13	13	HANG	Y	FORC	(LB)	GL03			255.91	SSE(M+)		
									-255.91	SSE		
									-1164.13	FLTD		
									-1303.56	UPST		
									-1440.05	HOT		
									-1522.59	COLD		
									-1549.01	HOT		
									-1684.50	UPST		
									-1803.93	FLTD(M-)		
				DISP	(IN)	GL03	.087	FLTD(M+)				
							.087	UPST				
							.086	HOT				
							-.240	HOT				
							-.240	UPST				
							-.240	FLTD(M-)				

Item 91 - 3.9.4.3.1, page 3.9-58

The first full paragraph says that "the dynamic behavior of the reactivity control components has been studied using experimental test data and experience from operating reactors." Provide details of the tests and data.

Response:

The statement relative to the reactivity control components is currently inappropriately located in Section 3.9N.4. It was agreed that this statement should be incorporated in another portion of Section 3.9.4. An FSAR change has been made to correct this deficiency. It was also pointed out that test data and operating experience data for reactivity control components is provided in Reference 11.

Based on the above discussion and the attached FSAR changes, this item was resolved.

N40

ATTACHMENT TO ITEM 91

CNS

4. Coolant Flow Forces (static)
5. Temperature Gradients
6. Differences in thermal expansion
   a. Due to temperature differences
   b. Due to expansion of different materials
7. Interference between components
8. Vibration (mechanically or hydraulically induced)
9. All operational transients listed in Table 3.9.1-1
10. Pump Overspeed
11. Seismic Loads (operation basis earthquake and design basis earthquake)
12. Blowdown Forces (due to cold and hot leg break)

The main objective of the analysis is to satisfy allowable stress limits, to assure an adequate design margin, and to establish deformation limits which are concerned primarily with the functioning of the components. The stress limits are established not only to assure that peak stresses will not reach unacceptable values, but also limit the amplitude of the oscillatory stress component in consideration of fatigue characteristics of the materials. Standard methods of strength of materials are used to establish the stresses and deflections of these components. The dynamic behavior of the reactivity control components has been studied using experimental test data and experience from operating reactors.

Move to pag 3.9-60

3.9.4.3.2 Drive Rod Assembly

All postulated failures of the drive rod assemblies either by fracture or uncoupling lead to a reduction in reactivity. If the drive rod assembly fractures at any elevation, that portion remaining coupled falls with, and is guided by the rod cluster control assembly. This always results in reactivity decrease.

3.9.4.3.3 Latch Assembly and Coil Stack Assembly

Results of Dimensional and Tolerance Analysis

With respect to the control rod drive mechanism system as a whole, critical clearances are present in the following areas:

1. Latch assembly (Diametral clearances)

2. Latch arm-drive rod clearances

3. Coil stack assembly-thermal clearances

4. Coil fit in coil housing

The following write-up defines clearances that are designed to provide reliable operation in the control rod drive mechanism in these four critical areas. These clearances have been proven by life tests and actual field performance at operating plants.

/

ATTACHMENT TO ITEM 91

CNS

Internal components subjected to wear will withstand a minimum of 3,000,000 steps without refurbishment as confirmed by life tests (Reference 11). Latch assembly inspection is recommended after 2.5 E6 steps have been accumulated on a single control rod drive mechanism.

To confirm the mechanical adequacy of the fuel assembly, the control rod drive mechanism, and rod cluster control assembly, functional test programs have been conducted on a full scale 12 foot control rod. The 12 foot prototype assembly was tested under simulated conditions of reactor temperature, pressure, and flow for approximately 1000 hours. The prototype mechanism accumulated about 3,000,000 steps and 600 trips. At the end of the test the control rod drive mechanism was still operating satisfactorily. A correlation was developed to predict the amplitude of flow excited vibration of individual fuel rods and fuel assemblies. Inspection of the drive line components did not reveal significant fretting.

These test include verification that the trip time achieved by the full length control rod drive mechanisms meet the design requirement of 2.2 seconds from start of rod cluster control assembly motion to dashpot entry. This trip time requirement will be confirmed for each control rod drive mechanism prior to initial reactor operation and at periodic intervals after initial reactor operation as required by the proposed Technical Specifications.

There are no significant differences between the prototype control rod drive mechanisms and the production units. Design materials, critical tolerances and fabrication techniques (Section 4.2.3.3.2) are the same.
P The dynamic behavior of the ...... (Sentence from page 3.9-58) .... reactors. ← FSAR Change here
These tests have been reported in Reference 11.

It is expected that all control rod drive mechanisms will meet specified operating requirements for the duration of plant life with normal refurbishment. However, a technical specification pertaining to an inoperable rod cluster control assembly has been set. Latch assembly inspection is recommended after 2.5 E6 steps have been accumulated on a single control rod drive mechanism.

If a rod cluster control assembly cannot be moved by its mechanism, adjustments in the boron concentration ensure that adequate shutdown margin would be achieved following a trip. Thus, inability to move one rod cluster control assembly can be tolerated. More than one inoperable rod cluster control assembly could be tolerated, but would impose additional demands on the plant operator. Therefore, the number of inoperable rod cluster control assemblies has been limited to one as discussed in the Technical Specifications.

In order to demonstrate proper operation of the Control Rod Drive Mechanism and to ensure acceptable core power distributions during rod cluster control assembly partial-movement checks are performed on the rod cluster control assemblies. (Refer to Technical Specifications.) In addition, periodic tests of the rod cluster control assemblies are performed at each refueling shutdown to demonstrate continued ability to meet trip time requirements, to ensure core subcriticality after reactor trip, and to limit potential reactivity insertions from a hypothetical rod cluster control assembly ejection. During these tests the acceptable drop time of each assembly is not greater than 2.2 seconds, at full flow and operating temperature, from the beginning of motion to dashpot entry.

Item 92 - 3.9.5.1, page 3.9-62

The first full paragraph refers to Figure 3.9.5-1. Provide this figure.

Response:

Figure 3.9.5-1 is already provided.

Item 93 - 3.9.5.1, page 3.9-63

The third paragraph discusses the energy absorbers. Provide details of the analysis. What do they look like? How much deflection is there?

Response:

The main purpose of the energy absorber is to absorb impact loads of the core and the supporting structure during a postulated core drop accident. The energy of the impact is absorbed by an energy absorbing mechanism which consist of a "necked-down" portion as shown in Figure 3.9.5-1A. Using energy principles the total potential energy of the system is absorbed by the strain energy of the energy-absorbing devices.

The maximum deformations of the energy absorbing assemblies during the core drop accident remain well within the functional limits so as not to affect the RCC Scram Function.

The strain limits for the energy absorbers was also discussed and Westinghouse indicated that appropriate strain limits had been satisfied. The NRC also indicated that these limits also satisfied SRP requirements. Westinghouse agreed to make FSAR changes (attached) to clarify this item including the definition of the strain limits which were met.

Based on the above discussion and the attached FSAR changes, this item was resolved.

ATTACHMENT
TO ITEM 93

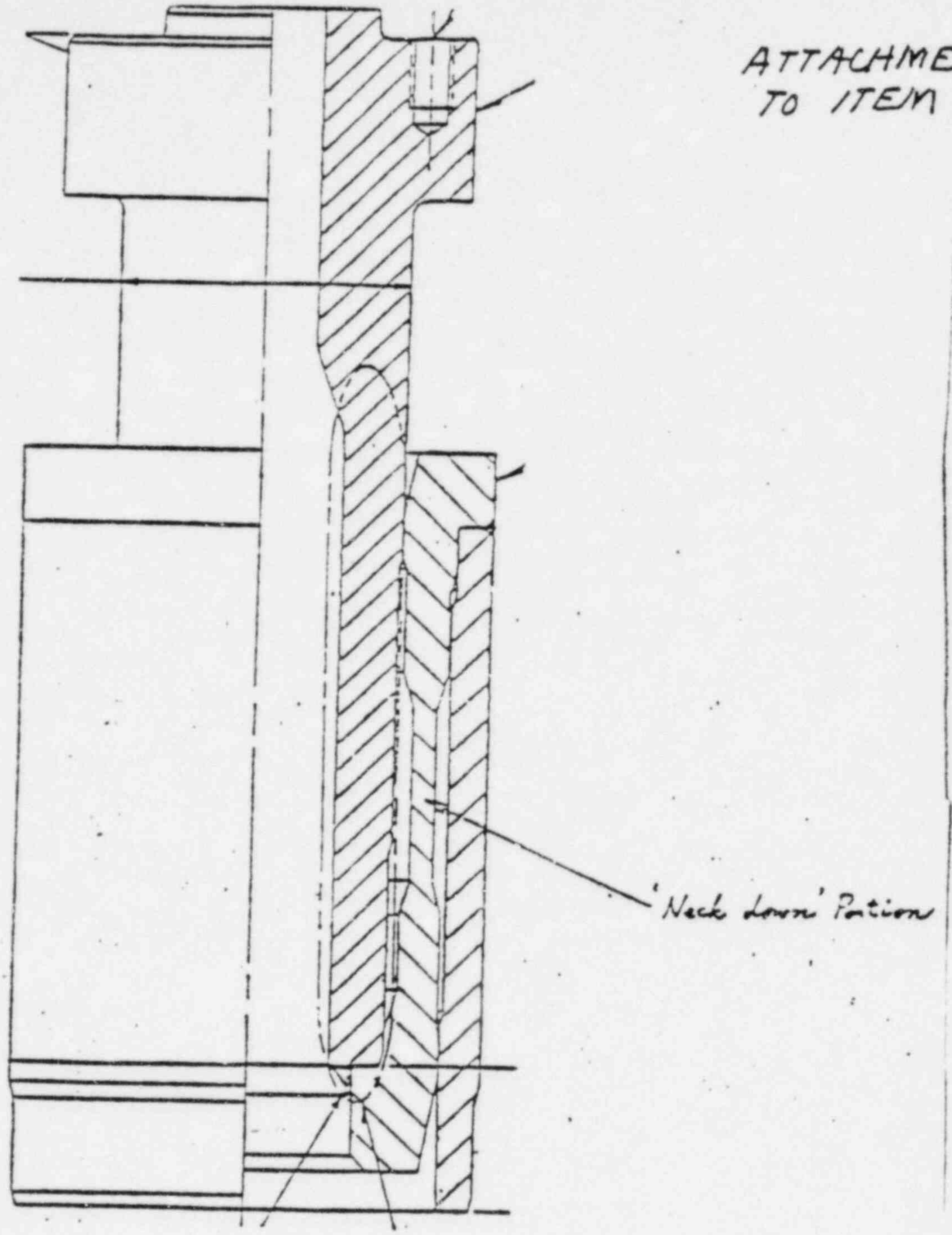


FIGURE 3.9.5-1A ENERGY ABSORBING ASSEMBLY

ATTACHMENT TO ITEM 93

CNS

The main radial support system of the lower end of the core barrel is accomplished by "key" and "keyway" joints to the reactor vessel wall. At equally spaced points around the circumference, an Inconel clevis block is welded to the vessel inner diameter. Another Inconel insert block is bolted to each of these blocks and has a "keyway" geometry. Opposite each of these is a "key" which is attached to the internals. At assembly, as the internals are lowered into the vessel, the keys engage the keyways in the axial direction. With this design, the internals are provided with a support at the furthest extremity, and may be viewed as a beam fixed at the top and simply supported at the bottom.

Radial and axial expansions of the core barrel are accommodated but transverse movement of the core barrel is restricted by this design. With this system, cyclic stresses in the internal structures are within the ASME Section III limits. In the event of an abnormal downward vertical displacement of the internals following a hypothetical failure, energy absorbing devices limit the displacement after contacting the vessel bottom head. The load is then transferred through the energy absorbing devices of the internals to the vessel.

The energy absorbers, cylindrical in shape, are contoured on their bottom surface to the reactor vessel bottom head geometry. * ~~Assuming a downward vertical displacement the potential energy of the system is absorbed mostly by the strain energy of the energy absorbing devices~~. (* INSERT-A)

Upper Core Support Assembly

The upper core support assembly, shown in Figures 3.9.5-2 and 3.9.5-3 consists of the top support plate assembly, and the upper core plate between which are contained support columns and guide tube assemblies. The support columns establish the spacing between the top support plate assembly and the upper core plate and are fastened at top and bottom to these plates. The UHI support columns transmit the mechanical loadings between the two plates and serve the supplementary function of supporting thermocouple guide tubes. They position the upper core plate and upper support which act as the boundaries for the flow plenum at the outlet of the core. Additionally each UHI column has a central axial flow passage full length for conveying core cooling water to the core when it is injected into the vessel head. The water enters the flow passage through a small hole on the side of the top of the UHI support column. A support column is provided at each fuel assembly position that does not contain accommodation for a control rod with the exception of the peripheral low power fuel assembly locations. The fuel assemblies which do not have a support column above them are located in front of the inlet and outlet nozzles of the vessel. The UHI support columns also contain thermocouple supports.

The guide tube assemblies shield and guide the control rod drive shafts and control rods. They are fastened to the top support plate and are restrained by pins in the upper core plate for proper orientation and support. Additional guidance for the control rod drive shafts is provided by the upper guide tube which is attached to the upper support plate and guide tube. In the UHI system, the guide tubes also serve to transport UHI water from the vessel head region to the area directly above the fuel assemblies. All units having UHI have the maximum number of guide tubes independent of other RCC requirements.

ATTACHMENT TO ITEM 93

INSERT A

The main purpose of the energy absorber is to absorb impact loads of the core and the supporting structure during a postulated core drop accident. The energy of the impact is absorbed by an energy absorbing mechanism which consists of a "necked-down" portion as shown in Figure 3.9.5-1A. Using energy principles the total potential energy of the system is absorbed by the strain energy of the energy-absorbing devices.

The maximum deformations of the energy absorbing assemblies during the core drop accident remain well within the functional limits so as not to affect the RCS Scram Function. It should also be noted that the maximum strains undergone by the energy absorbers ($\leq$ 15% strains, hot condition) during the core drop accident are well below the fracture limits (62% strains for 304 stainless steel at 600°F) and satisfy the SRP requirements.

Item 94 - 3.9.6, page 3.9-68

The applicant must provide a commitment that the inservice testing of ASME Class 1, 2, and 3 components will be in accordance with the revised rules of 10 CFR, Part 50, Section 50.55a, paragraph (g).

Response:

The inservice test program will be in accordance with 10 CFR, part 50, Section 50.55a, paragraph (g). This item was closed.

Item 95 - 3.9.6, page 3.9-68

Any requests for relief from ASME Section XI should be submitted as soon as possible.

Response:

Duke will submit requests as soon as possible. This item was closed.

Item 97 - Table 3.9.1-1, page 1

Explain Note 1a as it refers to the Inadvertent Auxiliary Spray transient.

Response:

Westinghouse indicated that the design requirement for the inadvertent auxiliary spray transient was ten occurrences under upset conditions. The basis for notes 1a and 1b was not apparent from the above stated design requirement. Therefore, it was agreed that notes 1a and 1b would be deleted from Table 3.9.1-1. Based upon the attached FSAR revision, this item was resolved.

ATTACHMENT TO ITEM 97

CATAWBA 97

Table 3.9.1-1 (page 7)

Design Transients for ASME Code Class 1 Piping

(1) DESIGN TRANSIENTS	(2) CONDITION	(3) OCCURRENCES	(4) RESIDUAL HEAT REMOVAL SYSTEM	SAFETY INJECTION SYSTEM	CHEMICAL AND VOLUME CONTROL SYSTEM	PRESSURIZER SURGE LINE	PRESSURIZER RELIEF	PRESSURIZER SPRAY	RTD BYPASS	REACTOR COOLANT DRAIN LINES	UPPER HEAD INJECTION LINES
Loss of Load without Immediate Turbine or Reactor Trip	Upset	80	X	X	X	X	X NOTES 4, 5	X	X	X	X
Loss of Flow in One Loop	Upset	80	X	X	X		X	X	X	X	X
Reactor Trip with Cooldown and Inadvertent SIS Actuation	Upset	10	X	X	X	X	X	X	X	X	X
Inadvertent RCS Depressurization	Upset	20	X	X	X	X	X	X	X	X	X
Inadvertent SI Accumulator Blowdown during Plant Cooldown	Upset	4	-	X	-	-	-	-	-	-	-
High Head Safety Injection	Upset	22	-	X	-	-	-	-	-	-	-
Boron Injection	Upset	48	-	X	-	-	-	-	-	-	-
Small Steam Break	Emergency	5									X
Small LOCA	Emergency	5									X
Large Steam Break	Faulted	1	X	X	X	X	X	X	X	X	X
Large LOCA	Faulted	1	X	X	X	X	X	X	X	X	X
High Head Safety Injection	Faulted	2	-	X	-	-	-	-	-	-	-
Boron Injection	Faulted	2	-	X	-	-	-	-	-	-	-
Turbine Roll Test	Test	10	X	X	X	X	X	X	X	X	X
Hydrostatic Test	Test	5	X	X	X	X	X	X	X	X	X
Primary Side Leak Test	Test	50	X	X	X	X	X	X	X	X	X
Inadvertent Auxiliary Spray	Test	1	-	-	X (NOTE 12) Delete	-	-	X (NOTE 16) DELETE	-	-	-

NOTES:

Delete

1\. a) Portion of piping analyzed for 10 upset occurrences, remainder for 9 upset and 1 test occurrences.
b) Piping analyzed for 9 upset and 1 test condition.

~~2~~ 1. Pressurizer surge line is analyzed for 80 occurrences of transient C-7, the final cooldown spray.

~~3~~ 2. Pressurizer surge line is analyzed for 150,000 initial fluctuations and 3,000,000 random fluctuations.

~~4~~ 3. These transients are conditions which can cause the PORV's to open. Although a total of 320 such transients are shown, the PORV inlet lines are analyzed for 100 such occurrances.

~~5~~ 4. For analysis of the safety valve, 40 occurrences were assumed.

~~6~~ 5. Number of occurrences is 20,000,000.

Item 98 - Table 3.9.1-3

The footnote indicates that a test may be performed in lieu of an analysis to determine ASME Code compliance. Provide the criteria for such tests.

Response:

This item was resolved under Item 88.

Item 99 - Tables 3.9.1-3, 3.9.3-7, and 3.9.3-8

What are the allowable stresses?

Response:

Tables 3.9.1-3, 3.9.3-7, and 3.9.3-8 will be revised.

Revised tables 3.9.3-7 and 3.9.3-8 are attached. Revised table 3.9.1-3 is attached as response to item 88.

TABLE 3.9.3-7

Stress Criteria and Load Combination Requirements for Duke Class A Piping

Condition	Load Combination	Applicable Stress Criteria
Design	Pressure +Weight +OBE	ASME III NB-3652 Σ (Primary) $\leq 1.5 S_m$
Normal, Upset	Pressure +Weight +Thermal +Thermal transients +OBE (incl. anchor motions) +Relief Valve (as applicable) +Fluid dynamic effects	ASME III NB-3653 & 3654 Σ (Primary + Secondary) $\leq 3.0 S$
Faulted	Pressure +Weight +SSE +Pipe Rupture +Relief Valve (as applicable) +Fluid dynamic effects	ASME III Appendix F (F-1360) Σ (Primary) $\leq 3.0 S_m$
Faulted	Pressure +Weight +Pipe Rupture +Relief Valve (as applicable) +Fluid dynamic effects	ASME III Appendix F (F-1360) Σ (Primary) $\leq 3.0 S_m$

NOTE:

(1) Refer to Section 3.9.3.1.2 for load combination method.

TABLE 3.9.3-8

Stress Criteria and Load Combination
Requirements for Duke Class B, C, and F Piping

Condition	Load Combination	Applicable Stress Criteria
Normal	Pressure +Weight +Thermal	ASME III NC- or ND-3652 $\Sigma(\text{Primary} + \text{Secondary}) \le (S_h + S_a)$
Upset	Pressure +Weight +Thermal +OBE (incl. anchor motions) +Valve thrust +Fluid dynamic effects	ASME III NC- or ND-3652 $\Sigma(\text{Secondary}) \le S_a$ $\Sigma(\text{Primary}) \le 1.2\, S_h$
Faulted	Pressure +Weight +SSE +Valve thrust +Fluid dynamic effects +Pipe rupture	ASME Code Case 1606 $\Sigma(\text{Primary}) \le 2.4\, S_h$
Faulted	Pressure +Weight +Valve thrust +Fluid dynamic effects +Pipe rupture	ASME Code Case 1606 $\Sigma(\text{Primary}) \le 2.4\, S_h$
Faulted	Pressure +Weight +Tornado	ASME Code Case 1606 $\Sigma(\text{Primary}) \le 2.4\, S_h$

NOTE:

(1) Refer to Section 3.9.3.1-3 for load combination method.

Item 100 - Table 3.9.3-6

Note 4 to Table 3.9.3-6 indicates that the design requirements are not applicable to parts contained within the valve or which are not part of the pressure boundary.

It is the staff's position that the valve disc is a part of the pressure boundary. Therefore, indicate the design criteria for valve discs when subject to "P_{max}"

Response:

The requirements implemented by Westinghouse for valve discs were discussed. Westinghouse indicated that the design requirement for valve discs was 110 percent of the maximum differential operating pressure. It was agreed that footnote 4 to Table 3.9.3-6 (attached) would be revised to reflect the design criteria utilized by Westinghouse.

Based on the above discussion and the attached FSAR change, this item was resolved.

ATTACHMENT TO ITEM 100

TABLE 3.9.3-6 (Page 2)

Stress Criteria for Safety Related ASME Code Class 2

and Class 3 Valves

NOTES:

2. Casting quality factor of 1.0 shall be used.

3. These stress limits are applicable to the pressure retaining boundary, and include the effects of loads transmitted by the extended structures, when applicable.

4. Design requirements listed in this Table are not applicable to valve ~~discs~~, stems, seat rings, or other parts of valves which are contained within the confines of the body and bonnet. ~~or otherwise not part of the pressure boundary.~~ Valve discs are designed to 110 percent of the maximum differential operating pressure.

5. The maximum pressure resulting from upset, emergency or faulted conditions shall not exceed the tabulated factors listed under P_{max} times the design pressure. If these pressure limits are met, the stress limits in Table 3.9.3-6 are considered to be satisfied.

6. Refer to Table 3.9.3-1 for Load Combinations.

/

Item 101 - 3.2.2, page 3.2-1

Are the safety and relief valve piping on the main steam line classified as safety-related? Are there any other piping > 2½" connected to the main steam line up to the outermost containment isolation valve? If so, what is its safety classification?

Explain the design of these portions of structures and systems that form an interface between Seismic Category I and non-Seismic Category I features. What QA requirements are applied to those systems, structures, and components? (Q210.1) Provide a discussion of your compliance W/R.G. 1.29.

Response:

Page 10.3-1 will be revised as attached.

Piping up to and including main safties is Duke Class B. Safety valve outlet pipes and vent stacks are Duke Class F so that a seismic event cannot damage the outlet pipes and/or vent stacks in such a manner as to impair valve operation.

The following piping is greater than 2½" and connected to the main steam lines upstream of the main steam isolation valves. All the listed piping is Duke Class B.

a) Condensate drain drip legs
b) Lines to PORV's and safeties
c) Lines to auxiliary FWP turbine.

F

10.3 MAIN STEAM SUPPLY SYSTEM

10.3.1 DESIGN BASES

The Main Steam Supply System is designed to achieve the following:

1. Provide steam flow requirements at main turbine inlet design conditions.

2. Dissipate heat from the Reactor Coolant System following a turbine and/or reactor trip by dumping steam to the condenser and atmosphere.

3. Provide steam as required for:

   a. Main and auxiliary feedwater pump turbines.
   b. Condenser steam air ejectors.
   c. Main and feedwater pump turbine seals.
   d. Miscellaneous auxiliary equipment.

4. Conform to applicable design codes presented in Table 3.2.2-2.

5. Allow visual in-service inspection.

6. Protect adjacent equipment against heat damage.

10.3.2 DESCRIPTION

Main steam is generated in the four steam generators by feedwater absorbing heat from the Reactor Coolant System. Main steam is conveyed by four lines, one per steam generator, to the turbine inlet valves. A pressure equalization and steam distribution header is connected to each main steam line upstream of the turbine inlet valves. A flow restrictor is provided in each steam generator outlet nozzle to limit maximum flow and the resulting thrust forces caused by a steam line rupture. The steam generators and all main steam piping and valves to the outer doghouse walls are Duke Safety Class B. Main steam piping across the yard to the Turbine Building wall is Duke Safety Class F. All other piping is Duke Class G. See Figures 10.3.2-1, -2, -3, -4, -5, -6, -7, and -8.

Five self-actuated safety valves are located on each main steam line (a total of twenty) in the doghouses to prevent overpressurization of the Main Steam System under all conditions. The valves are designed to pass 105 percent of the Engineered Safeguard Design (ESD) steam flow at a pressure not exceeding 110 percent of the system design pressure (1200 psia). See Tables 3.2.2-1 and 3.2.2-2 for applicable codes.

All piping up to [illegible] the valves [illegible] Duke Safety Class B. The safety valve [illegible] piping is Duke Safety Class F.

Item 102 - 3.6.1.1.1, page .36-1

The FSAR stated that "reactor coolant piping is restrained such that the lateral displacements of the broken ends of the pipe are less than the pipe wall thickness." Provide the assumptions and the analytical results to verify this statement. The FSAR states that system response due to breaks in the RCS are "accommodated directly by the supporting structures of the reactor vessel, the steam generator, and the reactor coolant pumps including two additional pipe supports." Provide the assumptions and analytical results to justify the statement.

Response:

Based on the discussions relative to Items 12 and 72 on break sizes, the criteria relative to pipe displacement and wall thickness is not pertinent to any of the criteria specified or analyses performed for the Catawba plant. Consequently, it was agreed that the reference to lateral displacements of RCS piping be deleted from the FSAR.

This item also refers to two pipe whip restraints in the RCS. This should be changed to seven to correctly reflect the restraint configuration of each RCS loop.

Based on the above discussion and the attached FSAR revisions, this item was resolved.

ATTACHMENT TO ITEM 102

CNS

3.6 PROTECTION AGAINST DYNAMIC EFFECTS ASSOCIATED WITH THE POSTULATED RUPTURE OF PIPING

General Design Criterion 4 of Appendix A to 10CFR50 required that structures, systems, and components important to safety be protected from the dynamic effects of pipe failure. This section describes the design bases and design measures to ensure that the containment vessel and all essential equipment inside or outside the containment, including components of the reactor coolant pressure boundary, have been adequately protected against the effects of blowdown jet and reactive forces and pipe whip resulting from postulated rupture of piping.

Criteria presented herein regarding break size, shape, orientation, and location are in accordance with the guidelines established by NRC Regulatory Guide 1.46, and include considerations which are further clarified in NRC Branch Technical Positions MEB 3-1 and APCSB 3-1 where appropriate. These criteria are intended to be conservative and allow a high margin of safety. For those pipe failures where portions of these criteria lead to unacceptable consequences, further analyses will be performed. However, any less conservative criteria will be adequately justified and fully documented.

3.6.1 POSTULATED PIPING FAILURES IN FLUID SYSTEMS INSIDE AND OUTSIDE CONTAINMENT

3.6.1.1 Design Bases

3.6.1.1.1 Reactor Coolant System

The Reactor Coolant System, as used in Section 3.6 of the Safety Analysis Report, is limited to the main coolant loop piping and all branch connection nozzles out to the first butt weld. The particular arrangement of the Reactor Coolant System, building structures, and mechanical restraints preclude the formation of plastic hinges for breaks postulated to occur in the Reactor Coolant System. Consequently, pipe whip and jet impingement effects of the postulated pipe break will not result in unacceptable consequences to essential components. ~~Reactor coolant loop piping is restrained such that the lateral displacements of the broken ends of the pipe are less than the pipe wall thickness.~~ This restraint configuration, along with the particular arrangement of the Reactor Coolant System and building structures, mitigates the effects of the jet from the given break such that no unacceptable consequences to essential components are experienced.

The application of criteria for protection against the effects of postulated breaks in the Reactor Coolant System in accordance with Reference 1 results in a system response which can be accommodated directly by the supporting structures of the reactor vessel, the steam generator, and the reactor coolant pumps including ~~two~~ SEVEN additional pipe supports. The design bases for postulated breaks in the Reactor Coolant System are discussed in Section 3.6.2.1.

Item 103 - 3.6.2.1.1, page 3.6-7

Describe the analysis performed to verify the integrity and operability of the isolation valves for a pipe break beyond the restraint.

Response:

The integrity and operability of the isolation valves is insured by the standard analyses for any pipe rupture event. An occurrence that would affect the design function of the double isolation valves, inclusive of a single active failure, will be reviewed and protection provided for a break downstream of the restraint. With the crane wall as a guide, the restraint will resist loading that would affect the valves, and the power cables will be protected if they are targets of the subject break. The break is 182 linear pipe feet away from the closest valve and is 43 arch feet away from the closest valve. The above analysis is consistent and sufficient to insure the integrity and operability of the double isolation valves.

The attached revision to FSAR page 3.6-29 provides Duke's commitment to supply a list of postulated pipe break locations.

3.6.2.4.3 Residual Heat Removal Recirculation Line Penetration

Residual heat removal recirculation line penetrations are of the cold-penetration type. (See Figure 3.6.2-6)

Design requirements for these penetrations are as follows:

a) The recirculation line is an extension of Containment up through the first valve.

b) These valves are Safety Class 2 and are conservatively designed (600 psig design pressure) to withstand the Containment design pressure of 15 psig.

c) Valves are located in an accessible area for maintenance during the post-accident period.

d) Expansion joints are utilized in the penetration design.

3.6.2.4.4 Access for Periodic Examination

A description of the method of providing access to permit periodic examinations of process pipe welds within the protective assembly as required by the plant inservice inspection program is discussed in Section 6.6.

3.6.2.5 Summary of Dynamic Analyses Results

A summary of the dynamic analyses, resulting from postulated pipe breaks in high-energy piping systems, is presented for a typical high-energy system. The analyses summary of the example system (Safety Injection, NI is comprised of the following information:

a) System pipe routing - Figures 3.6.2-9 thru 3.6.2-36

b) Location of postulated breaks - Figures 3.6.2-9 thru 3.6.2-36

c) Location of postulated pipe rupture restraints - Figures 3.6.2-9 thru 3.6.2-36 (Jet barriers are located near target to intercept jet)

d) Summary of protection requirements - Tables 3.6.2-7 and 3.6.2-8

e) Summary of combined stresses at break locations - Tables 3.6.2-4 thru 3.6.2-6

f) Plans of plant layout at various elevations - Figures 3.6.2-37 thru 3.6.2-41

A summary of postulated circumferential and longitudinal break locations are shown on Figures (later).

Item 104 - 3.6.2.1.1.1, page 3.6-9

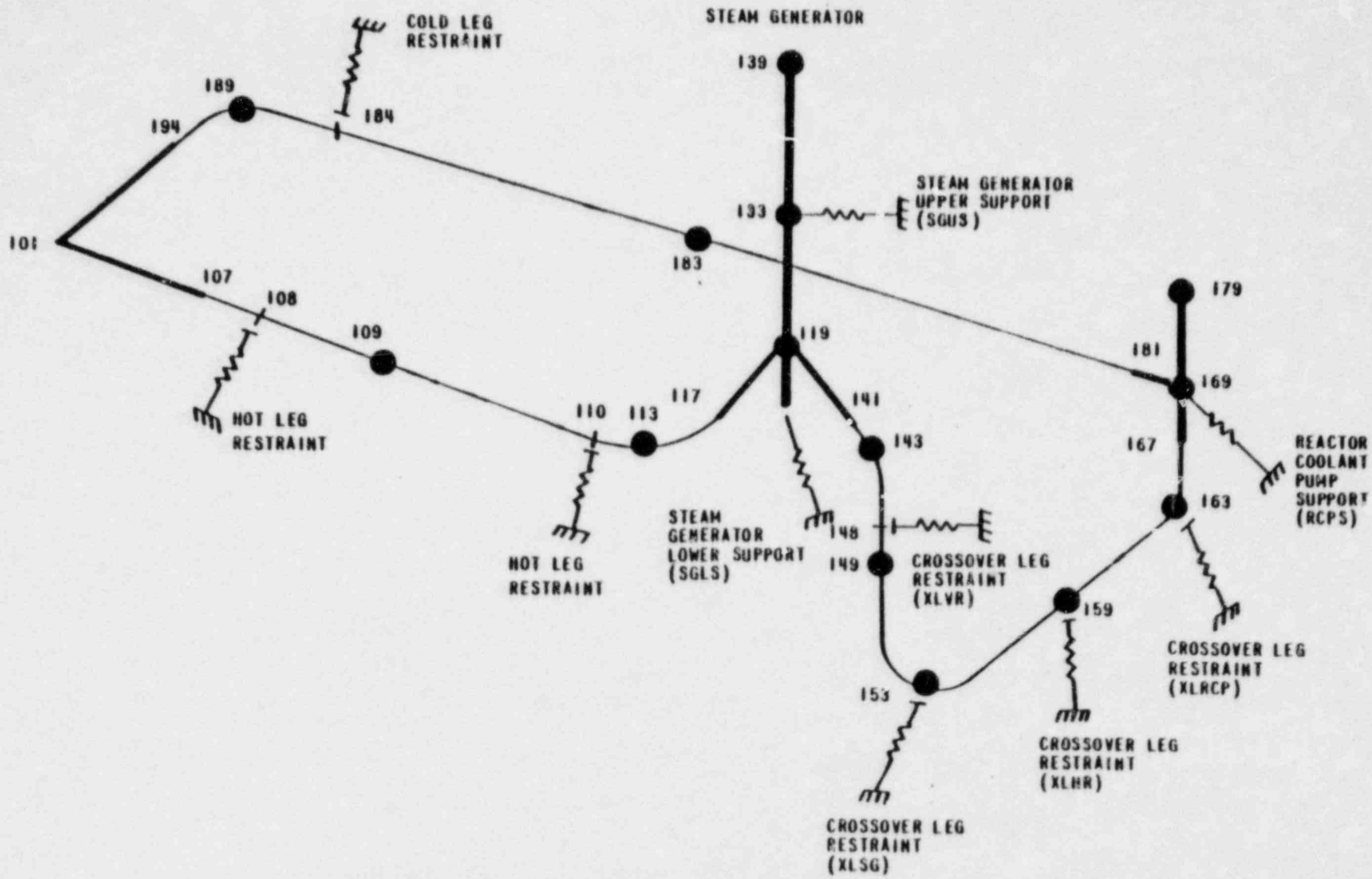
Show locations of pipe whip restraints on the reactor coolant piping and for which breaks in the RCS they are designed.

Response:

It was agreed that Figure 3.6.2-4 would be revised to indicate the location of pipe breaks and restraints for the RCS.

Based on the attached FSAR revision, this item was resolved.

ATTACHMENT TO ITEM 104



Reactor Coolant Loop Model

Item 105 - 3.6.2.1.1.2, page 3.6-10

A longitudinal break (Break 7) at 50° elbow on the Intrados assumes a break area less than the corss-sectional area of the pipe. Provide the analytical and experimental bases for the limited break. (Reference 1 does not contain the assumptions).

Response:

The longitudinal break at the 50° elbow in the RCS was assumed to be one full break area. The FSAR has been revised to reflect this break size and "less" will be deleted.

Based on the above discussion and the attached FSAR change, this item was resolved.

ATTACHMENT TO ITEM 105

CNS

c) Damage to the high head safety injection lines connected to the other leg of the affected loop or to the other loops is prevented.

d) Propagation of the break to high head safety injection line connected to the affected leg is prevented if the line break results in a loss of core cooling capability due to a spilling injection line.

3.6.2.1.1.1 Postulated Piping Break Locations and Orientations

In each leg of the Reactor Coolant System, a minimum of three postulated rupture locations shall be selected in the following manner:

Breaks shall be postulated at the terminal end points and at all locations in a run or branch in which the cumulative usage factor exceeds 0.2 for normal and upset operating conditions or in which the range of primary plus secondary stress intensity for normal and upset operating conditions exceeds 80 percent of the ASME Section III Code allowable on an elastic basis ($2.4\ S_m$). In the event that a location between the terminal end points cannot be chosen in this manner, the point of highest fatigue usage shall be used to obtain a total of three break locations.

At each possible break location, consideration must be given to the occurrence of either a circumferential or longitudinal break. As discussed in Reference 1, a circumferential rupture is more likely than a longitudinal rupture for reactor coolant piping. Only in the case of one elbow is a longitudinal rupture postulated.

Circumferential breaks are perpendicular to the longitudinal axis of the pipe.

Longitudinal breaks are parallel to the longitudinal axis of the pipe. Certain longitudinal break orientations may be excluded on the basis of the state of stress at the location considered.

For the main reactor coolant piping system, eleven discrete break locations were determined by stress and fatigue analyses. The locations are given in Table 3.6.2-1 and shown in Figure 3.6.2-2. The postulated locations conform to the criteria stated above and are discussed in Reference 1.

Break type at each discrete break location are presented in Table 3.6.2-1. The results of the analyses which lead to the break orientations are discussed in Reference 1.

3.6.2.1.1.2 Postulated Piping Break Sizes

For a circumferential break, the break area is the cross-sectional area of the pipe at the break location, unless pipe displacement is shown to be limited by analysis, experiment or physical restraint.

For a longitudinal break, the break area is the cross sectional area of the pipe at the break location unless analytically or experimentally shown otherwise. A longitudinal break area ~~less than~~ the cross sectional area of the
EQUAL TO

Item 106 - 3.6.2.2.2.3, page 3.6-24

In the equation used to calculate jet impingement loads, explain the use of "cosØ." Explain how the total cross-sectional area of the jet at the target structure (Aj) is calculated.

Response:

When determining a jet load on an object which is not perpendicular to the axis of the jet, the term cos Ø is used to determine the resultant jet load to which the object will be subjected. The total cross-sectional area of the jet (Aj) is calculated by the equation:

$$A_j = A_e \left(1 + \frac{2X}{D_e} \tan 10°\right)^2$$

where: A_e = break area

D_e = diameter of the break

X = distance from the source to target

the 10° angle is the half angle of expansion of the jet, for an expanding jet.

Item 107 - 3.6.2.3.3, page 3.6-36

Describe what buckling criteria and limits are used in the design of pipe whip restraints.

Response:

The allowable stress in compression is limited to 1.5 times the AISC allowable.

This item is closed.

#107

Table 3.6.2-3

Stress Allowables for Design of Pipe Rupture Restraints[1]

Stress	Allowable
1. Tension	1.5 x (Allowable stress from AISC manual)
a. On the net section, except at pinholes	~~F_t=.90Fy~~
b. On the net section at pinholes in eye-bars pin connected plates of builtup members	~~F_t=.66Fy~~
2. Shear	~~F_v=.55Fy~~
3. Compression	~~Fa=1.5x(AISC formula 1.5-1) but not to exceed Fa=23/18x(AISC formula 1.5-2)~~
4. Bending	~~F_b=1.33x(AISC Section 1.5.1.4)~~
5. Combined Stresses	~~per AISC Section 1.6 with F_t, F_v, F_a and F_b as modified above. Fe may be modified by 23/18 x (AISC formula)~~
6. Bolts ~~2~~	
a. Tension	~~60.0 ksi~~
b. Shear	~~22.5 ksi~~
7. Welds	
a. full penetration	~~equal to base material allowable~~
b. ~~fillet~~ partial penetration	~~1.5 x (AISC code)~~
c. fillet	

[1]Rupture restraints may also be designed to F-1300 of Appendix F to Section III of the ASME code. Also see Sections 3.6.2.3.2 and 3.6.2.3.3.

~~[2]For A193 bolts 1-1/8 inches in diameter and greater, a larger allowable shear and tensile value may be used, provided the factor of safety of slip, calculated in accordance with Commentary Section C4 of the Specification for Structural Joints is equal to, or greater than, that for A325 bolts.~~

~~[3]Anchor bolts which are drilled through a wall of floor and are pretensioned may be pretensioned with a value less than the proof load, provided the allowable shear is reduced in accordance with the formulas in AISC Section 1.6.3.~~

8. Crushing strength of crush pads are designed and purchased in accordance with individual device requirements shown on applicable drawings.
9. Crush pipes are designed using yield strength per actual mill test reports.

Item 108 - 3.6.2.5, page 3.6-29

Item c) - The locations of pipe whip restraints are not shown in the Figures 3.6.2-9 thru 3.6.2-36. Provide locations of all pipe whip restraints, jet barriers, and enclosures.

Response:

To determine the location of the restraint, you must identify the particular restraint used for a particular break, reference Table 3.6.2-7 and 3.6.2-8 (Summary of protection requirements). Then refer back to the figures (3.6.2-9 thru 3.6.2-36) showing the location of the break and find that particular restraint.

Jet barriers cannot be shown on the piping isometric drawings because jet barrier location can be anywhere between the source break and the target.

Item 109 - 3.7.2.14, page 3.7-36 (Proprietary version sent under separate letter) Provide justification that for the Catawba SSE, the fuel assembly displacements are large enough to result in no damping values less than 10%.

Response:

The fuel assembly damping values are measured from mechanical tests in both air and still water environments which envelop specific Catawba plant conditions. The measured damping characteristics indicated that the damping value tends to increase as a result of increasing fuel assembly deflection amplitude. The fuel assembly damping value measured in the submerged flow conditions are much higher than that obtained in air. Furthermore, the incore neutron detector results indicated a very high fuel assembly damping value due to hydrodynamic effects and inter-fuel assembly rubbing in a closely packed reactor core.

Under a postulated faulted condition transient such as an SSE or LOCA, the fuel assembly deflection amplitude generally reaches the physical limit imposed by accumulated inter-fuel assembly gaps. In order to accurately predict the fuel assembly dynamic responses under the postulated transients, a uniform [ ]+(a,b,c) damping value was imposed for all modes as a result of mechanical damping. An additional [ ]+(a,b,c) was included for the fuel assembly fundamental mode to account for the hydrodynamic effects; the damping combination for the fuel assembly model was calculated using the method of combining mass and stiffness damping coefficients. These damping values used for the fuel assembly analysis are conservatively justified, based on the measured results from in-core neutron detectors.

Additionally, Westinghouse has monitored in plant vibration of fuel assemblies. This data indicates that fuel assembly displacements in the range of .001 inch results in damping value in excess of [ ]^{a,b,c}. The results of this study have been published in an ASME paper (79-DET-43) entitled, "In-Core Detection of Nuclear Fuel Assembly Vibration."

Based upon the information provided above a fuel assembly damping value of [ ]^{a,b,c} is conservative over the entire range of fuel assembly displacements which could be postulated for the Catawba plant.

In conjunction with this item, Reference 4 in Section 3.7 (pg. 3.7-36) should be revised as follows:

Beaumont, M. D. (et.al.) Ed., "Verification Testing and Analyses of the 17x17 Optimized Fuel Assembly, "WCAP-9401-P-A/WCAP-9402-A dated August, 1981.

Based upon the above discussion and the attached FSAR changes, this item was resolved.

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ATTACHMENT TO ITEM 109

In-Core Detection of Nuclear Fuel Assembly Vibration

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Mem. ASME

In order to monitor in-plant vibrations of Westinghouse pressurized water reactor nuclear fuel assemblies, neutron flux variations were measured at fuel rod support locations. Fuel assemblies were monitored, at various core locations, in two operating nuclear power plants. The monitored assemblies produced frequencies and mode shapes which closely matched out-of-core test results. Digital analysis techniques described in this report can be applied to many other testing situations.

Contributed by the Design Engineering Division of the American Society of Mechanical Engineers for presentation at the Design Engineering Technical Conference, St. Louis, Mo., September 10-12, 1979. Manuscript received at ASME Headquarters May 29, 1979.

Copies will be available until June 1, 1980.

UNITED ENGINEERING CENTER, 345 EAST 47th STREET, NEW YORK, N.Y. 10017

In-Core Detection of Nuclear Fuel Assembly Vibration

W. J. BRYAN

ABSTRACT

In order to monitor in-plant vibrations of Westinghouse pressurized water reactor nuclear fuel assemblies, neutron flux variations were measured at fuel rod support locations. Fuel assemblies were monitored, at various core locations, in two operating nuclear power plants. The monitored assemblies produced frequencies and mode shapes which closely matched out-of-core test results. Digital analysis techniques described in this report can be applied to many other testing situations.

NOMENCLATURE

Applied force	= $f(t)$
critical damping coefficient	= C_c
damping constant	= c
Fourier transform function	= $X(j\omega)$
Fourier transform of output	= $O(j\omega)$
Fourier transform of input	= $I(j\omega)$
frequency	= ω
frequency response	= $H(j\omega)$
fuel assembly frequency measured divided by the fuel assembly calculated frequency	= θ
function in the time domain	= $x(t)$
Laplace variable	= s
Laplace transformed function	= $X(s)$
Laplace transform of output	= $O(s)$
Laplace transform of input	= $I(s)$
mass	= m
Modal damping coefficient	= ξ
natural frequency	= ω_m
resultant displacement	= x
rms value of vibration components between two frequencies	= σ
spring constant	= k
time	= t
transfer function	= $G(s)$

INTRODUCTION

To monitor nuclear fuel assembly vibrations within a Westinghouse pressurized water reactor core, a program employing movable in-core neutron detectors within the instrument tube of fuel assemblies was initiated. Neutron flux measurements were taken from two operating nuclear cores. Flux measurements, within selected fuel assemblies, were made at each fuel rod support (grid) location. The data was recorded on magnetic tape and analyzed with a fast Fourier transform analyzer. In this manner, a comparison of relative grid-to-grid displacement was made for a given fuel assembly, thereby, establishing its dynamic characteristics. A typical fuel assembly is shown in Figure 1.

DETERMINATION OF FUEL ASSEMBLY DYNAMIC CHARACTERISTICS

Fuel assembly vibrational characteristics during in-core tests were determined using modal analysis techniques. Modal analysis is a process of characterizing the dynamic properties of an elastic structure by identifying its modes of vibration. That is, each mode has a specific natural frequency and damping factor which can be identified from almost any point on the fuel assembly. In addition, the mode has a particular shape which defines it spatially over the entire assembly.

The tests consisted of recording time history neutron flux variations on magnetic tape and then reducing them via Fourier and Laplace transforms on a digital Fourier analyzer. The Fourier transforms were used for computing frequency response, power spectrum, and coherance functions. The Laplace transform was employed to compute analytical expressions for transfer functions from frequency response measurements. In the past, the disadvantage of transformation analysis was in the solving of the resulting

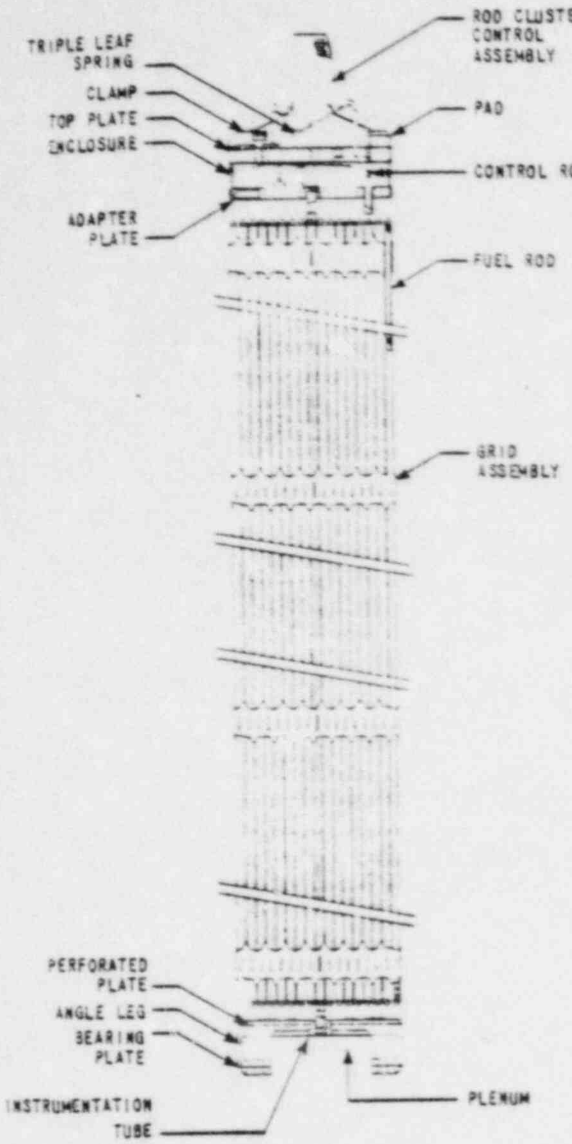

Fig. 1 Typical Fuel Assembly

integral equation, this was especially true for experimental data. However, with the advent of the digital computer and related transformation algorithms, experimental data is now quite easily handled. In fact, the relationships between the time, frequency, and Laplace domains are well defined quantities in today's digital Fourier analyzers, making them perfect analysis tools.

The Fourier and Laplace transforms are mathematical methods that allow data to be transformed from one independent variable to another: Fourier transforms time to frequency; Laplace transforms time to the Laplace s-variable. The Fourier transformation pair is defined as:

$$X(j\omega) = \int_{-\infty}^{\infty} x(t)e^{-j\omega t}dt \tag{1}$$

and

$$x(t) = \int_{-\infty}^{\infty} X(j\omega)\, e^{j\omega t}d\omega \tag{2}$$

where equation (1) is the forward transformation and equation (2) is the inverse transformation.

$X(j\omega)$ also contains the amplitude and phase information at every frequency present in $x(t)$ without stipulating $x(t)$ to be periodic.

In the same manner, the Laplace transform pair is defined as:

$$X(s) = \int_{0}^{\infty} x(t)e^{-st}\, dt \tag{3}$$

and

$$x(t) = \frac{1}{2\pi j}\int_{\sigma_1 - j\infty}^{\sigma_1 + j\infty} X(s)\, e^{st}\, ds \tag{4}$$

where equation (3) is forward transformation and equation (4) the inverse transformation.

The frequency response of the system is defined as the Fourier transform of the output divided by the Fourier transform of the input, or:

$$H(j\omega) = \frac{O(j\omega)}{I(j\omega)} \tag{5}$$

In the same manner, the transfer function is defined as the Laplace transform of the output divided by the Laplace transform of the input, or:

$$G(s) = \frac{O(s)}{I(s)} \tag{6}$$

In these processes of signal transformation, information is gained or lost as it is transformed from one domain to another. An example of presenting the same information in three different domains is shown in Figure 2. In the time domain, the transform function is the unit impulse response; in the frequency domain, it is the frequency response function; and in the Laplace or s-domain, it is the transfer function. Table 1 summarizes the transfer functions in their different forms.

The dynamic or apparent stiffness, impedance or mechanical impedance, and dynamic or apparent mass are all ratios of input force excitation to response motion and identify resonant frequencies by minimum values, or valleys in the graphic presentation. The dynamic compliance or compliance, mobility, and inertance are reciprocal relationships of the previous transforms, thus, resonant frequencies are identified as maximum values, or peaks, in the graphic presentations.

TABLE 1

DIFFERENT FORMS OF THE TRANSFER FUNCTION FOR MECHANICAL SYSTEMS

$\frac{\text{Displacement}}{\text{Force}}$ = Dynamic Compliance or Compliance

$\frac{\text{Force}}{\text{Displacement}}$ = Dynamic Stiffness or Apparent Stiffness

$\frac{\text{Velocity}}{\text{Force}}$ = Mobility

$\frac{\text{Force}}{\text{Velocity}}$ = Mechanical Impedance or Impedance

$\frac{\text{Acceleration}}{\text{Force}}$ = Inertance

$\frac{\text{Force}}{\text{Acceleration}}$ = Dynamic Mass or Apparent Mass

It can be shown that for a simple single degree-of-freedom system the Laplace transform equation can be written as:

$$X(s) = \frac{F(s)}{ms^2 + cs + k} \tag{7}$$

The denominator is called the characteristic equation, since the roots of the equation determine the character of the time response. The roots of the characteristic equation are known as poles or singularities of the system, and the function becomes zero at their locations. The roots of the numerator polynominal are called the zeroes of the system. These poles and zeroes are located at critical frequencies of the system. Therefore, the transfer function of a dynamic system is defined as the ratio of the output of the system to the input to the s-domain. It is, by definition, a function of the complex variable s. If a system has m inputs and n resultant outputs, then the system has mxn transfer functions.

The transfer function which relates the displacement to the force is referred to as the compliance transfer function and is expressed as:

$$H(s) = \frac{X(s)}{F(s)} \tag{8}$$

Therefore, for the single degree of freedom system

$$H(s) = \frac{1}{ms^2 + cs + k} \tag{9}$$

Since s is complex, the transfer function has a real and an imaginary part, and it can be represented by points in a plane. This plane is referred to as the s-plane. Any complex value of s may be located by plotting its real component on one axis and its imaginary component on the other. The magnitude of the function can be plotted as a surface above the plane. If the frequency response function of the system was measured using a Fourier transform, the function frequency would be complex-valued. It would be represented by its real and imaginary parts, or equivalently, by its magnitude and phase. The Fourier transform, as seen previously, is obtained by merely substituting $j\omega$ for s. This special case of the transfer function is called the frequency response function, and it is the basic concept used in spectrum analyzers. Hence, the Fourier transform is merely the Laplace transform evaluated along the $j\omega$, or frequency axis, of the complex Laplace plane.

The analytical form of the frequency response function is found, therefore, by letting $s = j\omega$:

$$H(j\omega) = \frac{1}{-m\omega^2 + jc\omega + k} \tag{10}$$

Substituting ω_n and ξ, and letting $F(j\omega = kf(j\omega)$ then, $H(j\omega)$ becomes

$$\frac{X(j\omega)}{f(j\omega)} = H(j\omega) \frac{1}{1 + 2\xi j\left(\frac{\omega}{\omega_n}\right) - \frac{\omega^2}{\omega_n^2}} \tag{11}$$

This equation is the classical form of the frequency response function.

The equation of motion of an n degree-of-freedom system and its Fourier and Laplace transforms can be set up in the same fashion incorporating matrix methods. In matrix form, H(s) is defined as the inverse of the system matrix and completely defines the dynamics of the system. The residues from any row or column of [H(s)] define the system mode shapes for the natural frequencies which are determined from the system poles. The poles also determine the system damping values. The n global system values for the pole locations will be the same for all transfer functions in the system because the modes of vibration of an elastic system are global properties. However, the value for the residues depend on the particular terms of the function and are unique for each system. In addition, values of the residues determine the amplitude of the resonance in each transfer function. Therefore, the four properties of any vibration can be determined, namely, its natural frequency, damping, magnitude, and phase. Except for positions at node points, these model parameters can be identified from any row or column of the transfer function matrix [H]. Therefore, from a testing point of view, these techniques offer important time saving advantages.

In a reactor core, nuclear fuel assemblies are subjected to pressure fluctuations caused by high-speed coolant flow. These pressure fluctuations cause flow-induced vibrations in the assemblies. The identification of the coolant flow pressure fluctuations, as well as their effects on the operation and life of the fuel assembly, is paramount. To determine these effects, the dynamic characteristics of the assemblies must be determined, however, before statistical methods used to determine these effects can be employed, data must be categorized. In particular, the excitation and response must be tested for randomness and whether they are stationary or nonstationary. Additional tests can divide stationary data, placing them into ergodic or non-ergodic categories. Data distribution must be known, so that, proper error formulas are used. All data can be analyzed using specialized techniques, however, this paper presents only random, stationary data. For any real system, random, stationary data can not be collected and, therefore, judgment must be used when evaluating analytical results.

Because F(t) is assumed to be random and stationary in nature, the probability distribution for vibrational amplitude, in a given direction, is Gaussian, and it can be written about a zero mean, as:

$$P_Y(y) = \frac{1}{\sqrt{2\pi}\,\sigma} \exp\left[-1/2 \left(\frac{y}{\sigma}\right)^2\right] \tag{12}$$

which implies that σ, the standard deviation, for a zero mean value, is equal to the rms value. The probability that an observed value of displacement will range between $-y_o$ and y_o, or cumulative distribution, is determined by the integration:

$$P\left[-y_o \leq y \leq y_o\right] =$$

$$\int_{-y_o}^{y} P_Y(y)\,dy = \frac{1}{\sqrt{2\pi}\,\sigma} \int_{-y_o}^{y} \exp\left[-1/2 \left(\frac{y}{\sigma}\right)^2\right] dy \tag{13}$$

The normal probability integral or cumulative distribution, has been evaluated and is tabulated in various sources. Several values are listed below:

n	P(-n≤y≤n)
0.5	0.383
1.0	0.683
1.5	0.866
2.0	0.954
2.5	0.988
3.0	0.997

Therefore, vibrational amplitude 0 to peak will be greater than 3σ for 0.3 percent of the time.

From this probabilistic view, σ, defined as the rms value of vibration amplitude components between two given frequency limits is obtained directly from the power spectrum as:

$$\sigma = \left[\int_{f_1}^{f_2} \sigma^2\, df\right]^{1/2} \tag{14}$$

which is the square root of the area under the power spectral density curve.

In addition to this information, the power spectral density curve can be used to obtain a damping value for a lightly damped system, i.e., $(\xi \ll 1) = \sqrt{1-\xi^2} = 1$. The mean squared response was equal to:

$$\bar{x}^2 = \frac{1}{2\pi} f \int_0^\infty |H(j\omega)|^2 \, d\omega \tag{15}$$

where $f(j\omega) = f$, a constant power spectral density function for white noise.

Substituting, the mean square response becomes

$$\bar{x}^2 = \frac{1}{2\pi} f \int_0^\infty \frac{1}{\left[1 - \left(\frac{\omega}{\omega_n}\right)^2\right]^2 + 4\xi^2 \frac{\omega^2}{\omega_n^2}} \, d\omega \tag{16}$$

The integral can be evaluated by the method of residues to obtain.[6]

$$\bar{x}^2 = \frac{f}{2\pi} \left(\frac{\pi}{4} \frac{\omega_n}{\xi}\right) = \frac{f\omega_n}{8\xi} \tag{17}$$

The value of the integral $\int_0^\infty |H(j\omega)|^2 \, d\omega$ is equal to

$\frac{\pi \omega_n}{4\xi}$

From these equations, it follows that the peak value of $|H(j\omega)|$ occurs at the natural frequency of the system ω_n.

$$|H(j\omega_n)| = \frac{1}{2\xi} \tag{18}$$

In Figure 3, the frequencies ω_1 and ω_2 are called the half power points. The frequency difference $(\omega_2 - \omega_1)$ is referred to as the bandwidth of the complex frequency response function $H(j\omega)$ and the modal damping coefficient can be determined by.[6]

$$\xi = \frac{|\omega_1 - \omega_2|}{2\omega_n} \tag{19}$$

To obtain the data for analysis, movable in-core neutron flux detectors were used. These detectors move vertically in the instrumentation tube of the fuel assemblies. The detectors measure the horizontal variation of neutron flux attenuation by changing current in its ion chamber. Thus, with the correct proportionality constant, the variations in neutron flux provide relative amplitudes of vibration between grid locations, absolute amplitudes, frequency, and damping content. To assure the relative amplitude of one grid motion to another, the neutron flux detector was positioned vertically at the minimum instrument signal within the grid. This was then checked by the insertion length of the neutron flux detector into the core.

Nuclear noise data was recorded on magnetic analog tape during start-up data collection periods at two nuclear plant sites. During data collection, reactor power levels were held at 30 percent, 32.5 percent, and 100 percent at full flow conditions. Fuel assemblies which were monitored were located such that all the possible core baffle boundary conditions present in the reactors were analyzed. These conditions were adjacent to two fuel assemblies and two baffle walls, adjacent to three fuel assemblies and one baffle wall, and adjacent to four fuel assemblies.

The following assumptions were made in the data reduction processes: 1) Fuel assembly vibrations were linear, 2) Random forcing function was used to excite fuel assembly vibrations. The first assumption was confirmed by the small assembly vibrational amplitudes. The second assumption was confirmed by the normal distribution of the neutron flux data.

To obtain frequencies, pikes were located on the spectral plots and their corresponding frequencies recorded. These plots were calculated in the frequency range of 0-50 Hz with a spectral resolution of 0.125 Hz and a noise bandwidth of 0.198 Hz. For each spectrum, sixty-four continuous spectral averages were performed. To normalize the spectrum, the results were divided by the measured dc level, which is proportional to the steady state flux. The error of the spectral density was approximately ± 10 percent. The first three frequencies of a typical fuel assembly are presented in terms of θ, the test frequency measured divided by the calculated frequency, in Figure 4. Test frequencies compared well to analytically calculated frequencies.

Fuel assembly motion was determined by the integration of the spectrum between frequency limits of interest (equation 14). This was accomplished by the use of a fast Fourier transform analyzer and a post-processing minicomputer. A transformation of neutron flux to displacement was performed and then normalized on a per mode basis. Typical fuel assembly mode shapes are shown in Figure 4. These values are presented next to analytical results determined by use of finite element methods and confirmed by out-of-core testing. Both methods showed good agreement with in-core test results. A typical σ displacement was found to be 0.1 mm and occured in modes 1 and 2. This displacement was found to be higher than that obtained in out-of-core test results but not high enough to cause assembly rubbing or impacting. The assembly which showed the largest amplitude of vibration, in one of the plants, was examined after its first cycle of use. No scuffing marks on any of its grids were observed, thus, further verifying the assumption of a linear fuel assembly vibration.

The best estimate damping curve for the fuel assemblies is presented in Figure 5. The damping coefficients were obtained by use of equation (19). These coefficients were found to be higher than those measured in air bench tests.

CONCLUSIONS

The in-core neutron flux detection tests demonstrated:

1) A movable neutron detector can be used to measure fuel assembly vibration characteristics during reactor operations.

2) The fuel assemblies which were monitored generally produced frequencies and mode shapes which matched out-of-core test and analytical results.

3) The damping coefficients obtained under reactor conditions are greater than those measured in air in bench tests.

4) The use of digital analyzer techniques greatly reduces the time and effort required to analyze the test data. These time-saving techniques can be applied to many similar test situations.

ACKNOWLEDGEMENTS

The work of K. L. Schmugar for initiating the program and setting up the data collection procedures, and the efforts of R. Gopal and W. Ciaramitaro for directing of the recording and reduction of neutron flux data to spectrum plots are acknowledged.

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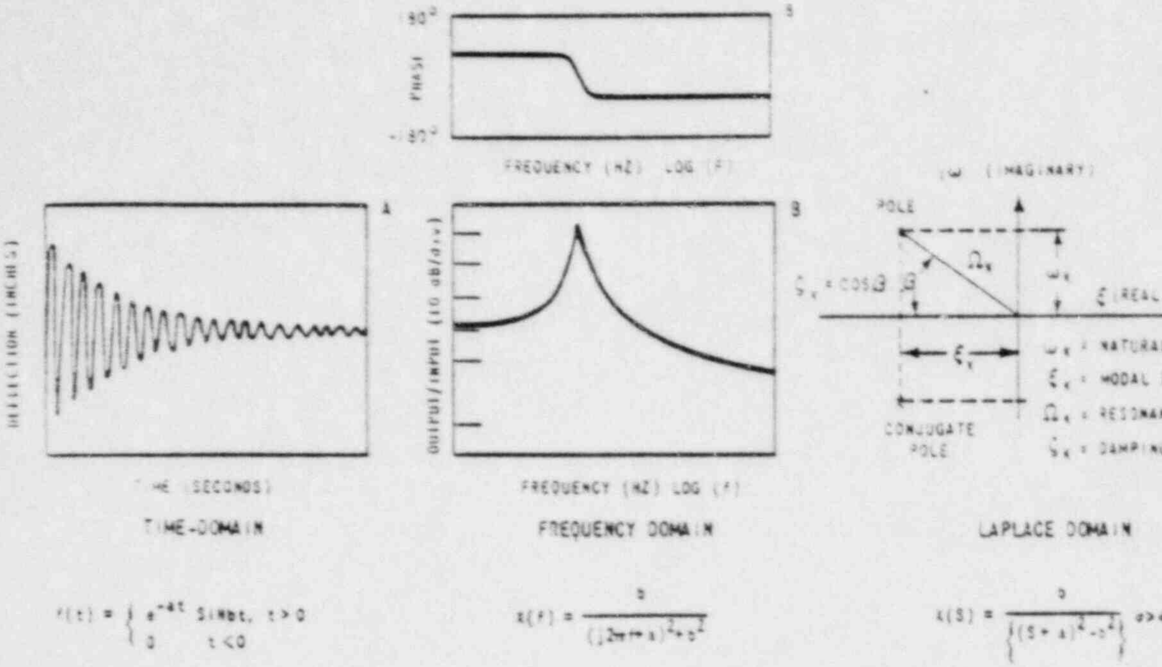

Figure 2. A Mechanical System Can Be Described In: (A) The Time Domain, (B) The Frequency Domain or (C) The Laplace Domain. (7)

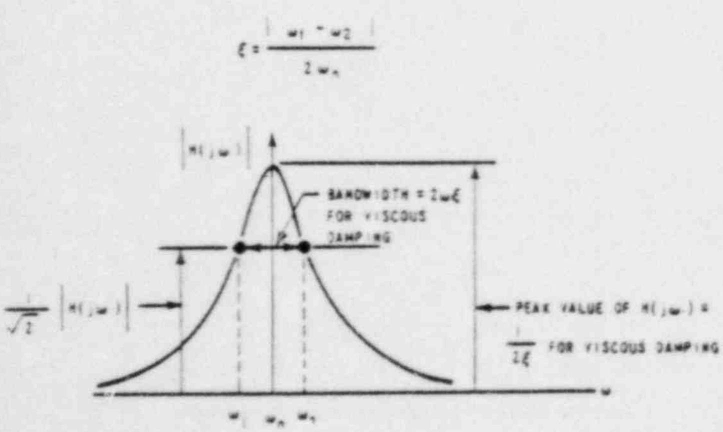

Figure 3. A Plot of H(jω) vs. ω for a Single Degree of Freedom (1)

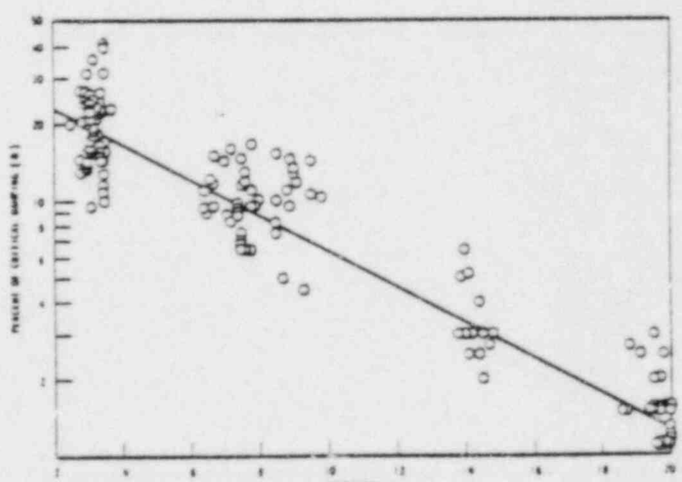

Figure 5. Best Estimate Damping Curve for the Assembly, In-Core Conditions (1)

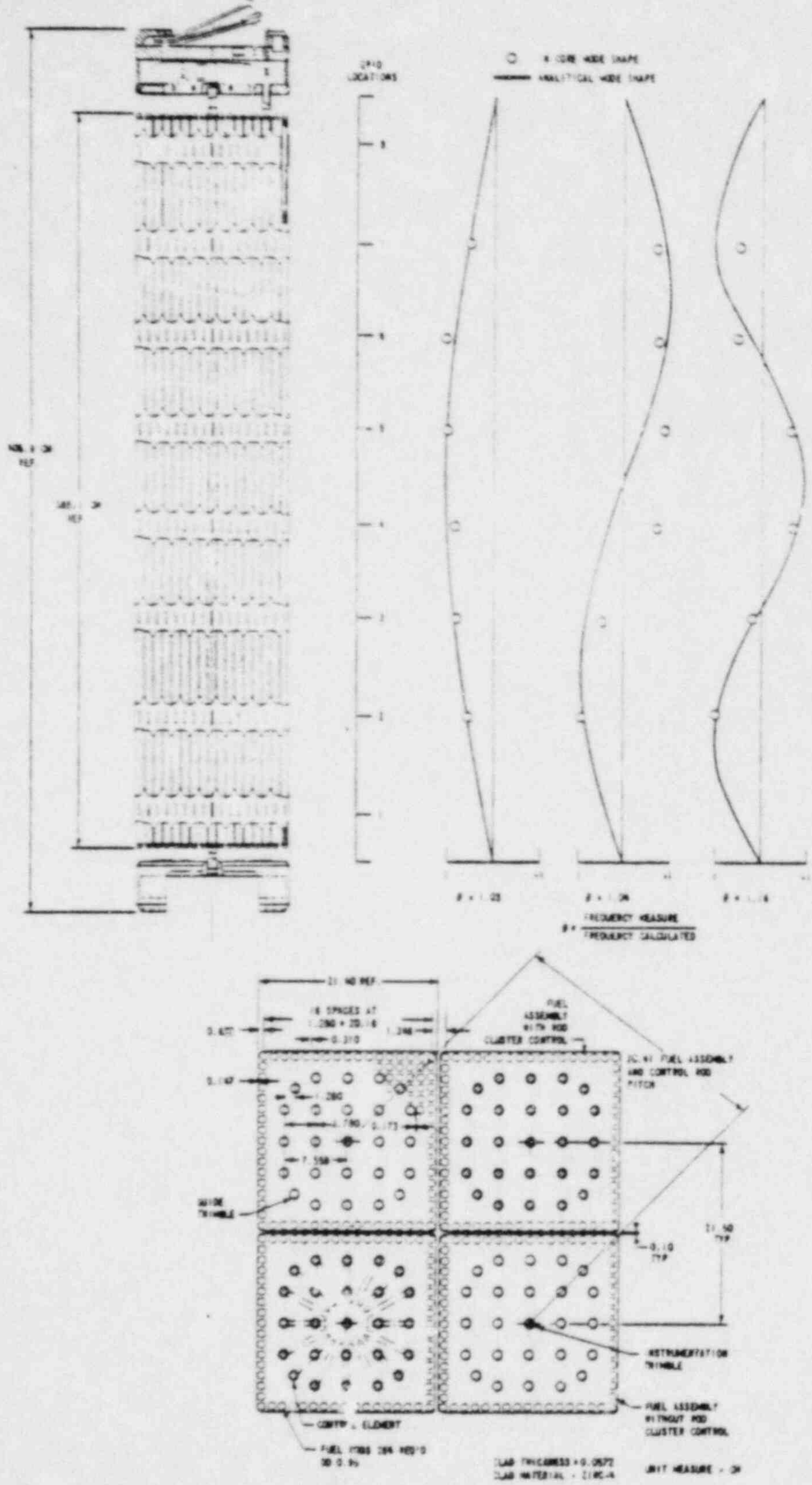

Figure 4. Typical Fuel Assembly Mode Shapes and θ Factor (1)

Item 110 - 3.9.3.3, page 3.9-32

The applicant states that "since Catawba has a slightly higher flow rate than Trojan, vibration levels due to the core barrel excitation are expected to be somewhat greater than those of Trojan." Provide assurance that the vibration levels in the reactor will not cause failure of the reactor neutron shield boltings which might result in the dropping of the neutron shielding pads.

Response:

The neutron shield pad is fastened to the core barrel using 16, 7/8 inch, bolts. Due to the preload of the neutron pad bolts, a high friction force exists between the neutron pad and the core barrel. The analysis shows that this friction force is more than sufficient to eliminate any relative motion between the neutron pad and the core barrel, i.e., cyclic loading of the neutron pad bolts due to dead weight, seismic, hydraulic and vibratory loads. Thus, the vibratory loads will not cause fatigue failure of the neutron pad bolts.

The neutron shield pad is also secured to the core barrel using 3, 2 3/8 in. dia., steel pins which provides added assurance that the neutron pad will not drop off the core barrel.

The properties of these bolts were also discussed. Westinghouse indicated that the subject bolts were 316 stainless steel with a minimum yield strength of 65,000 psi and a minimum tensile strength of 90,000 psi. The preload on these bolts is 70% of the minimum yield strength.

Based upon the above discussion, this item was resolved.

Item III - Unit 1 incorporates a Model D3 steam generator. Unit 2 incorporates a Model D5 steam generator. Provide assurance that the Model D3 S/G tubes are adequately designed to prevent failure and adverse secondary side leakage.

Response:

Model D3 steam generators for Catawba Unit 1 and Model D5 steam generators for Unit 2 are designed and manufactured in accordance with the ASME Code Section III Class 1 requirements. Tube degradation mechanisms encountered on steam generators are addressed here.

Tube Thinning - Tube thinning occurred with the use of phosphate chemistry secondary side water treatment. The Catawba units will utilize an all volatile type (AVT) chemistry treatment program and such tube thinning susceptiblity should not be a concern.

Tubesheet Crevice Corrosion - The tubes in these steam generators are expanded full depth in the tubesheet. Full depth expansion eliminates the tubesheet crevice and, therefore, crevice corrosion should not occur in these steam generators.

Denting - The first line of defense for susceptibility to denting is the use of AVT chemistry control from initial operation of the plant. The Catawba units are equipped with full flow condensate polishers to help control and maintain the secondary chemistry and utilize fresh water for condenser circulating water. Should there be an inleakage to the condensate and steam generator feedwater through the condensers, the chemical makeup of the circulation water would be less severe than if the plant used sea water or brackish water. Also, the large capacity continuous blowdown system contributes to maintaining the AVT chemistry program. The prevention of denting is predicated on maintaining the chemistry program and reducing to a minimum any periods of operation with off-normal chemistry.

Row 1 "U" Bend Cracking - Row one "U" bend cracking has only occurred in some plants with Model 51 steam generators. The cracking has been attributed to the small bend radius of the row one U bend and the residual stresses in the tube. The steam generators for the Catawba Units are Model D type with different size tubing and a larger row one "U" bend radius, which contribute to lower bending and residual stresses. Row one cracking is not expected to be a concern for these steam generators.

Tube Corrosion in Sludge - The sludge management program is expected to reduce the amount of sludge in the generators to a minimum. The AVT chemistry program reduces or should eliminate deposit of hard sludge so that tube corrosion in sludge should not be a concern in these steam generators. Additionally, the Catawba steam generators are designed to allow sludge lancing during outages to further reduce any sludge inventory that remains in the steam generator.

Flow Induced Vibration at Feed Inlet

Please refer to Duke Power Co., February 23, 1982, letter [1] response to NRC letter of January 22, 1982, regarding possible tube damage due to flow induced vibrations.

[1] Duke letter, W. O. Parker, Jr., to H. R. Denton, NRC, dated February 23, 1982.

Item 112 - 3.7.3.6, page 3.7-29

This section refers to 3.7.2.6 for a discussion of the method Westinghouse uses to account for three components of earthquake motion. For the NSSS piping, how are the three components of earthquake motion handled in the seismic analysis?

Response:

Westinghouse performed a two-dimensional seismic analysis for the Catawba plant. The directional inputs were combined algebraically. The components in the N-S and vertical directions were combined. The components in the E-W and vertical directions were also combined. The two resultants were compared and the larger magnitude used in the analysis.

Based on the above discussion, this item was resolved.

Item 113 - 3.9.3.1

A table of stress criteria and design loading combinations similar to Tables 3.9.3-1 and Table 3.9.3-1 and Table 3.9.3-2 is required for core support structures and component supports.

Response:

The loading combinations for core support structures were discussed and Westinghouse agreed to provide a new table (attached) in the FSAR to address this item. As identified in Item 7, it was pointed out that the core support structures were procured prior to implementation of Subsection NG of the Code. Thus it was agreed to add a footnote to the table indicating how the core support structures compared with ASME Code requirements. It was also agreed that the content of the footnote would also be incorporated in the FSAR text.

Attachment to Item 113

Table 3.9.3-1(A)

Design Loading Combinations for ASME Code Core Support Structures*

Condition Classification	Loading Combination
Design	Design Pressure, Design Temperature, Deadweight
Normal	Normal Condition Pressure, Normal Condition Metal Temperature, Deadweight, Nozzle Loads
Upset	Upset Condition Pressure, Upset Condition Metal Temperature, Deadweight, Nozzle Loads, Operating Basis Earthquake
Faulted	Faulted Condition Pressure, Faulted Condition Metal Temperature, Deadweight, Nozzle Loads, Safe Shutdown Earthquake

*By contract, this plant preceeded the application of Subsection NG of Section III of the ASME Code. Therefore, these internals are not "stamped" and no specific stress report is required. Nonetheless, the internals are designed to meet the intent of the code.

ATTACHMENT TO ITEM 113

CNS

The results obtained from linear analyses indicate that the relative displacement between the components will close the gaps and consequently the structures will impinge on each other. Linear analysis will not provide information about the impact forces generated when components impinge on each other; however, in some instances, linear approximations can, and are applied prior to and after gap closure. The effects of the gaps that could exist between vessel and barrel, between fuel assemblies, between fuel assemblies and baffle plates, and between the control rods and their guide paths were considered in the analysis using both linear approximations and non-linear techniques. Both static and dynamic stress intensities are within acceptable limits.

Even though control rod insertion is not required for plant shutdown, this analysis shows that most of the guide tubes will deform within the limits established experimentally to assure control rod insertion. For the guide tubes deflected above the no loss of function limit, it must be assumed that the rods will not drop. However, the core will still shut down due to the negative reactivity insertion in the form of core voiding. Shutdown will be aided by the great majority of rods that do drop. Seismic deflections of the guide tubes are generally negligible by comparison with the no loss of function limit.

3.9.2.6 Correlations of Reactor Internals Vibration Tests With the Analytical Results

As stated in Section 3.9.2.3, it is not considered necessary to conduct instrumented tests of the Catawba reactor vessel internals. Adequacy of these internals will be verified by use of the Sequoyah and Trojan results.

3.9.3 ASME CODE CLASS 1, 2 AND 3 COMPONENTS, COMPONENT SUPPORTS AND CORE SUPPORT STRUCTURES

The ASME Code Class components are constructed in accordance with the ASME Boiler and Pressure Vessel Code, Section III.

Detailed discussion of ASME Code Class 1 components is provided in Section 3.9.1 and 5.4.

For core support structures, design loading conditions are given in Section 3.9.5.2. (+ Insert a) item 113

In general, for reactor internals components and for core support structures the criteria for acceptability in regard to mechanical integrity analyses are that adequate core cooling and core shutdown must be assured. This implies that the deformation of the reactor internals must be sufficiently small so that the geometry remains substantially intact. Consequently, the limitations established on the internals are concerned principally with the maximum allowable deflections and stability of the parts in addition to a stress criterion to assure integrity of the components.

For the loss of coolant plus the safe shutdown earthquake condition, deflections of critical internal structures are limited. In a hypothesized downward vertical

ATTACHMENT TO ITEM 113

INSERT A

The design loading combinations for the ASME Code case support structures are given in Table 3.9.3-1(A). It is to be noted that the reactor internals of this plant are not "stamped" and no specific stress report is required. Nontheless, the internals are designed to meet the intent of the ASME Code.

Item 114 - 3.9.3.3.1, page 3.9-50

The ASME Code is referenced several times. Any reference to the ASME Code should specify the part of the code being referenced.

Response:

Section 3.9.3.3.1, page 3.9-50 discusses overpressure protection for the Main Steam System. This section references Chapter 10 for further description of ASME Code requirements. Section 10.3.1 references Table 3.2.2-2 which presents the design codes applicable to the Main Steam Supply System. The SM (Main Steam) System and SV (Main Steam Vent) System listed in Table 3.2.2-2 (page 8)indicate the applicable code is ASME Boiler and Pressure Vessel Code-Section III, Class 2.

Whenever practical, FSAR revisions referencing the ASME Code will include the applicable ASME section.

Item 115 - 3.9.5.2, page 3.9-52

The applicant has not included asymetric loads in the list of design loading conditions for the reactor internals. Assurances must be provided the reactor internals have been analyzed for asymetric loads.

Response:

See Item 83 for a discussion of asymmetric LOCA leads.

Item 116 - Table 3.9.2-2

Table 3.9.2-2 lists the maximum deflections for reactor internal support structures. The allowable and the no-loss-of function deflections are the same for the upper barrel (radial) component. Provide assurances that this provides for an adequate margin of safety.

Response:

The actual deflections on reactor internals were presented to the Staff and found to be acceptable. Westinghouse agreed to revise the FSAR to indicate that all deflections were acceptable. However, in reviewing the FSAR (attached) it was determined that the appropriate information is already contained in Section 3.9.4. The attached information is similar to those resulting from other MEB review meetings.

Based upon the information presented to the Staff and the attached FSAR material, this item was resolved.

ATTACHMENT TO ITEM 116

CNS

2. The barrel with the core is analyzed as a beam elastically supported at the top and at the lower radial support and the dynamic response is obtained.

Guide Tubes - The dynamic loads on rod cluster control guide tubes are more severe for a loss of coolant accident caused by hot leg rupture than for an accident by cold leg rupture since the cold leg break leads to much smaller changes in the transverse coolant flow over the rod cluster control guide tubes. The guide tubes in closest proximity to the ruptured outlet nozzle are the most severely loaded. The transverse guide tube forces during a blowdown decrease with increasing distance from the ruptured nozzle location.

A detailed structural analysis of the rod cluster control guide tubes is performed to establish the equivalent cross section properties and elastic end support conditions. An analytical model is verified by subjecting the control rod cluster guide tube to a concentrated force applied at the midpoint of the lower guide tube. In addition, the analytical model has been previously verified through numerous dynamic and static tests performed on the 17 x 17 guide tube design.

The response of the guide tubes to the transient loading from blowdown is found by representing the guide tube as an equivalent single degree of freedom system and assuming the slope of the time dependent load to be a step function with constant slope front end.

Upper Support Columns - Upper support columns located close to the broken nozzle during hot leg break will be subjected to transverse loads due to cross flow. The loads applied to the columns are computed with a method similar to the one used for the guide tubes, i.e., by taking into consideration the increase in flow across the column during the accident. The columns are studied as beams with variable section and the resulting stresses are obtained using the reduced section modulus and appropriate stress risers for the various sections.

Results of Reactor Internals Analysis

Maximum stresses due to the safe shutdown earthquake (vertical and horizontal components) and a loss of coolant accident (hot leg or cold leg break) were obtained and combined. All core support structure components were found to be within acceptable stress and deflection limits for a loss of coolant accident occurring simultaneously with the safe shutdown earthquake; the stresses and deflections which would result following a faulted condition are less than those which would adversely affect the integrity of the core support structures. For the transverse excitation, it is shown that the barrel does not buckle during a hot leg break and that it meets the allowable stress limits during all specified transients.

Item 116

Also, the natural and applied frequencies are such that resonance problems will not occur.

Item 122

The Post Accident Hydrogen Recombiner Package is incorrectly classified as Safety Class NA. To be acceptable this component should be classified Safety Class 2.

Response:

The post accident hydrogen recombiner package is safety Class 2, subject to QA requirements, and seismically designed. Table 3.2-2 (attached) has been revised to reflect this classification. It should be noted that this item was received after the MEB review meeting and, as such, was not discussed at the meeting.

Based on the attached FSAR revision, this item was resolved.

ATTACHMENT TO ITEM 122

Table 2.2-2 (Page 10)

Summary of Criteria - Mechanical System Components

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System	Component or System	(2) Scope	(3) Safety Class	(4) Code	(5) QA Reqd	(6) Location	(7) Rad Source	(8) Seismic OBE	(8) Seismic DBE	(9) Tornado Wind	(9) Tornado Missile
VN	**Diesel Generator Engine Air and Exhaust System**										
	Intake Filter	D	NA	-	-	DB	-	-	-	X	X
	Intake Silencers	D	NA	-	-	DB	-	-	-	X	X
	Exhaust Silencers	D	NA	-	-	DB	-	-	-	X	X
	Valves	D	3	III-3	X	DB		X	X	X	X
VP	**Containment Purge and Containment Ventilation System**										
	Containment Purge Air Handling Units	D	NNS	-	-	AB	P	-	-	X	X
	Containment Purge Air Exhaust Fans	D	NNS	-	-	[illegible]	P	-	-	X	X
	Containment Purge Air Exhaust Filters	D	NNS	-	-		P	-	-	X	X
	Incore Instr. Room Purge Exhaust Air Handling Unit	D	NNS	-	-	AB	P	-	-	X	X
	Incore Instr. Purge Supply Air Handling Unit	D	NNS	-	-	AB	P	-	-	X	X
	Valves	D	2	III-2	X	AB,C	P	X	X	X	X
VQ	**Containment Air Release and Addition System**										
	Filters	D	NNS	-	-	AB	P	-	-	X	X
	Valves	D	2	III-2	X	AB,C	P	X	X	X	X
	Fans	D	NA	-	-	AB	P	-	-	X	X
VV	**Containment Ventilation System**										
	Upper Containment Ventilation Units	D	NNS	-	-	C	P	-	-	X	X
	Upper Containment Return Air Fans	D	NNS	-	-	C	P	-	-	X	X
	CRDM Vent Fans	D	NNS	-	-	C	P	-	-	X	X
	Lower Containment Vent Units	D	NNS	-	-	C	P	-	-	X	X
	Containment Aux. Charcoal Filter Units	D	NNS	-	-	C	P	-	-	X	X
	Containment Aux. Charcoal Filter Unit Fans	D	NNS	-	-	C	P	-	-	X	X
	Incore Instr. Room Ventilation Units	D	NNS	-	-	C	P	-	-	X	X
VX	**Containment Air Return and Hydrogen Skimmer System**										
	Air Return Fans	D	2	AMCA(12)	X	C		X	X	X	X
	Hydrogen Skimmer Fans	D	2	AMCA(14)	X	C		X	X	X	X
	Valves	D	2	III-2	X	C		X	X	X	X
VY	**Containment Hydrogen Sample & Purge System**										
	Containment Hydrogen Purge Inlet Blower	D	NNS	(10)		RB	-	-	-	X	X
	Containment Sample Blower	D	NNS	(10)		AB	X	-	-	X	X
	Post Accident Elec. Hydrogen Recombiner Pkg.	W	~~NA~~ 2	(20)	X	C	-	X	X	X	X