MASTER

LOFT TECHNICAL REPORT LTR 114-98

RE & C REPORT NUMBER RE-A-78-067

JULY 13, 1978

NOTICE

MN ONLY

PORTIONS OF THIS REPORT ARE ILLEGIBLE. It
has been reproduced from the best available
copy to permit the broadest possible avail-
ability.

LOFT CIS ANALYSIS 1/2"-PCS-6-VA
OUTSIDE PENETRATION S-5B

C. G. Condie

EG&G Idaho, Inc.

IDAHO NATIONAL ENGINEERING LABORATORY

DEPARTMENT OF ENERGY

IDAHO OPERATIONS OFFICE UNDER CONTRACT EY-76-C-07-1570

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

LOFT TECHNICAL REPORT LTR 114-98

RE&C Report # RE-A-78-067

DATE July 13, 1978 *Sh*

WORK REQUEST NO. 52162-700-540

RESEARCH, ENGINEERING AND CONSTRUCTION REPORT ENGINEERING ANALYSIS DIVISION

APPLIED MECHANICS BRANCH

NOTICE
This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

LOFT CIS ANALYSIS 1/2"-PCS-6-VA

OUTSIDE PENETRATION S-5B

C. G. Condie/ *CG Condie*

AUTHOR

CHECKED BY: J. W. Muffett/ *JW Muffett*

APPROVED BY: C. A. Moore/ *CA Moore*

~~THIS DOCUMENT HAS NOT RECEIVED PATENT CLEARANCE AND IS NOT TO BE TRANSMITTED TO THE PUBLIC DOMAIN~~

cc: J. G. Arendts
C. G. Condie
S. M. Gardner (3)
C. A. Moore
J. W. Muffett
AM File (5)

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED *EB*

LOFT TECHNICAL REPORT
LOFT PROGRAM

FORM EG&G-220
(Rev. 12-75)

TITLE LOFT CIS ANALYSIS 1/2"-PCS-6-VA OUTSIDE PENETRATION S-5B		REPORT NO. LTR 114-98
		RE-A-78-067
AUTHOR C. G. Condie	GWA NO. 52162-700-540	
PERFORMING ORGANIZATION Applied Mechanics Branch <i>CA Moore 4-17-78</i>	DATE July 13, 1978	
LOFT APPROVAL <i>4-25-78</i> <i>6-30-78</i> <i>6-29-78</i> <i>[Signature]</i> <i>[Signature]</i> <i>[Signature]</i> PSE PSE C&BSS Supvr.		

PSE

PSE

[Signature]
PSB Mgr.

[Signature]
P&CSB Mgr.

[Signature]
RSB Mgr.

ABSTRACT

Line 1/2"-PCS-6-VA outside the LOFT containment penetration S-5B was analyzed to ASME Code, Subsection NC (Class 2) criteria. This piping is part of the Containment Isolation System. The model considered the piping from the penetration through one isolation valve and to the first wall through which the line passes. Results of this analysis show that this section of the line will meet Class 2 requirements without modification.

CONTENTS

ABSTRACT -----	ii
I. SCOPE -----	1
II. INTRODUCTION -----	2
III. PIPING SYSTEM DESCRIPTION -----	3
1. STRUCTURAL DESCRIPTION -----	3
2. MATERIAL AND GEOMETRIC DATA -----	3
IV. DESIGN AND SERVICE CONDITIONS -----	5
1. DESIGN CONDITIONS -----	5
2. LEVEL A SERVICE CONDITIONS -----	5
3. LEVEL B SERVICE CONDITIONS -----	5
4. LEVEL C SERVICE CONDITIONS -----	5
5. LEVEL D SERVICE CONDITIONS -----	6
6. TEST CONDITIONS -----	6
V. PIPING SYSTEM STRUCTURAL ANALYSIS -----	7
1. WEIGHT ANALYSIS -----	7
2. THERMAL EXPANSION ANALYSIS -----	7
3. SEISMIC ANALYSES -----	7
VI. ASME BOILER AND PRESSURE VESSEL CODE, SECTION III, STRESS ANALYSIS -----	10
1. MINIMUM THICKNESS CHECK -----	10
2. DESIGN, LEVEL A, AND LEVEL B SERVICE CONDITIONS STRESS ANALYSIS -----	11
3. LEVEL C SERVICE CONDITIONS STRESS ANALYSIS -----	11
4. LEVEL D SERVICE CONDITIONS STRESS ANALYSIS -----	11
VII. COMPONENT SUPPORT ANALYSIS -----	12
VIII. SPECIAL CONSIDERATIONS -----	14
IX. CONCLUSIONS -----	15
X. REFERENCES -----	16

CONTENTS (continued)

APPENDIX A -- BASIC DATA, INPUT PARAMETERS -----	A-i
APPENDIX B -- COMPUTER PROGRAM DESCRIPTION -----	B-i
APPENDIX C -- WEIGHT ANALYSIS RESULTS -----	C-i
APPENDIX D -- THERMAL EXPANSION ANALYSIS RESULTS -----	D-i
APPENDIX E -- SEISMIC ANALYSES RESULTS -----	E-i
APPENDIX F -- DESIGN, LEVEL A, AND LEVEL B SERVICE CONDITIONS STRESS ANALYSIS RESULTS -----	F-i
APPENDIX G -- LEVEL C SERVICE CONDITIONS STRESS ANALYSIS RESULTS -----	G-i
APPENDIX H -- LEVEL D SERVICE CONDITIONS STRESS ANALYSIS RESULTS -----	H-i
APPENDIX I -- COMPONENT SUPPORT ANALYSIS RESULTS -----	I-i

TABLES

I. Piping System Valve Design Weights and Centers of Gravity -----	9
II. Minimum Thickness Parameters -----	10
III. Loads on Piping Supports -----	13

FIGURES

1. Piping System Computer Model Plot -----	4
2. SSE-Seismic Response Spectra Envelope -----	8

LOFT CIS ANALYSIS 1/2"-PCS-6-VA
OUTSIDE PENETRATION S-5B

I. SCOPE

This document constitutes the stress report required by Subarticle NCA-3350 of the ASME Boiler and Pressure Vessel Code, Section III, "Nuclear Power Plant Components", 1977 through Winter 1977 Addenda*. The piping system analyzed, to be installed as part of the "Loss-of-Fluid-Test" (LOFT) Reactor, was the 1/2"-PCS-6-VA line outside containment vessel penetration S-5B. The line was analyzed as part of the Containment Isolation System.

*Hereafter referred to as the Code^[1].

II. INTRODUCTION

The piping system was analyzed according to the procedures specified in Subsection NC-3600 of the Code and found acceptable. The governing conditions, engineering assumptions, and analytical techniques used in completing the analysis are described in the following pages. All loading conditions and design data used in performing the analysis were obtained from the design specification^[2].

III. PIPING SYSTEM DESCRIPTION

The 1/2 O.D. piping being analyzed is outside LOFT containment vessel penetration S-5B. The piping passes through an isolation valve at approximately 30' from the penetration and then through a concrete wall where the piping is considered anchored. The valve operator is supported from moving in the horizontal directions.

1. STRUCTURAL DESCRIPTION

Figure 1 is an isometric plot of the Class 2 piping system analyzed in this report. The data points and elements are identified on the plot and a listing of the geometric data used in performing the system's structural analysis appears in Appendix A.

2. MATERIAL AND GEOMETRIC DATA

The piping has the following design parameters:

O.D. (inches)	.84
Thickness (inches)	.147
Weight (lbs/inch)	1.19
Material	A 376 Gr. TP 316
E_{cold} (10^6 psi)	28.3
S (100°F) (psi)	18,800
S_y (psi)	30,000
α (10^{-6} in./in. °F)	9.16

The expansion coefficients and thermal conductivities of SA-376, Gr. TP 316 steel are defined in Tables I-4.0 and I-5.0 of the Code.

LOFT CIS ANALYSIS - 1/2 -PCS-6-VA (CJ)
 NUPIPE MATHEMATICAL MODEL

••LEGEND••

- / - NODE LOCATION
- - MASSPOINT LOCATION
- - SPRING HANGER
- - SNUBBER
- - RIGID SUPPORT
- - ANCHOR
- * - ELASTO JOINT
- - FLEXIBLE ANCHOR
- - VALVE

ROTATION ABOUT Y-AXIS
 X-Z PLANE TILT

45.4 DEG.
 45.4 DEG.

See Reference 4.

CTR 114 98

IV. DESIGN AND SERVICE CONDITIONS

Listed in the following sections are the various design and service conditions used in analyzing the piping. This information was obtained from the design specification.

1. DESIGN CONDITIONS

An internal pressure of 2500 psig and a uniform temperature of 200°F were used in this model.

2. LEVEL A SERVICE CONDITIONS

Level A service conditions, dealing mainly with the stress range due to thermal expansion, are based on the operating temperature(s) given below:

Entire model: 100°F

3. LEVEL B SERVICE CONDITIONS

The only Level B service condition resulting in significant dynamic loads for the piping system is the Operating Basis Earthquake (OBE).

4. LEVEL C SERVICE CONDITIONS

The only significant Level C service condition which affects the piping system is the Safe Shutdown Earthquake (SSE).

5. LEVEL D SERVICE CONDITIONS

The SSE plus Loss-of-Coolant Accident (LOCA) response envelopes all other Level D service responses for LOFT and will be used as the basis for Level D service conditions analysis.

6. TEST CONDITIONS

Cold Hydrostatic Test - Design Pressure x 1.25

Cold Leakage Test - Design Pressure Only

Hot Leakage Test - Design Pressure and Level A Service Temperature(s).

V. PIPING SYSTEM STRUCTURAL ANALYSIS

The piping system was analyzed for the various structural loads described in Section IV using the computer code NUPIPE-II, developed by Nuclear Services Corporation. This computer program is described in Appendix B. All limiting assumptions made in performing the analysis are listed in the following subsections.

1. WEIGHT ANALYSIS

An analysis for normal weight loading was performed for the system; the piping uniform weights used are listed in Section III.2 of this report. The weights and C.G.'s of the valves and operators are given in Table I. The results of the weight analysis are contained in Appendix C of this report.

2. THERMAL EXPANSION ANALYSIS

The piping system addressed in this report was analyzed for the steady-state temperature conditions as outlined in Section IV.2. The results of this analysis are contained in Appendix D.

3. SEISMIC ANALYSES

The piping system was analyzed for the effects of the Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE). For this analysis, OBE is to be considered one-half the magnitude of the SSE. The SSE response spectra is shown in Figure 2. This response spectra, multiplied by conservative directional intensity factors, was applied in all three directions simultaneously. Any seismic differential anchor movement effects present on the piping were taken into account. The results of the seismic analyses are contained in Appendix E.

FIGURE 2
SSE - SEISMIC RESPONSE SPECTRA ENVELOPE

1% DAMPING

TABLE I.

Piping System Valve Design Weights
And Centers of Gravity

<u>Valve</u>	<u>Flooded Weight</u>	<u>(Distance from C.G. axis of Pipe)</u>
CVP-136-13		
Body	25 lb (est.)	0
Operator	375 lb (est.)	2 feet

VI. ASME BOILER AND PRESSURE VESSEL CODE, SECTION III, STRESS ANALYSIS

A stress analysis of the Class 2 piping addressed in this report, per rules of Subsection NC-3600 of the Code, was performed using the results obtained from the analyses described in Section V of this report.

1. MINIMUM THICKNESS CHECK

The Code requires verification that the piping minimum wall thickness is satisfactory. The thickness was checked against Equation (1) of NC-3641.1:

$$t_M = \frac{P D_o}{2(S + P_y)} + A$$

where t_M = Minimum required wall thickness

P = Internal design pressure

D_o = Outside diameter

S = Allowable stress

$y = .4$ or $\frac{d}{d + D_o}$ if $D_o/t_M < 6$ (per Code)

A = Corrosion allowance (.08).

Results of this calculation are contained in Table II.

TABLE II.

MINIMUM THICKNESS PARAMETERS

<u>Pressure (psi)</u>	<u>O.D. (inches)</u>	<u>S (psi)</u>	<u>t_M (inches)</u>	<u>t_{actual} (inches)</u>
2500	.84	18,800	.13	.147

Since the actual thicknesses are all greater than the t_M calculated, the system meets the requirements of NC-3641.1.

2. DESIGN, LEVEL A, AND LEVEL B SERVICE CONDITIONS STRESS ANALYSIS

The loading conditions, defined as Design, Level A, and Level B in Section IV.1, 2, and 3, were used in performing a stress analysis of the piping system per the rules given in Subsection NC-3650 of the Code. The computer program NUPIPE-II was used for this analysis. The results of Equations (8), (9), (10), and (11) are detailed in Appendix F. Test conditions are encompassed by this stress analysis.

3. LEVEL C SERVICE CONDITIONS STRESS ANALYSIS

The only loading which was postulated as a Level C service condition is the SSE. NC-3611.2 (c) requires that Equation (9) of NC-3652.2 be satisfied with an allowable of $1.8 S_h$. These results, as calculated using NUPIPE-II, are contained in Appendix G.

4. LEVEL D SERVICE CONDITIONS STRESS ANALYSIS

Not applicable.

VII. COMPONENT SUPPORT ANALYSIS

Any component supports designed and built by EG&G Idaho, Inc. have been analyzed in accordance with the AISC Manual of Steel Construction^[3]. The analysis of these component supports would be contained in Appendix I. All component supports which have been supplied by a commercial manufacturer carry loads which are less than the manufacturer's stated load capacity. A summary of sustained loads on all piping supports is contained in Table III.

TABLE III

LOADS ON PIPING SUPPORTS

<u>Support Type</u>	<u>Support No.</u>	<u>Deadweight</u>	<u>Thermal</u>	<u>OBE</u>	<u>SSE</u>	<u>Rated Load</u>
Wall bracket	1	8 lb	0	3 lb	6 lb	300 lb (est.)
Wall bracket	2	8 lb	1 lb	3 lb	4 lb	300 lb (est.)
Wall bracket	3	1 lb	7 lb	5 lb	9 lb	300 lb (est.)
Wall bracket	4	2 lb	0	8 lb	15 lb	300 lb (est.)
Wall bracket	5	209 lb	4 lb	28 lb	56 lb	300 lb (est.)
Wall bracket	6	205 lb	4 lb	27 lb	53 lb	300 lb (est.)
Wall bracket	7	2 lb	24 lb	13 lb	26 lb	300 lb (est.)
Hinge support	8	0	1 lb	3 lb	6 lb	300 lb (est.)

VIII. SPECIAL CONSIDERATIONS

None.

IX. CONCLUSIONS

The piping system addressed in this report was analyzed for the loads and operating conditions given in the design specification using the techniques described herein. All stresses have been found to be within limits established by Section III of the ASME Boiler and Pressure Vessel Code.

X. REFERENCES

1. American Society of Mechanical Engineers, ASME Boiler & Pressure Vessel Code, Section III, Division 1, "Nuclear Power Plant Components", Subsection NC, 1977 Edition, Winter 1977 Addenda.
2. Specification ANC-P-1, "Line Designation Tables", January 17, 1973.
3. American Institute of Steel Construction, Manual of Steel Construction, Seventh Edition, pp 5-6 to 5-24, 1973.
4. Mathematical Model is based on a field isometric drawn in February, 1978.

APPENDIX A
BASIC DATA, INPUT PARAMETERS

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 1

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PROGRAM CONTROL CARD

CARDTYPE	KCHECK	DAMP	CODE	GLOB	DYN	THEATA	INTOUT	STORE
CONTROL	0	0	2.	0.	0.	0.0000	0.	0.

CARDTYPE	NPR	NPIPS	UNITS	EIGSAV
CONTROL	10	0	ENGLISH	0

FLEXIBILITY ANALYSIS CONTROL CARDS

CARDTYPE	NCASE	MODE	TLOAD	CMODE	CFREQ	SPEC	SAVE	CYCLE	TITLE
FLEXAN	1	1	3.	0.	0.	0.00	1.	0.	DEADWEIGHT
FLEXAN	2	1	2.	0.	0.	0.00	1.	0.	THERMAL EXPANSION PLUS ANCHOR MOVEMENTS
FLEXAN	3	1	11.	30.	50.	1.00	1.	0.	SSE RESPONSE SPECTRUM - 1% DAMPING

CASE COMBINATION CONTROL CARDS

CARDTYPE	NCASE	CASES-COMD	AMULT	BMULT	CCODE	SAVE	CYCLE	TITLE
MODFLEX	4	3 AND 1	.5	0.0	0.0	1.0	0.0	GBE RESPONSE SPECTRUM - ONE-HALF SSE

LTR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 2

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

SEISMIC RESPONSE SPECTRA - SET 1

X-EARTHQUAKE		Y-EARTHQUAKE		Z-EARTHQUAKE	
PERIOD (SEC)	ACCELERATION (G)	PERIOD (SEC)	ACCELERATION (G)	PERIOD (SEC)	ACCELERATION (G)
0.000	.342	0.000	.228	0.000	.342
.010	.342	.010	.228	.010	.342
.250	1.460	.250	.973	.250	1.460
.800	.637	.800	.425	.800	.637
1.400	.342	1.400	.228	1.400	.342
2.200	.217	2.200	.145	2.200	.217
3.000	.186	3.000	.124	3.000	.186
10.000	.186	10.000	.124	10.000	.186

LTR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 3

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
XSECTN	0	1	.840E+00	.147E+00	.119E+01	.283E+02	.250E+04	0.
DPVAL	1	1	.281E+02	.340E-02	0.	0.	.250E+04	0.
CHECK MAGNITUDE OF ENTRIES CN ABOVE DPVAL CARE ****								
ANCHOR	0	1	0.	0.	0.	0.	0.	0.
FGRUN	1	5	-.330E+00	0.	-.248E+01	.100E+01	.100E+01	0.
MASSPT	0	5	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	5	10	-.330E+00	0.	-.248E+01	.100E+01	.100E+01	0.
MASSPT	0	10	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	10	15	-.330E+00	0.	-.248E+01	.100E+01	.100E+01	0.
MASSPT	0	15	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	15	20	.250E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	20	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	20	25	0.	-.100E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	25	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	25	30	.250E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	30	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	30	35	.233E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	35	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	35	40	.233E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	40	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	40	45	.250E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	45	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	45	50	0.	0.	-.750E+00	.100E+01	.100E+01	0.
MASSPT	0	50	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	50	.100E+07	.100E+07	0.	0.	0.	0.
FGRUN	50	55	0.	0.	-.181E+01	.100E+01	.100E+01	0.

LIR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LCFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PAGE 4

*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
MASSPT	0	55	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	55	60	0.	0.	-.181E+01	.100E+01	.100E+01	0.
MASSPT	0	60	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	60	65	0.	0.	-.181E+01	.100E+01	.100E+01	0.
MASSPT	0	65	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	65	.100E+07	.100E+07	0.	0.	0.	0.
FGRUN	65	70	0.	0.	-.204E+01	.100E+01	.100E+01	0.
MASSPT	0	70	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	70	75	0.	0.	-.204E+01	.100E+01	.100E+01	0.
MASSPT	0	75	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	75	.100E+07	.100E+07	0.	0.	0.	0.
FGRUN	75	80	0.	0.	-.133E+01	.100E+01	.100E+01	0.
MASSPT	0	80	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	80	85	.250E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	85	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	85	90	-.133E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	90	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	90	0.	.100E+07	.100E+07	0.	0.	0.
FGRUN	90	95	-.167E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	95	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	95	100	-.167E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	100	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	100	0.	.100E+07	.100E+07	0.	0.	0.
FGRUN	100	105	-.170E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	105	.100E+01	.100E+01	.100E+01	0.	0.	0.

MAR 11 4 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 5

LCFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
VALVE	105	110	-.330E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	110	.100E+01	.100E+01	.100E+01	0.	0.	0.
CWEIGHT	0	110	0.	.250E+02	0.	0.	0.	0.
RUN	110	113	0.	.200E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	113	.100E+01	.100E+01	.100E+01	0.	0.	0.
CWEIGHT	0	113	0.	.375E+03	0.	0.	0.	0.
RESTRAINT	0	113	.100E+07	0.	.100E+07	0.	0.	0.
VALVE	110	115	-.330E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	115	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	115	120	-.170E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	120	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	120	0.	.100E+07	.100E+07	0.	0.	0.
FGRUN	120	125	-.225E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	125	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	125	130	-.225E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	130	.100E+01	.100E+01	.100E+01	0.	0.	0.
RESTRAINT	0	130	0.	.100E+07	.100E+07	0.	0.	0.
FGRUN	130	135	-.500E+00	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	135	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	135	140	.250E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	140	.100E+01	.100E+01	.100E+01	0.	0.	0.
FGRUN	140	145	0.	-.200E+01	0.	.100E+01	.100E+01	0.
MASSPT	0	145	.100E+01	.100E+01	.100E+01	0.	0.	0.
ELBOW	145	150	.250E+01	0.	0.	.100E+01	.100E+01	0.
MASSPT	0	150	.100E+01	.100E+01	.100E+01	0.	0.	0.

114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PAGE 6

*** INPUT DATA ***

CARDTYPE	I1	I2	DELTA(1)	DELTA(2)	DELTA(3)	DELTA(4)	DELTA(5)	DELTA(6)
FGRUN	150	155	0.	0.	-.500E+00	.100E+01	.100E+01	0.
ANCHOR	0	155	0.	0.	0.	0.	0.	0.
STRESS7	0	0	0.	0.	0.	0.	0.	0.
9CASES		0	1	0	4	0	0	0
10CASES		0	2	0	0	0	0	0
CKNODES		0	0	0	0	0	0	0
ALLDONE		0	0	0	0	0	0	0

LTR 114 98

APPENDIX B
COMPUTER PROGRAM DESCRIPTION

The NUPIPE-II computer program performs linear elastic analysis of three-dimensional piping systems subject to thermal, deadweight, seismic, and other static and dynamic loads. The NUPIPE-II program is also designed to perform stress and fatigue analyses in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Nuclear Power Plant Components, 1974 Edition through the Summer 1975 Addenda; and the ANSI B31.1 Code, 1967 and Summer 1973 versions. Piping systems of more than one classification can be analyzed.

NUPIPE-II utilizes the finite element method of analysis with special features incorporated to accommodate specific requirements of piping system analysis. In accordance with the finite element method, the continuous piping is mathematically idealized as an assembly of elastic structural members connecting discrete nodal points. Nodal points are placed in such a manner as to isolate particular types of piping elements, such as straight runs of pipe, elbows, valves, etc., for which force-deformation characteristics can be categorized. Nodal points are also placed at all discontinuities, such as piping supports, concentrated weights, branch lines, and changes in cross-section. System loads such as weights, equivalent thermal forces, and earthquake inertia forces are applied at the nodal points. For the deadweight and dynamic time-history and response spectra analyses, distributed weight properties of the piping as well as concentrated weights, such as valves, pumps, or snubbers, can be considered. A lumped mass model of the piping system is used for all dynamic analyses. Both translational and rotational degrees-of-freedom may be considered.

For further information concerning NUPIPE-II capabilities or analytical procedures, contact Applied Mechanics Branch.

APPENDIX C
WEIGHT ANALYSIS RESULTS

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 18

LOFT CIS ANALYSIS - 1/2M-PCS-6-VA (OUTSIDE)

SUPPORT REACTIONS FOR LOAD CASE NO. 1

DEADWEIGHT

NODE	TYPE	REACTION (LBS OR IN-LBS)	DIRECTION
1	FORCE	1.	X COORD
1	FORCE	10.	Z COORD
1	FORCE	1.	Z COORD
1	MOMENT	393.	X COORD
1	MOMENT	-49.	Y COORD
1	MOMENT	-141.	Z COORD
50	FORCE	-2.	X COORD
50	FORCE	8.	Y COORD
65	FORCE	1.	X COORD
65	FORCE	8.	Y COORD
75	FORCE	-0.	X COORD
75	FORCE	1.	Y COORD
90	FORCE	-1.	Z COORD
90	FORCE	2.	Y COORD
100	FORCE	209.	Y COORD
100	FORCE	0.	Z COORD
113	FORCE	0.	X COORD
113	FORCE	-0.	Z COORD
120	FORCE	205.	Y COORD
120	FORCE	-0.	Z COORD
130	FORCE	-0.	Y COORD
130	FORCE	-0.	Z COORD
155	FORCE	-0.	X COORD
155	FORCE	5.	Y COORD
155	FORCE	0.	Z COORD
155	MOMENT	-24.	X COORD
155	MOMENT	-2.	Y COORD
155	MOMENT	1.	Z COORD

LIR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 20

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 1

DEADWEIGHT

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	1	1:	10:	1:	39:	-49:	-141:	-.000	-.000	-.000	-.0000	.CG00	.C000
	5	-1:	-7:	-1:	-14:	33:	108:	-.034	-.258	.005	-.0140	.CG22	.C080
FGRUN	5	1:	7:	1:	14:	-33:	-108:	-.034	-.258	.005	-.0140	.CG22	.C080
	10	-1:	-4:	-1:	16:	17:	87:	-.121	-.788	.016	-.0172	.CG35	.C145
FGRUN	10	1:	4:	1:	-16:	-17:	-87:	-.121	-.788	.016	-.0172	.CG35	.C145
	15	-1:	-1:	-1:	66:	3:	78:	-.224	-1.292	.030	-.0146	.CG40	.C198
ELBOW	15	1:	1:	1:	-86:	-3:	-78:	-.224	-1.292	.030	-.0146	.CG40	.C198
	20	-1:	-1:	-1:	86:	1:	79:	-.184	-1.334	.067	-.0140	.CG40	.C204
FGRUN	20	1:	1:	1:	-86:	-1:	-79:	-.184	-1.334	.067	-.0140	.CG40	.C204
	25	-1:	-0:	-1:	81:	1:	83:	-.037	-1.334	.161	-.0129	.CG41	.C214
ELBOW	25	1:	0:	1:	-81:	-1:	-83:	-.037	-1.334	.161	-.0129	.CG41	.C214
	30	-1:	0:	-1:	79:	-0:	85:	-.017	-1.279	.182	-.0123	.CG40	.C220
FGRUN	30	1:	-0:	1:	-79:	0:	-85:	-.017	-1.279	.182	-.0123	.CG40	.C220
	35	-1:	3:	-1:	79:	-20:	45:	-.017	-.680	.084	-.0077	.CG36	.C240
FGRUN	35	1:	-3:	1:	-79:	20:	-45:	-.017	-.680	.084	-.0077	.CG36	.C240
	40	-1:	5:	-1:	79:	-39:	-59:	-.017	-.041	.007	-.0031	.CG23	.C240
ELBOW	40	1:	-5:	1:	-79:	39:	59:	-.017	-.041	.007	-.0031	.CG23	.C240
	45	-1:	6:	-1:	65:	-42:	-73:	-.011	-.014	.002	-.0024	.CG20	.C240
FGRUN	45	1:	-6:	1:	-65:	42:	73:	-.011	-.014	.002	-.0024	.CG20	.C240
	50	-1:	6:	-1:	26:	-46:	-73:	-.000	-.000	.002	-.0019	.CG15	.C229
FGRUN	50	1:	2:	1:	-26:	46:	73:	-.000	-.000	.002	-.0019	.CG15	.C229
	55	-1:	0:	-1:	49:	-26:	-73:	-.016	-.027	.002	-.0005	.CG01	.C192
FGRUN	55	1:	-0:	1:	-49:	26:	73:	-.016	-.027	.002	-.0005	.CG01	.C192
	60	-1:	2:	-1:	24:	-6:	-73:	-.011	-.021	.002	-.0009	.CG05	.C156
FGRUN	60	1:	-2:	1:	-24:	6:	73:	-.011	-.021	.002	-.0009	.CG05	.C156
	65	-1:	4:	-1:	46:	14:	-73:	-.000	-.000	.002	-.0005	.CG03	.C120
FGRUN	65	0:	-4:	1:	46:	-14:	73:	-.000	-.000	.002	-.0005	.CG03	.C120
	70	-0:	-1:	-1:	13:	5:	-73:	-.003	-.002	.002	-.0002	.CG01	.C079

LIR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PAGE 21

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	70	0:	1:	-1:	-13:	-5:	73:	.003	-.002	.002	-.0002	.0001	.007
	75	-0:	1:	-1:	13:	-5:	-73:	.000	-.000	.002	.0003	.0001	.003
FGRUN	75	0:	-0:	-1:	-13:	5:	73:	.000	-.000	.002	.0003	.0001	.003
	80	-0:	2:	-1:	1:	-6:	-73:	-.000	.000	.002	.0005	-.0001	.001
ELBOW	80	0:	-2:	-1:	-1:	-6:	73:	-.000	.006	.002	.0005	-.0001	.001
	85	-0:	2:	-1:	-3:	-5:	-69:	.000	.004	.002	.0005	-.0001	.001
FGRUN	85	0:	-2:	-1:	-3:	5:	69:	.000	-.004	.002	.0005	-.0001	.001
	90	-0:	3:	-1:	-3:	5:	-33:	.000	-.000	.000	.0004	-.0001	.0002
FGRUN	90	0:	-2:	-0:	-3:	-5:	33:	.000	-.000	.000	.0004	-.0001	.0002
	95	-0:	4:	0:	-3:	1:	21:	.000	.010	-.001	.0004	-.0001	.0002
FGRUN	95	0:	-4:	-0:	-3:	-1:	-21:	.000	-.010	-.001	.0004	-.0001	.0002
	100	-0:	6:	0:	-3:	-2:	115:	.000	-.000	-.000	.0001	.0000	.000
FGRUN	100	0:	-203:	-0:	-3:	-2:	-115:	.000	-.000	-.000	.0001	.0000	.000
	105	-0:	203:	-0:	-3:	-2:	-299:	.000	-.004	.000	.0000	.0000	.0016
VALVE	105	0:	-203:	-0:	-3:	-2:	299:	.000	-.004	.000	.0000	.0000	.0016
	110	-0:	203:	-0:	-3:	-1:	-1102:	.000	-.009	.000	.0000	-.0000	.0000
RUN	110	0:	-377:	-0:	3:	0:	0:	.000	-.009	.000	.0000	-.0000	.0000
	113	-0:	375:	-0:	3:	0:	0:	-.000	-.010	.000	-.0000	-.0000	.0000
VALVE	110	0:	-200:	-0:	0:	1:	1102:	.000	-.009	.000	.0000	-.0000	.0000
	115	-0:	200:	-0:	-0:	-1:	-309:	.000	-.004	.000	.0000	-.0000	.0016
FGRUN	115	0:	-200:	-0:	-0:	-1:	309:	.000	-.004	.000	.0000	-.0000	.0016
	120	-0:	200:	-0:	-0:	-1:	99:	.000	-.000	.000	.0000	-.0000	.0020
FGRUN	120	0:	-2:	-0:	-0:	1:	-99:	.000	-.000	.000	.0000	-.0000	.0020
	125	-0:	2:	-0:	-0:	0:	5:	.000	.011	-.000	.0000	-.0000	.0005
FGRUN	125	0:	-2:	-0:	-0:	-0:	-5:	.000	-.011	-.000	.0000	-.0000	.0005
	130	-0:	1:	-0:	-0:	1:	-18:	.000	.000	-.000	-.0000	-.0000	.0001
FGRUN	130	0:	-1:	-0:	-0:	-1:	18:	.000	-.000	.000	-.0000	.0000	.0001
	135	-0:	2:	-0:	-0:	0:	-10:	.000	-.000	.000	-.0000	.0000	.0001
ELBOW	135	0:	-2:	-0:	0:	-0:	10:	.000	-.000	.000	-.0000	.0000	.0001
	140	-0:	3:	-0:	0:	-1:	-3:	.000	-.000	.000	-.0000	.0000	.0000
FGRUN	140	0:	-3:	-0:	-0:	1:	3:	.000	-.000	.000	-.0000	.0000	.0000
	145	-0:	3:	-0:	-0:	-1:	0:	.000	-.000	.000	.0001	.0000	.0000

LTR 114 58

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 22

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
ELBOW	145	0:	-5:	-0:	-6:	1:	-0:	.000	-.000	-.000	.0001	.0000	-.0000
	150	-0:	5:	0:	-5:	-1:	-1:	.000	-.000	-.000	.0001	.0000	-.0000
FGRUN	150	0:	-5:	-0:	5:	1:	-1:	.000	-.000	-.000	.0001	.0000	-.0000
	155	-0:	5:	0:	-24:	-2:	1:	.000	-.000	-.000	.0000	.0000	-.0000

LIR 1.14 98

APPENDIX D
THERMAL EXPANSION ANALYSIS RESULTS

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 23

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

SUPPORT REACTIONS FOR LOAD CASE NO. 2

THERMAL EXPANSION PLUS ANCHOR MOVEMENTS

NODE	TYPE	REACTION (LBS OR IN-LBS)	DIRECTION
------	------	-----------------------------	-----------

1	FORCE	0.	X COORD
11	FORCE	-0.	Y COORD
11	FORCE	-1.	Z COORD
11	MOMENT	-2.	X COORD
11	MOMENT	-15.	Y COORD
11	MOMENT	0.	Z COORD
50	FORCE	-0.	X COORD
50	FORCE	0.	Y COORD
65	FORCE	1.	X COORD
65	FORCE	0.	Y COORD
75	FORCE	-7.	X COORD
75	FORCE	-0.	Y COORD
90	FORCE	0.	Y COORD
90	FORCE	-0.	Z COORD
100	FORCE	-3.	Y COORD
100	FORCE	2.	Z COORD
113	FORCE	-1.	X COORD
113	FORCE	0.	Z COORD
120	FORCE	4.	Y COORD
120	FORCE	-1.	Z COORD
130	FORCE	-24.	Y COORD
130	FORCE	-2.	Z COORD
155	FORCE	6.	X COORD
155	FORCE	23.	Y COORD
155	FORCE	2.	Z COORD
155	MOMENT	-105.	X COORD
155	MOMENT	33.	Y COORD
155	MOMENT	-47.	Z COORD

LTR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 24

LOFT CIS ANALYSIS - 1/2" PCS-6-VA (OUTSIDE)

INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 2

THERMAL EXPANSION PLUS ANCHOR MOVEMENTS

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	1	-0:	-0:	-1:	-2:	-15:	0:	-.000	.000	-.000	.0000	.0000	-.0000
	5	-0:	-0:	1:	-1:	-3:	0:	-.010	.001	-.007	.0000	.0000	-.0000
FGRUN	5	-0:	-0:	-1:	-4:	-9:	-0:	-.010	-.001	-.007	.0000	.0000	-.0000
	10	-0:	-0:	1:	-4:	-9:	0:	-.024	-.000	-.014	-.0001	.0003	-.0000
FGRUN	10	-0:	-0:	-1:	-4:	-9:	-0:	-.024	-.000	-.014	-.0001	.0003	-.0000
	15	-0:	-0:	1:	-6:	-20:	1:	-.025	-.006	-.022	-.0003	-.0004	.0000
ELBOW	15	-0:	-0:	-1:	-6:	-20:	-1:	-.025	-.006	-.022	-.0003	-.0004	.0000
	20	-0:	-0:	1:	-4:	-21:	1:	-.024	-.007	-.022	-.0003	-.0005	.0000
FGRUN	20	-0:	-0:	-1:	-4:	-21:	-1:	-.024	-.007	-.022	-.0004	-.0005	.0000
	25	-0:	-0:	1:	-1:	-21:	-4:	-.024	-.009	-.019	-.0004	-.0009	.0000
ELBOW	25	-0:	-0:	-1:	-1:	-21:	-4:	-.024	-.009	-.019	-.0004	-.0009	.0000
	30	-0:	-0:	1:	-2:	-19:	4:	-.023	-.010	-.015	-.0004	-.0010	.0001
FGRUN	30	-0:	-0:	-1:	-2:	-19:	-4:	-.023	-.010	-.015	-.0004	-.0010	.0001
	35	-0:	-0:	1:	-2:	-1:	2:	-.016	-.006	-.018	-.0002	-.0015	.0002
FGRUN	35	-0:	-0:	-1:	-2:	-1:	2:	-.016	-.006	-.018	-.0002	-.0015	.0002
	40	-0:	-0:	1:	-2:	18:	-0:	-.009	-.000	.018	-.0001	-.0015	.0002
ELBOW	40	-0:	-0:	-1:	-2:	18:	0:	-.009	-.000	.018	-.0001	-.0015	.0002
	45	-0:	-0:	1:	-2:	-18:	-1:	-.006	-.000	.052	-.0001	-.0011	.0002
FGRUN	45	-0:	-0:	-1:	-2:	-18:	1:	-.006	-.000	.052	-.0001	-.0011	.0002
	50	-0:	-0:	1:	-2:	-17:	-1:	-.000	-.000	.052	-.0000	-.0007	.0002
FGRUN	50	-0:	-0:	-1:	-2:	-17:	1:	-.000	-.000	.052	-.0000	-.0007	.0002
	55	-0:	-0:	1:	-1:	-13:	-1:	.010	-.001	.046	-.0000	-.0002	.0002
FGRUN	55	-0:	-0:	-1:	-1:	-13:	1:	.010	-.001	.046	-.0000	-.0002	.0002
	60	-0:	-0:	1:	-0:	-9:	-1:	.009	-.000	.040	-.0000	-.0002	.0002
FGRUN	60	-0:	-0:	-1:	-0:	-9:	1:	.009	-.000	.040	-.0000	-.0002	.0002
	65	-0:	-0:	1:	-1:	-5:	-1:	-.000	-.000	.034	-.0000	.0005	.0001
FGRUN	65	-1:	-0:	-1:	-1:	-5:	1:	-.000	-.000	.034	-.0000	.0005	.0001
	70	-1:	-0:	1:	-0:	-21:	-1:	-.011	.000	.027	-.0000	.0002	.0001

LTR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PAGE 25

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	70	-1.	-0.	-1.	0.	21.	1.	-.011	.000	.027	-.0000	-.0002	.0001
	75	-1.	-0.	-1.	0.	-48.	-1.	.000	.000	.020	-.0000	-.0013	.0000
FGRUN	75	-5.	-0.	-1.	-1.	48.	1.	.000	.000	.020	.0000	-.0013	.0000
	80	-5.	-0.	-1.	-0.	26.	-1.	.021	.000	.016	.0000	-.0015	.0000
ELBOW	80	-5.	-0.	-1.	0.	-26.	1.	.021	.000	.016	.0000	-.0015	.0000
	85	-5.	-0.	-1.	-0.	38.	-1.	.024	.000	.012	.0000	-.0013	.0000
FGRUN	85	-5.	-0.	-1.	0.	-38.	1.	.024	.000	.012	.0000	-.0013	.0000
	90	-5.	-0.	-1.	-0.	28.	0.	.020	-.000	.000	.0000	-.0005	.0000
FGRUN	90	-5.	-0.	-1.	0.	-28.	0.	.020	-.000	.000	.0000	-.0005	.0000
	95	-5.	-0.	-1.	-0.	8.	-1.	.015	-.000	-.003	-.0000	-.0001	.0000
FGRUN	95	-5.	-0.	-1.	0.	-8.	1.	.015	-.000	-.003	-.0000	-.0001	.0000
	100	-5.	-0.	-1.	-0.	-12.	-1.	.009	-.000	-.000	-.0000	-.0001	.0000
FGRUN	100	-5.	-3.	-1.	0.	12.	1.	.009	.000	-.000	-.0000	-.0001	.0000
	105	-5.	-3.	-1.	-0.	-10.	5.	.009	.000	.000	-.0000	-.0000	.0000
VALVE	105	-5.	-3.	-1.	0.	10.	-5.	.008	.000	.000	-.0000	-.0000	.0000
	110	-5.	-3.	-1.	-0.	-7.	18.	.007	.000	.000	-.0000	-.0000	.0000
RUN	110	-1.	-0.	-0.	-1.	0.	-21.	.007	.000	-.000	-.0000	-.0000	.0000
	113	-1.	-0.	-0.	-0.	0.	-0.	.000	.007	-.000	-.0000	-.0000	.0000
VALVE	110	-6.	-3.	-1.	-2.	7.	3.	.007	.000	.000	-.0000	-.0000	.0000
	115	-6.	-3.	-1.	-2.	-3.	9.	.006	.000	.000	-.0000	-.0000	.0000
FGRUN	115	-6.	-3.	-1.	-2.	3.	-9.	.006	.000	.000	-.0000	-.0000	.0000
	120	-6.	-3.	-1.	-2.	-1.	16.	.006	-.000	.000	-.0000	-.0000	.0001
FGRUN	120	-6.	-1.	-0.	-2.	1.	-16.	.006	-.000	.000	-.0000	-.0000	.0001
	125	-6.	-1.	-0.	-2.	1.	-10.	-.002	-.000	-.001	-.0001	-.0000	.0002
FGRUN	125	-6.	-1.	-0.	-2.	-1.	10.	-.002	-.000	-.001	-.0001	-.0000	.0002
	130	-6.	-1.	-0.	-2.	4.	-35.	-.010	-.000	-.001	-.0002	-.0001	.0009
FGRUN	130	-6.	-23.	-2.	-2.	-4.	35.	-.010	.000	.000	-.0002	.0001	-.0009
	135	-6.	-23.	-2.	-2.	-1.	47.	-.011	.003	.000	-.0003	.0001	-.0006
ELBOW	135	-6.	-23.	-2.	2.	1.	-47.	-.011	.003	.000	-.0003	.0001	-.0006
	140	-6.	-23.	-2.	2.	-5.	90.	-.013	.004	.001	-.0003	.0001	-.0003
FGRUN	140	-6.	-23.	-2.	-2.	-5.	-90.	-.013	-.004	.001	-.0003	-.0001	-.0003
	145	-6.	-23.	-2.	32.	-5.	-31.	-.002	-.001	.003	-.0003	-.0001	.0007

LTR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PAGE 26

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
ELBOW	145	-6.	-23.	-2.	-32.	5.	31.	-.002	-.001	.003	.0003	-.0001	.0007
	150	6.	23.	2.	-23.	11.	-47.	-.000	-.001	.001	.0004	-.0001	.0004
FGRUN	150	-6.	-23.	-2.	-23.	-11.	47.	-.000	-.001	.001	.0004	-.0001	.0004
	155	6.	23.	2.	-105.	33.	-47.	-.000	-.000	-.000	.0000	-.0000	.0000

D-4
LTR 114 98

APPENDIX E
SEISMIC ANALYSES RESULTS

03/09/78

NUFIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 27

LEFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

*** PIPING DYNAMIC ANALYSIS ***
 - FREE VIBRATION RESULTS -

-NO. OF SIGNIFICANT MODES = 17

- MODE ORTHOGONALITY CHECK -

MAX. ON DIAGONAL TERM = .100E+01
 MIN. ON DIAGONAL TERM = .100E+01
 MAX. OFF DIAGONAL TERM = .246E-12
 MIN. OFF DIAGONAL TERM = -.148E-12

MASS PARTICIPATION FACTOR = SUM(M(I)*XPHI(I))

MODE

X

Y

Z

1	.1491E-01	.1646E+00	.1281E-01
2	.2433E+00	.7254E-02	.1221E+00
3	.1671E+00	.6743E-02	.3475E-02
4	.9544E-01	.6614E-01	.6062E-01
5	.1124E+00	.2166E-01	.1449E+00
6	.4205E-01	.4847E-01	.5110E-01
7	.1080E+00	.4384E-01	.6916E-01
8	.2569E-02	.8710E-01	.4426E-02
9	.5328E-01	.4892E-01	.3423E-01
10	.4525E-02	.9388E+00	.2010E-02
11	.5398E-01	.4079E-01	.1009E-01
12	.1452E-02	.1461E-01	.5660E-01
13	.1428E-01	.1436E+00	.1213E-01
14	.1293E-01	.1405E+00	.9820E-02
15	.2896E-03	.3195E+00	.5096E-02
16	.6015E-01	.5061E-02	.8575E-02
17	.1607E+00	.1307E-01	.2704E-01

LTR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 113

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

SUPPORT REACTIONS FOR LOAD CASE NO. 3

SSE RESPONSE SPECTRUM - 1% DAMPING

COMBINED RESULT FOR MODE 1 THRU 17 BY RMS SUMMATION

SPECTRA SET = 1

MODE	TYPE	REACTIONS (LBS OR IN-LBS)	DIRECTION
------	------	------------------------------	-----------

1	FORCE	4.	X CGORD
11	FORCE	7.	Y CGORD
11	FORCE	2.	Z CGORD
11	MOMENT	344.	X CGORD
11	MOMENT	105.	Y CGORD
11	MOMENT	132.	Z CGORD
500	FORCE	5.	X CGORD
65	FORCE	3.	Y CGORD
65	FORCE	3.	X CGORD
75	FORCE	3.	Y CGORD
75	FORCE	8.	X CGORD
90	FORCE	4.	Y CGORD
90	FORCE	2.	Y CGORD
100	FORCE	13.	Z CGORD
100	FORCE	55.	Y CGORD
113	FORCE	9.	Z CGORD
113	FORCE	6.	X CGORD
113	FORCE	0.	Z CGORD
120	FORCE	53.	Y CGORD
120	FORCE	5.	Z CGORD
130	FORCE	26.	Y CGORD
130	FORCE	2.	Z CGORD
155	FORCE	12.	X CGORD
155	FORCE	26.	Y CGORD
155	FORCE	2.	Z CGORD
155	MOMENT	119.	X CGORD
155	MOMENT	65.	Y CGORD
155	MOMENT	122.	Z CGORD

LTR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 114

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 3

SSE RESPONSE SPECTRUM - 1% DAMPING

COMBINED RESULT FOR MODE 1 THRU 17 BY RMS SUMMATION

SPECTRA SET = 1

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	1 5	4: 4:	7: 7:	2: 2:	344: 157:	105: 45:	132: 108:	.000 .053	.000 .232	.000 .007	.0000 .0128	.0000 .0027	.0000 .0077
FGRUN	5 10	1: 1:	5: 5:	2: 2:	157: 48:	45: 53:	108: 87:	.053 .134	.232 .732	.007 .018	.0128 .0167	.0027 .0034	.0077 .0142
FGRUN	10 15	2: 2:	3: 3:	2: 2:	48: 85:	53: 23:	87: 76:	.134 .221	.732 1.228	.018 .029	.0167 .0147	.0034 .0040	.0142 .0194
ELBOW	15 20	3: 3:	2: 2:	2: 2:	85: 86:	23: 29:	76: 75:	.221 .180	1.228 1.270	.029 .066	.0147 .0142	.0040 .0041	.0194 .0200
FGRUN	20 25	3: 3:	1: 1:	2: 2:	86: 83:	29: 29:	75: 79:	.180 .039	1.270 1.270	.066 .161	.0142 .0131	.0041 .0041	.0200 .0209
ELBOW	25 30	4: 4:	1: 1:	2: 2:	83: 82:	29: 27:	79: 81:	.039 .020	1.270 1.217	.161 .184	.0131 .0125	.0041 .0041	.0209 .0214
FGRUN	30 35	4: 4:	2: 2:	2: 2:	82: 82:	27: 34:	81: 40:	.020 .020	1.217 .640	.184 .094	.0125 .0077	.0041 .0037	.0214 .0236
FGRUN	35 40	4: 4:	4: 4:	2: 2:	82: 82:	34: 51:	40: 58:	.020 .020	.640 .040	.094 .052	.0077 .0030	.0037 .0026	.0236 .0230
ELBOW	40 45	5: 5:	4: 4:	2: 2:	82: 73:	51: 49:	58: 67:	.020 .014	.040 .013	.052 .053	.0030 .0024	.0026 .0024	.0230 .0224
FGRUN	45 50	5: 5:	4: 4:	2: 2:	73: 51:	49: 49:	67: 67:	.014 .000	.013 .000	.053 .053	.0024 .0017	.0024 .0020	.0224 .0214
FGRUN	50 55	1: 1:	1: 1:	3: 3:	51: 34:	49: 41:	67: 67:	.000 .026	.000 .020	.053 .053	.0017 .0003	.0020 .0005	.0214 .0181
FGRUN	55 60	1: 1:	1: 1:	4: 4:	34: 14:	41: 26:	67: 67:	.026 .021	.020 .013	.053 .053	.0003 .0006	.0005 .0008	.0181 .0148
FGRUN	60 65	2: 2:	2: 2:	6: 6:	14: 28:	26: 27:	67: 67:	.021 .000	.013 .000	.053 .053	.0006 .0004	.0008 .0011	.0148 .0115
FGRUN	65 70	2: 2:	2: 2:	7: 7:	28: 18:	27: 42:	67: 67:	.000 .020	.000 .007	.053 .053	.0004 .0002	.0011 .0004	.0115 .0078
FGRUN	70 75	2: 2:	1: 1:	9: 9:	18: 37:	42: 81:	67: 67:	.020 .000	.007 .000	.053 .053	.0002 .0008	.0004 .0023	.0078 .0040

LTR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PAGE 115

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	75	6.	3.	10.	37.	81.	67.	.000	.000	.053	.0008	.0023	.0040
	80	6.	3.	10.	3.	64.	67.	.040	.015	.053	.0012	.0035	.0020
ELBOW	80	6.	3.	11.	3.	64.	67.	.040	.015	.053	.0012	.0035	.0020
	85	6.	3.	11.	8.	53.	60.	.049	.013	.044	.0011	.0037	.0015
FGRUN	85	6.	3.	11.	8.	53.	60.	.049	.013	.044	.0011	.0037	.0015
	90	6.	3.	11.	8.	124.	26.	.049	.000	.000	.0009	.0023	.0006
FGRUN	90	5.	1.	4.	8.	124.	26.	.049	.000	.000	.0009	.0023	.0006
	95	5.	1.	4.	8.	38.	21.	.049	.006	.013	.0005	.0005	.0001
FGRUN	95	4.	1.	5.	8.	38.	21.	.049	.006	.013	.0005	.0005	.0001
	100	4.	1.	5.	8.	54.	22.	.049	.000	.000	.0002	.0002	.0006
FGRUN	100	4.	55.	5.	8.	54.	22.	.049	.000	.000	.0002	.0002	.0006
	105	4.	55.	5.	8.	45.	95.	.049	.001	.000	.0001	.0001	.0005
VALVE	105	4.	55.	5.	8.	45.	95.	.049	.001	.000	.0001	.0001	.0005
	110	4.	55.	5.	8.	26.	312.	.049	.002	.000	.0001	.0000	.0001
RUN	110	6.	100.	0.	7.	0.	138.	.049	.002	.000	.0001	.0000	.0001
	113	6.	100.	0.	0.	0.	0.	.000	.003	.000	.0001	.0000	.0030
VALVE	110	8.	54.	5.	2.	26.	311.	.049	.002	.000	.0001	.0000	.0001
	115	8.	54.	5.	2.	9.	100.	.049	.001	.000	.0001	.0001	.0005
FGRUN	115	8.	54.	5.	2.	9.	100.	.049	.001	.000	.0001	.0001	.0005
	120	8.	54.	5.	2.	8.	21.	.049	.000	.000	.0001	.0001	.0006
FGRUN	120	9.	1.	1.	2.	8.	21.	.049	.000	.000	.0001	.0001	.0006
	125	9.	1.	1.	2.	8.	29.	.049	.009	.002	.0001	.0000	.0001
FGRUN	125	10.	2.	0.	2.	8.	29.	.049	.009	.002	.0001	.0000	.0001
	130	10.	2.	0.	2.	4.	26.	.049	.000	.000	.0002	.0001	.0002
FGRUN	130	11.	26.	2.	2.	4.	26.	.049	.000	.000	.0002	.0001	.0002
	135	11.	26.	2.	2.	3.	95.	.049	.001	.000	.0002	.0001	.0004
ELBOW	135	11.	26.	2.	2.	3.	95.	.049	.001	.000	.0002	.0001	.0004
	140	11.	26.	2.	3.	6.	130.	.047	.002	.001	.0002	.0001	.0012
FGRUN	140	12.	26.	2.	3.	6.	130.	.047	.002	.001	.0002	.0001	.0012
	145	12.	26.	2.	3.	6.	93.	.005	.002	.001	.0004	.0002	.0019
ELBOW	145	12.	26.	2.	3.	6.	93.	.005	.002	.001	.0004	.0002	.0019
	150	12.	26.	2.	28.	24.	122.	.001	.001	.000	.0005	.0003	.0010

86 4 11 4 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PAGE 116

MEMBER	END	FORCES (LBS)			MX	MOMENTS (IN-LBS)		MZ	DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ		MY			DX	DY	DZ	RX	RY	RZ
FGRUN	150	12:	26:	2:	28:	24:		122:	:001	:001	:000	:0005	:0003	:0010
	155	12:	26:	2:	119:	65:		122:	:000	:000	:000	:0000	:0000	:0000

LFR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 117

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

SYSTEM ACCELERATION FOR LOAD CASE NO. 3

SSE RESPONSE SPECTRUM - 1% DAMPING

COMBINED RESULT FOR MODE 1 THRU 17 BY RMS SUMMATION

SPECTRA SET = 1

POINT NO.	X-DIRECTION (G)	Y-DIRECTION (G)	Z-DIRECTION (G)
1	.000	.000	.000
5	.834	.743	.111
10	1.153	1.062	.153
15	.761	1.242	.102
20	.673	1.310	.170
25	.440	1.310	.569
30	.394	1.259	.683
35	.394	.845	.857
40	.393	.336	.668
45	.288	.234	.670
50	.001	.000	.670
55	.650	.561	.670
60	.620	.443	.670
65	.000	.000	.670
70	.586	.629	.669
75	.000	.000	.669
80	.459	.683	.669
85	.543	.676	.575
90	.543	.000	.000
95	.543	.553	.193
100	.544	.005	.000
105	.544	.122	.005
110	.544	.239	.009
113	.000	.264	.000
115	.544	.124	.006
120	.544	.005	.000
125	.543	1.260	.346
130	.543	.001	.000
135	.543	.047	.060
140	.518	.060	.092
145	.059	.059	.030
150	.007	.027	.000
155	.000	.000	.000

RIR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 118

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

SUPPORT REACTIONS FOR LOAD COMBINATION CASE NO. 4

OBE RESPONSE SPECTRUM - ONE-HALF SSE

NODE	TYPE	REACTIONS (LBS OR IN-LBS)	DIRECTION
1	FORCE	2.	X COORD
1	FORCE	4.	Y COORD
1	FORCE	1.	Z COORD
1	MOMENT	172.	X COORD
1	MOMENT	52.	Y COORD
1	MOMENT	66.	Z COORD
50	FORCE	2.	X COORD
50	FORCE	1.	Y COORD
65	FORCE	2.	X COORD
65	FORCE	2.	Y COORD
73	FORCE	4.	X COORD
73	FORCE	2.	Y COORD
90	FORCE	1.	Y COORD
90	FORCE	6.	Z COORD
100	FORCE	27.	Y COORD
100	FORCE	3.	Z COORD
113	FORCE	3.	X COORD
113	FORCE	6.	Z COORD
120	FORCE	27.	Y COORD
120	FORCE	3.	Z COORD
130	FORCE	13.	Y COORD
130	FORCE	1.	Z COORD
155	FORCE	6.	X COORD
155	FORCE	13.	Y COORD
155	FORCE	1.	Z COORD
155	MOMENT	60.	X COORD
155	MOMENT	32.	Y COORD
155	MOMENT	61.	Z COORD

TR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 119

LOFT CIS ANALYSIS - 1/2" PCS-6-VA (OUTSIDE)

INTERNAL FORCES AND DEFLECTIONS FOR LOAD CASE NO. 4

OBE RESPONSE SPECTRUM - ONE-HALF SSE

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	1 5	2. 2.	4. 4.	1. 1.	172. 79.	52. 23.	66. 54.	.000 .027	.000 .116	.000 .004	.0000 .0064	.0000 .0014	.0000 .0038
FGRUN	5 10	1. 1.	3. 3.	1. 1.	79. 24.	23. 26.	54. 44.	.027 .067	.116 .366	.004 .009	.0064 .0084	.0014 .0017	.0038 .0071
FGRUN	10 15	1. 1.	2. 2.	1. 1.	24. 43.	26. 11.	44. 38.	.067 .110	.366 .614	.009 .015	.0084 .0074	.0017 .0020	.0071 .0097
ELBOW	15 20	2. 2.	1. 1.	1. 1.	43. 43.	11. 15.	38. 38.	.110 .090	.614 .635	.015 .033	.0074 .0071	.0020 .0020	.0097 .0100
FGRUN	20 25	2. 2.	1. 1.	1. 1.	43. 41.	15. 15.	38. 39.	.090 .019	.635 .635	.033 .081	.0071 .0066	.0020 .0020	.0100 .0104
ELBOW	25 30	2. 2.	0. 0.	1. 1.	41. 41.	15. 13.	39. 40.	.019 .010	.635 .609	.081 .092	.0066 .0062	.0020 .0020	.0104 .0107
FGRUN	30 35	2. 2.	1. 1.	1. 1.	41. 41.	13. 17.	40. 20.	.010 .010	.609 .320	.092 .047	.0062 .0039	.0020 .0019	.0107 .0118
FGRUN	35 40	2. 2.	2. 2.	1. 1.	41. 41.	17. 26.	20. 29.	.010 .010	.320 .020	.047 .026	.0039 .0015	.0019 .0013	.0118 .0115
ELBOW	40 45	2. 2.	2. 2.	1. 1.	41. 37.	26. 25.	29. 33.	.010 .007	.020 .007	.026 .027	.0015 .0012	.0013 .0012	.0115 .0112
FGRUN	45 50	2. 2.	2. 2.	1. 1.	37. 26.	25. 25.	33. 33.	.007 .000	.007 .000	.027 .027	.0012 .0009	.0012 .0010	.0112 .0107
FGRUN	50 55	1. 1.	1. 1.	2. 2.	26. 17.	25. 20.	33. 33.	.000 .013	.000 .010	.027 .027	.0009 .0001	.0010 .0002	.0107 .0091
FGRUN	55 60	1. 1.	1. 1.	2. 2.	17. 7.	20. 13.	33. 33.	.013 .011	.010 .007	.027 .027	.0001 .0003	.0002 .0004	.0091 .0074
FGRUN	60 65	1. 1.	1. 1.	3. 3.	7. 14.	13. 14.	33. 33.	.011 .000	.007 .000	.027 .027	.0003 .0002	.0004 .0005	.0074 .0057
FGRUN	65 70	1. 1.	1. 1.	4. 4.	14. 9.	14. 21.	33. 33.	.000 .010	.000 .003	.027 .027	.0002 .0001	.0005 .0002	.0057 .0039
FGRUN	70 75	1. 1.	1. 1.	4. 4.	9. 18.	21. 41.	33. 33.	.010 .000	.003 .000	.027 .027	.0001 .0004	.0002 .0011	.0039 .0020

LIR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
 LCFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PAGE 120

MEMBER	END	FORCES (LBS)			MOMENTS (IN-LBS)			DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ	MX	MY	MZ	DX	DY	DZ	RX	RY	RZ
FGRUN	75	3.	1.	5.	18.	41.	33.	.000	.000	.027	.0004	.0011	.0020
	80	3.	1.	5.	2.	32.	33.	.020	.007	.027	.0006	.0018	.0010
ELBOW	80	3.	1.	5.	2.	32.	33.	.020	.007	.027	.0006	.0018	.0010
	85	3.	1.	5.	4.	26.	30.	.025	.007	.022	.0006	.0018	.0008
FGRUN	85	3.	1.	6.	4.	26.	30.	.025	.007	.022	.0006	.0018	.0008
	90	3.	1.	6.	4.	26.	13.	.025	.000	.000	.0004	.0012	.0003
FGRUN	90	2.	1.	2.	4.	62.	13.	.025	.000	.000	.0004	.0012	.0003
	95	2.	1.	2.	4.	19.	10.	.025	.003	.007	.0003	.0003	.0001
FGRUN	95	2.	1.	2.	4.	19.	10.	.025	.003	.007	.0003	.0003	.0001
	100	2.	1.	2.	4.	27.	11.	.025	.000	.000	.0001	.0001	.0003
FGRUN	100	2.	27.	2.	4.	27.	11.	.025	.000	.000	.0001	.0001	.0003
	105	2.	27.	2.	4.	22.	47.	.025	.001	.000	.0001	.0000	.0002
VALVE	105	2.	27.	2.	4.	22.	47.	.025	.001	.000	.0001	.0000	.0002
	110	2.	27.	2.	4.	13.	156.	.025	.001	.000	.0001	.0000	.0000
RUN	110	3.	50.	0.	4.	0.	69.	.025	.001	.000	.0001	.0000	.0000
	113	3.	50.	0.	0.	0.	0.	.000	.001	.000	.0000	.0000	.0015
VALVE	110	4.	27.	2.	1.	13.	156.	.025	.001	.000	.0001	.0000	.0000
	115	4.	27.	2.	1.	4.	50.	.025	.001	.000	.0001	.0000	.0002
FGRUN	115	4.	27.	2.	1.	4.	50.	.025	.001	.000	.0001	.0000	.0002
	120	4.	27.	2.	1.	4.	10.	.025	.000	.000	.0000	.0000	.0003
FGRUN	120	4.	1.	0.	1.	4.	10.	.025	.000	.000	.0000	.0000	.0003
	125	4.	1.	0.	1.	4.	15.	.025	.005	.001	.0001	.0000	.0001
FGRUN	125	5.	1.	0.	1.	4.	15.	.025	.005	.001	.0001	.0000	.0001
	130	5.	1.	0.	1.	2.	13.	.025	.000	.000	.0001	.0001	.0001
FGRUN	130	5.	13.	1.	1.	2.	13.	.025	.000	.000	.0001	.0001	.0001
	135	5.	13.	1.	1.	1.	47.	.025	.000	.000	.0001	.0001	.0002
ELBOW	135	6.	13.	1.	1.	1.	47.	.025	.000	.000	.0001	.0001	.0002
	140	6.	13.	1.	1.	3.	65.	.023	.001	.001	.0001	.0001	.0006
FGRUN	140	6.	13.	1.	16.	3.	65.	.023	.001	.001	.0001	.0001	.0006
	145	6.	13.	1.	16.	3.	46.	.003	.001	.001	.0002	.0001	.0009
ELBOW	145	6.	13.	1.	14.	12.	61.	.000	.001	.000	.0002	.0001	.0009
	150	6.	13.	1.	14.	12.	61.	.000	.001	.000	.0002	.0001	.0009

114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 121

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

MEMBER	END	FORCES (LBS)			MX	MOMENTS (IN-LBS)		MZ	DEFLECTIONS (IN)			ROTATIONS (RAD)		
		FX	FY	FZ		MY			DX	DY	DZ	RX	RY	RZ
FGRUN	150	6.	13.	1.	14.	12.		61.	.000	.001	.000	.0002	.0001	.0005
	155	6.	13.	1.	60.	32.		61.	.000	.000	.000	.0000	.0000	.0000

IR 114 98

APPENDIX F
DESIGN, LEVEL A, AND LEVEL B SERVICE
CONDITIONS STRESS ANALYSIS RESULTS

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 124

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

ASME SECTION III CLASS 2 CR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ. 8 (PSI)	OCCASIONAL STRESS EQ. 9 (PSI)	EXPANSION STRESS EQ. 10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ. 11 (PSI)
FGRUN	1	1.000	11160.	14612.	269.	11429.
	5	1.000	6875.	8642.	56.	6931.
FGRUN	5	1.300	6875.	8642.	56.	6931.
	10	1.300	5194.	6211.	173.	5367.
FGRUN	10	1.000	5194.	6211.	173.	5367.
	15	1.500	5657.	6708.	372.	6029.
ELBOW	15	1.000	5657.	6708.	372.	6029.
	20	1.000	5679.	6746.	383.	6062.
FGRUN	20	1.000	5679.	6746.	383.	6062.
	25	1.000	5667.	6730.	379.	6046.
ELBOW	25	1.000	5667.	6730.	379.	6046.
	30	1.000	5661.	6728.	352.	6012.
FGRUN	30	1.000	5661.	6728.	352.	6012.
	35	1.000	5251.	6131.	55.	5306.
FGRUN	35	1.000	5251.	6131.	55.	5306.
	40	1.000	5485.	6504.	324.	5809.
ELBOW	40	1.000	5485.	6504.	324.	5809.
	45	1.000	5494.	6492.	343.	5837.
FGRUN	45	1.000	5494.	6492.	343.	5837.
	50	1.000	5197.	6077.	307.	5504.
FGRUN	50	1.000	5197.	6077.	307.	5504.
	55	1.000	5221.	5989.	237.	5457.
FGRUN	55	1.000	5221.	5989.	237.	5457.
	60	1.000	4963.	5619.	167.	5130.
FGRUN	60	1.000	4963.	5619.	167.	5130.
	65	1.000	5152.	5849.	99.	5251.
FGRUN	65	1.000	5152.	5849.	99.	5251.
	70	1.000	4911.	5641.	382.	5292.

114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 125

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ.8 (PSI)	OCCASIONAL STRESS EQ.9 (PSI)	EXPANSION STRESS EQ.10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ.11 (PSI)
FGRUN	70	1.000	4911.	5641.	382.	5292.
	75	1.000	4910.	5915.	860.	5771.
FGRUN	75	1.000	4910.	5915.	860.	5771.
	80	1.000	4892.	5724.	471.	5363.
ELBOW	80	1.000	4892.	5724.	471.	5363.
	85	1.000	4813.	5536.	686.	5498.
FGRUN	85	1.000	4813.	5536.	686.	5498.
	90	1.000	4185.	5332.	510.	4695.
FGRUN	90	1.000	4185.	5332.	510.	4695.
	95	1.000	3952.	4351.	149.	4101.
FGRUN	95	1.000	3952.	4351.	149.	4101.
	100	1.000	5645.	6178.	214.	5859.
FGRUN	100	1.000	5645.	6178.	214.	5859.
	105	1.000	8969.	9915.	205.	9174.
RUN	110	1.000	3621.	4870.	378.	3999.
	113	1.000	3571.	3571.	0.	3571.
FGRUN	115	1.000	9152.	10055.	178.	9330.
	120	1.000	5362.	5565.	284.	5646.
FGRUN	120	1.000	5362.	5565.	284.	5646.
	125	1.000	3656.	3929.	180.	3835.
FGRUN	125	1.000	3656.	3929.	180.	3835.
	130	1.000	3893.	4134.	637.	4530.
FGRUN	130	1.000	3893.	4134.	637.	4530.
	135	1.000	3747.	4600.	850.	4597.
ELBOW	135	1.000	3747.	4600.	850.	4597.
	140	1.000	3620.	4793.	1623.	5243.
FGRUN	140	1.000	3620.	4793.	1623.	5243.
	145	1.000	3684.	4572.	805.	4489.

IR 114 98

03/09/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1
LCFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

PAGE 126

ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ. 8 (PSI)	OCCASIONAL STRESS EQ. 9 (PSI)	EXPANSION STRESS EQ. 10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ. 11 (PSI)
ELBOW	145	1.000	3684.	4572.	805.	4489.
	150	1.000	3671.	4821.	960.	4631.
FRUN	150	1.000	3671.	4821.	960.	4631.
	155	1.000	4005.	5651.	2158.	6163.

RTR 114 98

APPENDIX G
LEVEL C SERVICE CONDITIONS
STRESS ANALYSIS RESULTS

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIFY FACTOR	SUSTAINED STRESS EQ.8 (PSI)	OCCASIONAL STRESS EQ.9 (PSI)	EXPANSION STRESS EQ.10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ.11 (PSI)
FGRUN	1	1.000	11160.	18063.	0.	11160.
	5	1.000	6875.	10409.	0.	6875.
FGRUN	5	1.000	6875.	10409.	0.	6875.
	10	1.000	5194.	7228.	0.	5194.
FGRUN	10	1.000	5194.	7228.	0.	5194.
	15	1.000	5657.	7759.	0.	5657.
ELBOW	15	1.000	5657.	7759.	0.	5657.
	20	1.000	5679.	7814.	0.	5679.
FGRUN	20	1.000	5679.	7814.	0.	5679.
	25	1.000	5667.	7793.	0.	5667.
ELBOW	25	1.000	5667.	7793.	0.	5667.
	30	1.000	5661.	7795.	0.	5661.
FGRUN	30	1.000	5661.	7795.	0.	5661.
	35	1.000	5251.	7012.	0.	5251.
FGRUN	35	1.000	5251.	7012.	0.	5251.
	40	1.000	5485.	7523.	0.	5485.
ELBOW	40	1.000	5485.	7523.	0.	5485.
	45	1.000	5494.	7490.	0.	5494.
FGRUN	45	1.000	5494.	7490.	0.	5494.
	50	1.000	5197.	6956.	0.	5197.
FGRUN	50	1.000	5197.	6956.	0.	5197.
	55	1.000	5221.	6756.	0.	5221.
FGRUN	55	1.000	5221.	6756.	0.	5221.
	60	1.000	4963.	6276.	0.	4963.
FGRUN	60	1.000	4963.	6276.	0.	4963.
	65	1.000	5152.	6546.	0.	5152.
FGRUN	65	1.000	5152.	6546.	0.	5152.
	70	1.000	4911.	6371.	0.	4911.

LVR 114 98

LOFT CIS ANALYSIS - 1/2"-PCS-6-VA (OUTSIDE)

ASME SECTION III CLASS 2 OR ANSI B31.1.B STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ.8 (PSI)	OCCASIONAL STRESS EQ.9 (PSI)	EXPANSION STRESS EQ.10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ.11 (PSI)
FGRUN	70	1.000	4911.	6371.	0.	4911.
	75	1.000	4910.	6919.	0.	4910.
FGRUN	75	1.000	4910.	6919.	0.	4910.
	80	1.000	4892.	6555.	0.	4892.
ELBOW	80	1.000	4892.	6555.	0.	4892.
	85	1.000	4813.	6259.	0.	4813.
FGRUN	85	1.000	4813.	6259.	0.	4813.
	90	1.000	4185.	6479.	0.	4185.
FGRUN	90	1.000	4185.	6479.	0.	4185.
	95	1.000	3952.	4749.	0.	3952.
FGRUN	95	1.000	3952.	4749.	0.	3952.
	100	1.000	5645.	6711.	0.	5645.
FGRUN	100	1.000	5645.	6711.	0.	5645.
	105	1.000	8969.	10861.	0.	8969.
RUN	110	1.000	3621.	6120.	0.	3621.
	113	1.000	3571.	3571.	0.	3571.
FGRUN	115	1.000	9152.	10958.	0.	9152.
	120	1.000	5362.	5768.	0.	5362.
FGRUN	120	1.000	5362.	5768.	0.	5362.
	125	1.000	3656.	4203.	0.	3656.
FGRUN	125	1.000	3656.	4203.	0.	3656.
	130	1.000	3893.	4375.	0.	3893.
FGRUN	130	1.000	3893.	4375.	0.	3893.
	135	1.000	3747.	5453.	0.	3747.
ELBOW	135	1.000	3747.	5453.	0.	3747.
	140	1.000	3620.	5967.	0.	3620.
FGRUN	140	1.000	3620.	5967.	0.	3620.
	145	1.000	3684.	5461.	0.	3684.

03/07/78

NUPIPE-IIM - NUCLEAR SERVICES CORPORATION PIPING ANALYSIS PROGRAM - VERSION 1.1

PAGE 126

LOFT CIS ANALYSIS - 172"-PCS-6-VA (OUTSIDE)

ASME SECTION III CLASS 2 OR ANSI B31.1.8 STRESS SUMMARY

MEMBER	NODE	STRESS INTENSIF FACTOR	SUSTAINED STRESS EQ.8 (PSI)	OCCASIONAL STRESS EQ.9 (PSI)	EXPANSION STRESS EQ.10 (PSI)	SUSTAINED PLUS EXPANSION STRESS EQ.11 (PSI)
ELBOW	145	1.000	3684.	5461.	0.	3684.
	150	1.000	3671.	5971.	0.	3671.
FGRUN	150	1.000	3671.	5971.	0.	3671.
	155	1.000	4005.	7298.	0.	4005.

L R 114 9B

APPENDIX H
LEVEL D SERVICE CONDITIONS
STRESS ANALYSIS RESULTS

Level D SERVICE CONDITIONS
ARE NOT APPLICABLE TO THIS
STRESS ANALYSIS.

APPENDIX I
COMPONENT SUPPORT ANALYSIS RESULTS

ALL supports were DETERMINED BY
ENGINEERING JUDGEMENT TO BE
GROSSLY OVER DESIGNED AND THEREFORE
NO ANALYSIS OF THESE RESTRAINTS
HAS BEEN PERFORMED.