ATTACHMENT 3

EVALUATION OF RELEVANT CONDITION

CONSOLIDATED EDISON COMPANY OF NEW YORK,
INDIAN POINT UNIT NO. 2
DOCKET NO. 50-247
JANUARY, 1997

9701070059 970103
PDR ADOCK 05000247
P PDR

CON EDISON CALCULATION / ANALYSIS
COVER SHEET

1/3/97

Calculation Number: FFX-00426-02
Entry Date: 1/3/97

Type: CA33
OPERABILITY ANALYSIS

Project Number: NONE
Document Page : 21
Old_Calculation:

Modification: NONE
Scanned: N
Revision:

Title: EVALUATION OF LINE 183, WHICH WAS FOUND TO HAVE A WEEP A WELD

Tag Number
LINE183

Component Type	Component Description
PIPE	PIPE

Component Style	Style Description
PIPE	PIPE OR PIPING

System	Description
SIS	SAFETY INJECTION

Structure	Description
PAB	PRIMARY AUXILIARY BUILDING

Preparer: ALTADONNA
Signature: R. Altadonna

Update Date 1/3/97

Reviewer:
Signature/Date: A. LAGANA / A. Lagana / 1/3/97

Approval/Date J. Tuohy / 1/3/97

Confirm. Required? NO

N/A
Concurrence (If Required)

CON EDISON CALCULATION/ANALYSIS

Description of change sheet

Calculation No: FFX-00426

Revision No.	Description of Change	Reason for Change
00	Initial Issue	
01	Page 3 - corrected CITRS #, code case #. Added operability Det. #. Page 4 - Added part & surface Flaw Length. Revised equation for 2a. Corrected 15% Flaw length acceptance, & equation A.	Correct minor errors.
02	Page 5 → 20 - Ran smart-pipe stress analysis with actual line design Temperature	Reflect actual Design Temperature.

REF.

CALCULATION/ANALYSIS SUMMARY SHEET

Objective Of Calculation:

Background- Stainless steel line 183 developed a weep at the toe of the downstream weld of the first elbow off of the header line 155. (Ref. CITRS-96-02834). 1R-1
The leak is so small that there is no visible fluid on the surface. Only boron crystals appear on the surface.

UT readings on the pipe and elbow indicate full wall thickness and no wall thinning.
PT examination of the weld barely shows an indication. A previous attempt at PT showed the weld to be acceptable.

Assuming that the weep is the result of a Through Wall Flaw, determine if the flaw is stable.

A Smart Pipe analysis was performed to determine the actual stress for use in the Through Wall Flaw analysis.

Acceptance: The stress intensity factor is less than 135,000 for stainless steel.
The flaw length is less than 3" or 15% of the circumference.

Design Basis And References:

References-
- Altran Smart Pipe Program — Operability Determination # 96-0058 1R-1
- B31.1 1986
- Code case N-8 for allowable stress for SS piping 1R-1
- NRC Generic Letter 90-05
- CITRS-96-02834 1R-1

Assumptions-
- A through wall flaw in the radial direction exists. Conservative based upon the QC inspection results
- The stress at the location of the weep is the maximum stress determined from the Smart Pipe analysis of line 183. Conservative
- The flaw length at T_{min} is calculated based on a flaw profile having a 70 degree angle.
- Full design pressure is utilized. Conservative

Conclusions:

The stress intensity factor is less than 135,000
The flaw length is less than 15% and less than 3".

CON EDISON-NUCLEAR POWER ENGINEERING		CALCULATION/ANALYSIS SHEET
STATION/UNIT Indian Point Unit 2	CALCULATION NO. FFX- 00426-02	PAGE 4 OF 21
PARER/DATE R. Altadonna 12/21/96	REVIEWER/DATE AJ 12/23/96	CLASS (I.R. ONLY) A
SUBJECT OF COMPUTATION Evaluation Of SI Line 183 Which Was Found To Have A Weep At A Weld		MOD. NO./PROJ. NO. None COMPONENT DESCRIPTION Pipe

REF.

Through Wall Flaw Evaluation

FLAW DESCRIPTION- 2" RHR line 155 to the Refueling Water Purification Pump
Dried Boron evidence on the downstream side weld of the first elbow off of the 16" header

INPUTS

S = stress at defect= 5120

SE= allowable stress (B31.1)= 18700

D= OD = 2.375

P= des. pressure = 150

d= ID = 2.157

y= B31.1 coef. (para 104.1.2) = 0.4

A= add wall (B31.1)= 0

SFL= Surface flaw length = 0 | R-1

Material- Stainless Steel

CALCULATIONS

tm= min wall = (P*D/(2*(SE+P*y)))+A= 0.009495

2a= length of flaw at t min = '2*(tm/Tan 35 degrees)+SFL= 0.02712 | R-1

R= mean pipe radius= (D+d)/4= 1.133

r = R/ tm = 119.3268

K= Stress Intensity Factor= 1.4*S*F* Sq rt(3.1416*a) = 2121.732

F= 1 + A*1.5rt(c) +B*2.5rt (c) + C*3.5rt(c) = 1.434117

c= a/ (3.1416*R) = 0.00381

A=-3.26543 + 1.52784*r - 0.072698*r sq + 0.0016011*r cube = 1864.304 | R-1

B= 11.36322 - 3.91412*r + 0.18619*r sq - 0.004099*r cube = -4769.08

C= -3.18609 + 3.84763*r - 0.18304*r sq + 0.00403*r cube = 4696.944

ACCEPTANCE

K= 2121.732

Carbon Steel- K must be less than 35,000

Stainless Steel- K must be less than 135,000 **OK**

Flaw length's which exceed 3" or 15% of the circumference are unacceptable. 15%= 1.118625 2a= 0.02712 **OK** | R-1

This evaluation utilizes B31.1 for determination of min wall thickness rerquired.

The approach evaluates the stability of the flaw by linear elastic fracture mechanics as described in NRC Generic letter 90-05.

SMART-PIPE REPORT

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Attachment A - Model Plot

DISCLAIMER

SMART-PIPE is for the evaluation of localized piping and tubing segments subjected to deadweight, pressure, thermal, and seismic loading. It is NOT intended for the design and/or analysis of complete piping systems. The basis of the SMART-PIPE program is the simplified static method of seismic analysis.
The SMART-PIPE computer program has been verified in accordance with the requirements of the ALTRAN Quality Assurance Manual. ALTRAN Corporation takes no responsibility for the use of SMART-PIPE, or the calculations developed from its use. Preparation of input, and acceptance of results are the sole responsibility of the user and the reviewer. In case of errors, ALTRAN Corporation's only responsibility is to promptly correct the error in the computer code. (SMART-pipe v2.0 Revision 4-6-92)

1.0 ANALYTICAL MODEL

Reference: SMART-PIPE [1], Att. A, Model Plot

GEOMETRY OF THE LINE

Segment No -	Class	Outside Diameter (Do) in	Wall Thickness (t) in	Segment Length in	Segment Direction -
0	151	2.375	0.109	28	Up
1	151	2.375	0.109	20	Up
2	151	2.375	0.109	15	North
3	151	2.375	0.109	74	North
4	151	2.375	0.109	8	North
5	151	2.375	0.109	16	North
6	151	2.375	0.109	36	North
7	151	2.375	0.109	12	North
8	151	2.375	0.109	36	Up
9	151	2.375	0.109	36	North
10	151	2.375	0.109	12	Down
11	151	2.375	0.109	0.0	Down

Notes:

1. Segment Direction: x = East
   : y = Up
   : z = South

2.0 ANALYTICAL PARAMERERS

References: Line Schedule [5],
Pipe Specifications [2],
Tubing Specifications [4],
Insulation Specifications [3]

2.1 OPERATING CONDITIONS

Segment No	Line#	Class	Pressure (P) psi	Temperature (T) oF	Content	Insulation Type	Insulation Thickness in
0	183	151	150	120	WATER	NON	0.00
1	183	151	150	120	WATER	NON	0.00
2	183	151	150	120	WATER	NON	0.00
3	183	151	150	120	WATER	NON	0.00
4	183	151	150	120	WATER	NON	0.00
5	183	151	150	120	WATER	NON	0.00
6	183	151	150	120	WATER	NON	0.00
7	183	151	150	120	WATER	NON	0.00
8	183	151	150	120	WATER	NON	0.00
9	183	151	150	120	WATER	NON	0.00
10	183	151	150	120	WATER	NON	0.00
11	183	151	150	120	WATER	NON	0.00

2.2 MATERIAL PROPERTIES

References: ASA B31.1 - 1955, [8],
ANSI B31.1 - 1967, [9]

Segment No - -	Material	Grade	Temperature (T) oF	Young Modulus *e+6(E) lb/in2	Thermal Expansion *e-6(alfa) in/in/oF	Allowables Cold *e+3(Sc) psi	Allowables Hot *e+3(Sh) psi
0	A312	304	120	28.1	9.20	18.75	17.90
1	A312	304	120	28.1	9.20	18.75	17.90
2	A312	304	120	28.1	9.20	18.75	17.90
3	A312	304	120	28.1	9.20	18.75	17.90
4	A312	304	120	28.1	9.20	18.75	17.90
5	A312	304	120	28.1	9.20	18.75	17.90
6	A312	304	120	28.1	9.20	18.75	17.90
7	A312	304	120	28.1	9.20	18.75	17.90
8	A312	304	120	28.1	9.20	18.75	17.90
9	A312	304	120	28.1	9.20	18.75	17.90
10	A312	304	120	28.1	9.20	18.75	17.90
11	A312	304	120	28.1	9.20	18.75	17.90

2.3 SUPPORT TYPE SUMMARY

Beginning of Segment	Support Type	Support Direction
0	Rigid	Up
0	Rigid	Down
0	Rigid	North
0	Rigid	South
0	Rigid	East
0	Rigid	West
3	Rigid	Down
4	Rigid	East
4	Rigid	West
5	Rigid	Down
7	Rigid	Down
11	Anchor	

Notes:

1. Support Direction: x = East
   : y = Up
   : z = South

2.4 LOADING

2.4.1 Distributed Loading

Segment No -	SIF i -	Pipe Weight lbf/ft	Contents Weight lbf/ft	Insulation Weight lbf/ft	Total Weight lbf/ft
0	1.3	2.640	1.58000	00.00	4.22
1	1.3	2.640	1.58000	00.00	4.22
2	1.3	2.640	1.58000	00.00	4.22
3	1.3	2.640	1.58000	00.00	4.22
4	1.3	2.640	1.58000	00.00	4.22
5	1.3	2.640	1.58000	00.00	4.22
6	1.3	2.640	1.58000	00.00	4.22
7	1.3	2.640	1.58000	00.00	4.22
8	1.3	2.640	1.58000	00.00	4.22
9	1.3	2.640	1.58000	00.00	4.22
10	1.3	2.640	1.58000	00.00	4.22
11	1.3	2.640	1.58000	00.00	4.22

Note: A value of i=0 indicates that the program will calculate i in accordance with Section 3.1 of the SMART-pipe Theorical Manual.

2.4.2 Concentrated Loading

Beginning of Segment -	Concentrated Weight lbs	CGD in	Direction -
1	15	000.000	East
6	15	000.000	Down
10	15	000.000	

3.0 SEISMIC INPUT DATA

Building 1 = Ground Response ft,

Building 2 =

Reference: IP2 Spectra Database, [6]

EAST - WEST		UP - DOWN		NORTH - SOUTH	
Frequency Hz	Acceleration g	Frequency Hz	Acceleration g	Frequency Hz	Acceleration g
0.100	0.074	0.100	0.049	0.100	0.074
0.529	0.078	0.529	0.052	0.529	0.078
0.558	0.084	0.558	0.056	0.558	0.084
0.602	0.090	0.602	0.060	0.602	0.090
0.645	0.099	0.645	0.066	0.645	0.099
0.672	0.104	0.672	0.069	0.672	0.104
0.698	0.108	0.698	0.072	0.698	0.108
0.735	0.113	0.735	0.075	0.735	0.113
0.768	0.120	0.768	0.080	0.768	0.120
0.800	0.128	0.800	0.085	0.800	0.128
0.855	0.135	0.855	0.090	0.855	0.135
0.915	0.146	0.915	0.097	0.915	0.146
0.953	0.154	0.953	0.103	0.953	0.154
1.010	0.163	1.010	0.109	1.010	0.163
1.094	0.175	1.094	0.117	1.094	0.175
1.159	0.188	1.159	0.125	1.159	0.188
1.223	0.199	1.223	0.133	1.223	0.199
1.341	0.213	1.341	0.142	1.341	0.213
1.447	0.232	1.447	0.155	1.447	0.232
1.562	0.246	1.562	0.164	1.562	0.246
1.640	0.255	1.640	0.170	1.640	0.255
1.778	0.274	1.778	0.183	1.778	0.274
2.021	0.301	2.021	0.201	2.021	0.301
2.264	0.332	2.264	0.221	2.264	0.332
2.541	0.352	2.541	0.235	2.541	0.352
2.659	0.364	2.659	0.243	2.659	0.364
2.898	0.374	2.898	0.249	2.898	0.374
3.133	0.382	3.133	0.255	3.133	0.382
3.354	0.394	3.354	0.263	3.354	0.394

CON EDISON CALCULATION SHEET	Calculation No. FFX-00426	Revision 02	Page 12 of 21
Preparer/Date ROBERT ALTADONNA	Reviewer/Date AL 1/3/97		Class A
Subject/Title Evaluation of SI Line for Weep Hole			Project No. NONE
Reference Model Name line183			Mod.No. NONE Rev.

Seismic Data cont.

EAST - WEST		UP - DOWN		NORTH - SOUTH	
Frequency Hz	Acceleration g	Frequency Hz	Acceleration g	Frequency Hz	Acceleration g
3.650	0.398	3.650	0.265	3.650	0.398
3.832	0.399	3.832	0.266	3.832	0.399
4.212	0.399	4.212	0.266	4.212	0.399
4.584	0.397	4.584	0.265	4.584	0.397
4.965	0.391	4.965	0.261	4.965	0.391
5.368	0.384	5.368	0.256	5.368	0.384
5.949	0.373	5.949	0.249	5.949	0.373
6.646	0.355	6.646	0.237	6.646	0.355
7.199	0.342	7.199	0.228	7.199	0.342
8.420	0.308	8.420	0.205	8.420	0.308
10.210	0.266	10.210	0.177	10.210	0.266
12.280	0.227	12.280	0.151	12.280	0.227
13.657	0.202	13.657	0.135	13.657	0.202
15.821	0.178	15.821	0.119	15.821	0.178
18.000	0.159	18.000	0.106	18.000	0.159
20.782	0.142	20.782	0.095	20.782	0.142
24.305	0.131	24.305	0.087	24.305	0.131
28.104	0.120	28.104	0.080	28.104	0.120
32.388	0.113	32.388	0.075	32.388	0.113
33.000	0.100	33.000	0.067	33.000	0.100
100.000	0.100	100.000	0.067	100.000	0.100

4.0 ANALYSIS

Reference: SMART-PIPE [1]

4.1 DEADWEIGHT

Y-direction (Up-Down)

Beam Model Segment No.	User Mod. Segment No.	Maximum Moment in*lbf	Maximum Deflection in
0	0	1.649e+02	0.000
1	3	1.649e+02	0.004
2	4	2.046e+02	0.001
3	5	2.046e+02	0.001
4	6	1.366e+02	0.001
5	7	1.366e+02	0.001
6	8	1.042e+02	0.001
7	10	0.000e+00	0.000

Deadweight Analysis Summary

Peak Stress: 485.96 psi

4.2 SEISMIC

X-direction (East-West)

Beam Model Segment No.	User Mod. Segment No.	Maximum Moment in*lbf	Maximum Deflection in
0	0	2.312e+02	0.017
1	1	2.385e+02	0.023
2	2	2.334e+02	0.024
3	3	3.500e+02	0.023
4	4	3.500e+02	0.001
5	5	2.373e+02	0.004
6	6	1.173e+02	0.014
7	7	1.329e+02	0.015
8	8	1.342e+02	0.015
9	9	1.434e+02	0.011
10	10	3.136e+02	0.001
11	11	0.000e+00	0.000

Y-direction (Up-Down)

Beam Model Segment No.	User Mod. Segment No.	Maximum Moment in*lbf	Maximum Deflection in
0	0	1.105e+01	0.000
1	3	1.105e+01	0.000
2	4	1.371e+01	0.000
3	5	1.371e+01	0.000
4	6	9.150e+00	0.000
5	7	9.150e+00	0.000
[illegible]	8	6.980e+00	0.000
[illegible]	10	0.000e+00	0.000

Preparer/Date	Reviewer/Date	Class
ROBERT ALTADONNA	AZ 1/3/97	A

Subject/Title	Project No.
Evaluation of SI Line for Weep Hole	NONE
Reference Model Name	Mod.No. Rev.
line183	NONE

SEISMIC (cont.)

Z-direction (North-South)

Beam Model Segment No.	User Mod. Segment No.	Maximum Moment in*lbf	Maximum Deflection in
0	0	3.718e+02	0.019
[illegible]	1	4.792e+02	0.021
2	2	4.792e+02	0.021
3	9	7.282e+02	0.003
4	11	0.000e+00	0.000

Seismic Analysis Summary

	X-direction (East-West)	Y-direction (Up-Down)	Z-direction (North-South)
Frequency, Hz:	12.01	51.58	12.39
Acceleration OBE, g:	0.23	0.07	0.23
Multimode Magnification Factor:	1.50	1.00	1.50
Peak Stress, psi:	1.164e+03	3.257e+01	2.422e+03

4.3 THERMAL

X-direction (East-West)

Beam Model Segment No.	User Mod. Segment No.	Maximum Moment in*lbf	Maximum Deflection in
0	0	0.000e+00	0.000
1	1	0.000e+00	0.000
[illegible]	2	0.000e+00	0.000
[illegible]	3	0.000e+00	0.000
4	4	0.000e+00	0.000
5	5	0.000e+00	0.000
6	6	0.000e+00	0.000
7	7	0.000e+00	0.000
8	8	0.000e+00	0.000
9	9	0.000e+00	0.000
10	10	0.000e+00	0.000
11	11	0.000e+00	0.000

Y-direction (Up-Down)

Beam Model Segment No.	User Mod. Segment No.	Maximum Moment in*lbf	Maximum Deflection in
0	0	8.536e+02	0.000
1	3	8.536e+02	0.000
2	4	7.203e+02	0.000
3	5	7.402e+02	0.000
4	6	1.297e+03	0.000
5	7	1.673e+03	0.000
[illegible]	8	1.673e+03	0.000
[illegible]	10	0.000e+00	0.000

THERMAL (cont.)

Z-direction (North-South)

Beam Model Segment No.	User Mod. Segment No.	Maximum Moment in*lbf	Maximum Deflection in
0	0	6.778e+02	0.000
1	1	1.627e+03	0.000
2	2	1.627e+03	0.000
3	9	4.885e+03	0.000
4	11	4.885e+03	0.000

Thermal Analysis Summary

	X-direction (East-West)	Y-direction (Up-Down)	Z-direction (North-South)
Peak Stress, psi :	0.000e+00	5.166e+03	2.112e+04

5.0 ANSI B31.1 STRESS SUMMARY

Reference: ANSI B31.1 - 1973, [7]
ASA B31.1 - 1955, [8]

Stresses due to Sustained Loads:

EQ 11 (Pressure + Dead Weight) : P*Do/4t + 0.75iMa/Z <= 1.0 Sh

Stresses due to Occasional Loads:

EQ 12 (Sustained + OBE Seismic): P*Do/4t + 0.75i(Ma+Mb)/Z <= 1.2 Sh

EQ 12a(Sustained + DBE Seismic): P*Do/4t + 0.75i(Ma+Mb)/Z <= 1.8 Sh

Thermal Expansion Stress:

EQ 14 (Sustained + Thermal): P*Do/4t + 0.75iMa/Z + iMc/Z <= Sa + Sh

Equation	Calculated Stress psi	Allowable Stress psi	Stress/Allowable Ratio -	Conclusion
11	1.303e+03	1.790e+04	0.07	OK.
12	3.757e+03	2.148e+04	0.17	OK.
12a	4.984e+03	3.222e+04	0.15	OK.
14	2.304e+04	4.496e+04	0.51	OK.

6.0 SUPPORT LOAD SUMMARY

Reference: SMART-PIPE [1]

	Rx lbs	Ry lbs	Rz lbs
SUPPORT LOADING REPORT FOR NODE 0			
Deadweight	-----	23.53	-----
Seismic OBE	9.97	1.58	14.94
Seismic DBE	14.96	2.36	22.41
Thermal	0.00	56.91	33.89
SUPPORT LOADING REPORT FOR NODE 3			
Deadweight	-----	27.58	-----
Seismic OBE	0.00	1.85	0.00
Seismic DBE	0.00	2.77	0.00
Thermal	0.00	73.58	0.00
SUPPORT LOADING REPORT FOR NODE 4			
Deadweight	-----	0.00	-----
Seismic OBE	26.59	0.00	0.00
Seismic DBE	39.88	0.00	0.00
Thermal	0.00	0.00	0.00
SUPPORT LOADING REPORT FOR NODE 5			
Deadweight	-----	35.76	-----
Seismic OBE	0.00	2.40	0.00
Seismic DBE	0.00	3.59	0.00
Thermal	0.00	51.49	0.00
SUPPORT LOADING REPORT FOR NODE 7			
Deadweight	-----	31.08	-----
Seismic OBE	0.00	2.08	0.00
Seismic DBE	0.00	3.12	0.00
Thermal	0.00	282.33	0.00
SUPPORT LOADING REPORT FOR NODE 11			
Deadweight	-----	30.16	-----
Seismic OBE	14.92	2.02	35.00
Seismic DBE	22.38	3.03	52.50
Thermal	0.00	46.47	392.92

Note: Seismic, and Thermal reactions are absolute values.

7.0 REFERENCES

1. Altran Corporation, 'SMART-Pipe - Simplified Piping/Tubing Structural Qualification Program, version 2.0'. Boston: Altran, 1992

2. Consolidated Edison Co. 'Specification for Fabrication of Piping Systems', Spec. No 9321-01-248-18 &-35, Revision 5A, ConEd & UE&C, 1985

3. Consolidated Edison Co. 'Specification for Thermal Insulation Spec. No 9321-01-249-1, Revision 1, ConEd & UE&C, 1974

4. Consolidated Edison Co. 'Installation of Tubing' Spec. No MP-85-017, Revision 0, ConEd, 1984

Consolidated Edison Co. 'Nuclear Line Schedule' Drawing No 9321-C-2741, Revision Varies, ConEd & UE&C

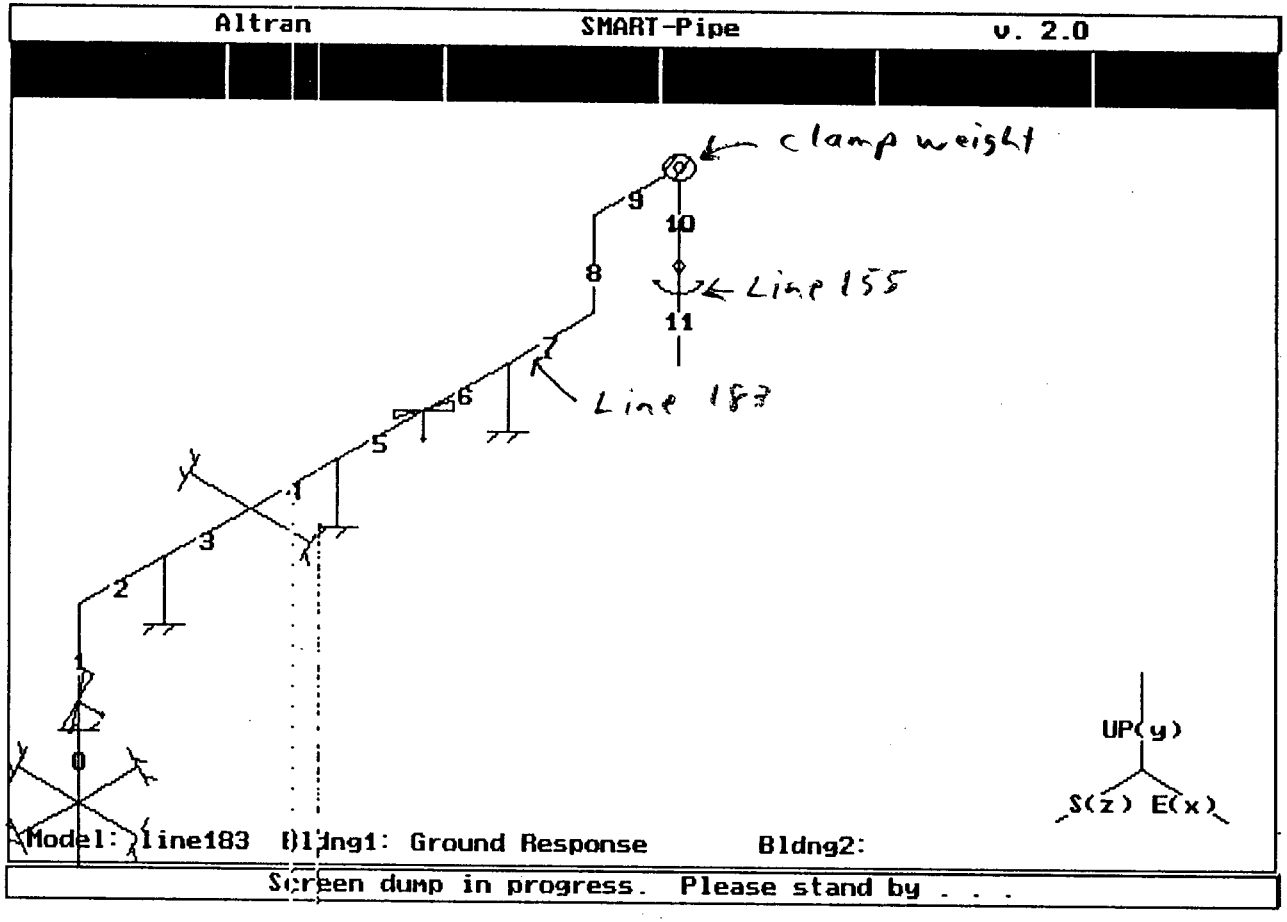
6. Altran Corporation, 'Indian Point Unit 2 Response Spectra Database' Technical Report 89144-C-01, Revision 1, Boston: Altran, 1990

7. American Society of Mechanical Engineers, 'Code for Pressure Piping' ANSI B31.1 - 1973, ASME, NY 1973

8. American Standard, 'Code for Pressure Piping' ASA B31.1-1955, ASME, NY

9. American Society of Mechanical Engineers, 'Code for Pressure Piping' ANSI B31.1 - 1967, ASME, NY 1967

10. National Valve & Manufacturing Co (NAVCO). 'Piping Datalog' NAVCO, Pittsburg, PA, 1976


Altran
SMART-Pipe
v. 2.0
clamp weight
Line 155
Line 183
0
1
2
3
4
5
6
7
8
9
10
11
UP(y)
S(z) E(x)
Model: line183 Bldng1: Ground Response Bldng2:
Screen dump in progress. Please stand by . . .