

**Attachment 6**

**Gothic Verification Calculation**

9803300295 980326  
PDR ADDCK 05000263  
P PDR

VECTRA

## CALCULATION PACKAGE

FILE NO: 091-19407-C-3

PROJECT: 0091-19407.000

P.O. NO: 7972SQ

PROJECT NAME:  
Monticello HELB/GOTHIC Analysis 1

CLIENT: Northern States Power

## CALCULATION TITLE:

GOTHIC Verification

## PROBLEM STATEMENT OR OBJECTIVE OF THE CALCULATION:

This calculation documents a verification comparison of output results between a GOTHIC thermal/hydraulic computer model of the Turbine Building and the same model results obtained previously using RELAP 4 / MOD 5.

DOCUMENT REVISION	AFFECTED AREAS	REVISION DESCRIPTION	PROJECT ENGINEER APPROVAL/DATE	NAME AND INITIALS OF PREPARERS & CHECKERS
0	Turbine Bldg.	Issue	<i>Steph Huddleston 12-11-94</i>	<p>Preparer: Stephen C. Huddleston Sig. <i>Steph Huddleston</i> 12/11/94 Init. <i>SH</i></p> <p>Checker: <i>Raj Krishnamurthy</i> Raj Krishnamurthy Sig. <i>RK</i> 12/11/94 Init. <i>RK</i></p>

PAGE 1 OF 10  
TOTAL PAGES

# VECTRA

PROJECT: Monticello HELB/GOTHIC Analysis 1

FILE NO:091-19407-C-3

CLIENT: Northern States Power

## CALCULATION CHECKLIST INDEPENDENT DESIGN VERIFICATION

CALCULATION TITLE: GOTHIC Verification  
REV. 0

Was verification in accordance with QPES 3-2 & 3-4?

Are references identified?

Are assumptions identified?

Is input traceable?

Is technical procedure clearly stated?

Is the technical procedure adequate?

Is the technical procedure correctly implemented?

Are input documents and the appropriate revisions listed on the Design Input Log?

Are computations correct?

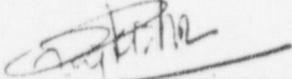
Are calculation results consistent with inputs, technical procedure and design criteria?

Are comments and corrections reconciled?

Are results reasonable?

Others:

Verified By/Date:



Independent Checker



Initials

PREPARED BY / DATE	<u>Jeff H. Jr.</u>					
CHECKED BY / DATE	<u>2/2/94</u>					

## TABLE OF CONTENTS

SECTION	PAGE
1.0 INTRODUCTION	4
2.0 METHODOLOGY	4
3.0 RESULTS	8
4.0 REFERENCES	10

## ATTACHMENTS

- A. OUTPUT PLOTS
- B. INPUT TABLES
- C. MODEL VOLUMES AND FLOW PATHS
- D. RELAP INPUT
- E. RELAP OUTPUT

## GOTHIC VERIFICATION

REV	BY	DATE	CHECKED	DATE	 VECTRA	JOB NO	0091-19407.000	PAGE
3	LH	1/30/94	✓	1/11/94		CALC NO	091-19407-C-3	4

4

## 1.0 INTRODUCTION

This calculation documents a project verification of the GOTHIC computer code. The verification is done by running the program using input from a previous RELAP 4 / MOD 5 analysis (Ref. 2) and comparing the results of a postulated main steam line break in the turbine building of the Northern States Power Monticello generating plant.

GOTHIC (Generation of Thermal-Hydraulic Information for Containments) is a general purpose thermal-hydraulics computer program package for the analysis of nuclear power plant containments and other confinement buildings (Ref. 1). The application considered in this calculation is the analysis of high energy line break (HELB) temperature determinations.

As a verification criteria, the GOTHIC temperature results are to be within 5% of the RELAP 4 analysis.

## 2.0 METHODOLOGY

The methodology for the verification is given in the following steps:

1. The following input VOLUME parameters are taken from the RELAP 4 analysis (Ref. 2, Table 3.1):

- Initial Temperature (TEMP)
- Volume (V)
- Height (ZVOL)
- Flow area (FLOWA)
- Floor elevation (ELEV)

2. Other volume parameters required by GOTHIC are derived from the above, ie:

### *Hydraulic diameter*

The hydraulic diameter of the volume is used to define the surface area in the volume wetted by liquid film. It is defined as (Ref. 1, pg. 7-6):

$$D_h = 4 A / P_w \quad [1]$$

where:

A = volume cross sectional area (ie, FLOWA)

and					GOTHIC VERIFICATION		
REV	BY	DATE	CHECKED	DATE	 VECTRA	JOB NO	PAGE
						CALC NO	0091-19407.000
					091-19407-C-3		4

5

$$P_w = \text{wetted perimeter} = S/h \quad [2]$$

where:

$S$  = total surface area in the volume

$h$  = volume height (ie, ZVOL)

The volume ( $V$ ) is:

$$V = lwh \quad [3]$$

where:

$l$  = volume length (in the horizontal plane)

$w$  = volume width

using:

$$A = wh \quad [4]$$

or:

$$w = A/h = FLOWA / ZVOL \quad [5]$$

The volume is also defined as:

$$V = Al \quad [6]$$

The volume length is found by rearranging eq. 6:

$$l = V/A = V / FLOWA \quad [7]$$

the total surface area ( $S$ ) in the volume is:

$$S = 2lw + 2hl + 2wh \quad [8]$$

3. Volume parameters taken from the RELAP reference and those derived from the referenced parameters are given in a spread sheet table of Attachment A

					GOTHIC VERIFICATION		
REV	BY	DATE	CHECKED	DATE	 VECTRA	JOB NO 0091-19407.000	PAGE
						CALC NO 091-19407-C-3	5 OF 10
Olett	11/30/94	GD	12/1/94				

4. Flow path (a.k.a. junction) parameters are taken from the RELAP calculation (Ref.2,Table 3.2).

These are:

- First connected volume (GOTHIC "A" volume, RELAP "IW1")
- Second connected volume (GOTHIC "B" volume, RELAP "IW2")
- Junction area (AJUN)
- Forward flow resistance (FJUNF)
- Reverse flow resistance (FJUNR)
- Elevation (ZJUN)

5. The Hydraulic diameter ( $D_{hj}$ ) is determined for the GOTHIC input by:

$$D_{hj} = 4 \text{ AJUN} / w_p \quad [10]$$

where:

$w_p$  = flow path wetted perimeter, and

$$\text{AJUN} = w_j h_j, \text{ where} \quad [10.1]$$

$w_j$  = flow path width

$$w_p = 4w \quad [11]$$

w and h are not given in ref. 2,  
but are computed from rearrangements of eq. 10.1 or  
assigning a value consistent with model limits and  
AJUN, ie:

$$w_j = \text{SQRT(AJUN)} \quad [12]$$

or,

$$w_j = 3', \text{ for doorways} \quad [12.1]$$

or,

$$w_j = \text{AJUN}/h, \text{ when } h \text{ is limited by} \\ \text{volume height} \quad [12.2]$$

					GOTHIC VERIFICATION		
					JOB NO	0091-19407.000	PAGE
					CALC NO	6	OF
Rev	By	Date	Checked	Date		091-19407-C-3	19

6. The junction height ( $h_j$ ) is taken from:

$$h_j = w_j \quad [13]$$

or,

$$h_j = AJUN/w_j, \text{ when } w_j \text{ is assigned (eq. 12.1)} \quad [13.1]$$

or,

$$h_j = \text{Volume height (h)} \quad [13.2]$$

7. The inertia length is found for the center to center distance of two connected volumes. In this analysis for horizontal flow paths between two volumes ("A" and "B"), each with a given length,  $l_a$  and  $l_b$ ,

$$L_i = l_a/2 + l_b/2 \quad [14]$$

8. Heat sink slab data is taken from the RELAP calculation (Ref.2, Table 3.3)

- Volume where located - IVSR
- Area - AHTR, except for Heat Sink no. 6 where "Actual Slab Data" is used
- Thickness - .25 ft
- Specific Heat ( $\rho_c$ ) - 22.6 btu/ft<sup>3</sup> -F
- Conductivity (k) - 0.92 Btu/h - ft -F

GOTHIC VERIFICATION				
0	1H	1/30/94	SL	11/11/94
REV	BY	DATE	CHECKED	DATE
VECTRA				
JOB NO 0091-19407.000 PAGE				
CALC NO 091-19407-C-3				

### 3.0 RESULTS

Temperature peaks are given for the RELAP and GOTHIC runs in Table 3-1. Results show that the greatest difference between GOTHIC and RELAP temperature peaks occur for model volume 5 where the GOTHIC temperature is 4.07% higher.

Some variances in time history distribution between the GOTHIC and RELAP results are seen. The greatest occurrence is in volume 2 where the RELAP temperature peak is at 50 seconds, compared to the GOTHIC peak at 3.5 seconds. The next greatest time variance is in volume 1 where the RELAP temperature peak is at 4 seconds compared to the GOTHIC temperature peak at 0.7 seconds. The time spread between the occurrence of RELAP and GOTHIC temperature peaks for the other volumes is at or under 2 seconds.

The minor variance in temperature peaks and time history is due to the inherent differences in the manor in which the two codes handle steam/gas/liquid mixtures. GOTHIC is a state-of-the-art program that solves the conservation of mass, momentum, and energy equations for multi-component, multi-phase flow. The RELAP code (RELAP 4 / MOD 5) uses a simplified method of homogeneous (i.e., phase properties averaged together) fluid equations with the phases in thermodynamic equilibrium.

Based on the results of this analysis it is concluded that the GOTHIC model results are comparable with minor differences in peak temperatures that are under 5%. Time-history differences are attributed to the T/H analysis sophistication of the two codes in addressing multi-phase conditions in the volumes.

					GOTHIC VERIFICATION		
Q	left	11/30/94	Re	12/21/94	 VECTRA	JOB NO	0091-19407.000
REV	BY	DATE	CHECKED	DATE		CALC NO	091-19407-C-3

**RELAP 4 / MOD 6 AND GOTHIC 4.0 COMPARISON**

**Peak Temperature Results**

Volume No.	RELAP Temp. (F)	Time (sec)	GOTHIC Temp (F)	Time (sec)	Percent Comparison
1	111.3	4	111	0.7	-0.27%
2	114	50	112.2	3.5	-1.60%
3	109.9	3	113.9	3.5	3.51%
4	110.5	4	111.7	3.5	1.07%
5	110.7	2	115.4	3.5	4.07%
6	128.9	3	129.9	4	0.77%
7	110.3	4	111.7	3.5	1.25%
8	159.6	6	161.1	5.7	0.93%
9	104	0	104	0	0.00%
10	136.3	4	133.8	6	-1.87%
11	93.7	6	93.5	7	-0.21%
12	102.1	6	102.6	7	0.49%
13	149.1	50	152	50	1.91%
14	114.4	5	119	7	3.87%
15	302.1	2	292.5	2.3	-3.28%

**TABLE 3-1**

**GOTHIC VERIFICATION**

0	L4	11/30/94	CD	11/31/94	 VECTRA	JOB NO	0091-19407.000	PAGE	4
REV	BY	DATE	CHECKED	DATE		CALC NO	091-19407-C-3	OF	10

10

#### 4.0 REFERENCES

1. George, T. L. GOTHIC Containment Analysis Package User's Manual, Version 4.0, Richland WA., Numerical Applications Inc., September 1993
2. VECTRA (Impeli) Calculation, No. 091-127-TH3, Rev.0, "Monticello Turbine Building /Operating Deck Environmental Analysis"

					GOTHIC VERIFICATION		
REV	BY	DATE	CHECKED	DATE	 VECTRA	JOB NO	PAGE
						CALC NO	0091-19407.000
0	LH	11/30/94	SC	11/11/94		091-19407-C-3	

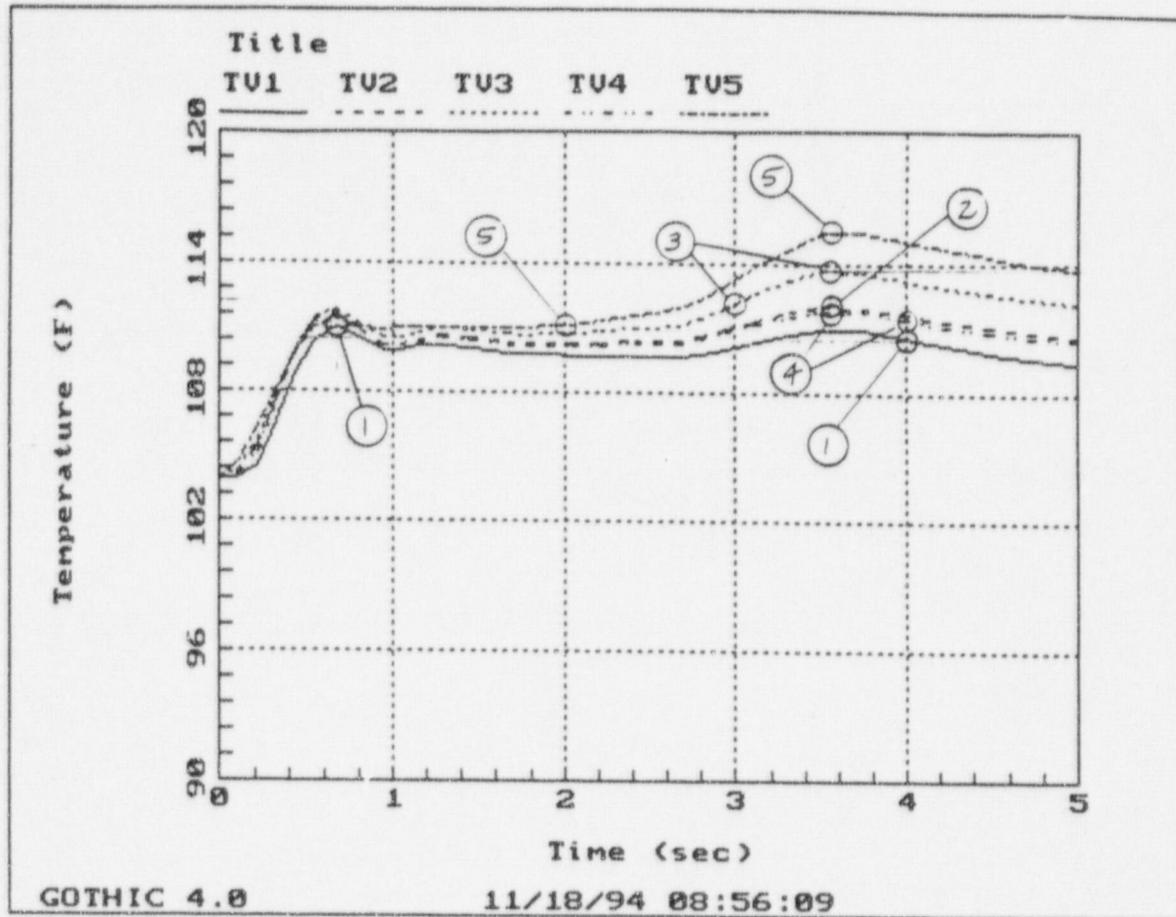
ATTACHMENT A

OUTPUT PLOTS

GOTHIC VERIFICATION

REV	BY	DATE	CHECKED	DATE	 VECTRA	JOB NO	0091-19407.000	PAGE
O	Le H	11/30/94	Rm	12/21/94		CALC NO	091-19407-C-3	41 OF 1

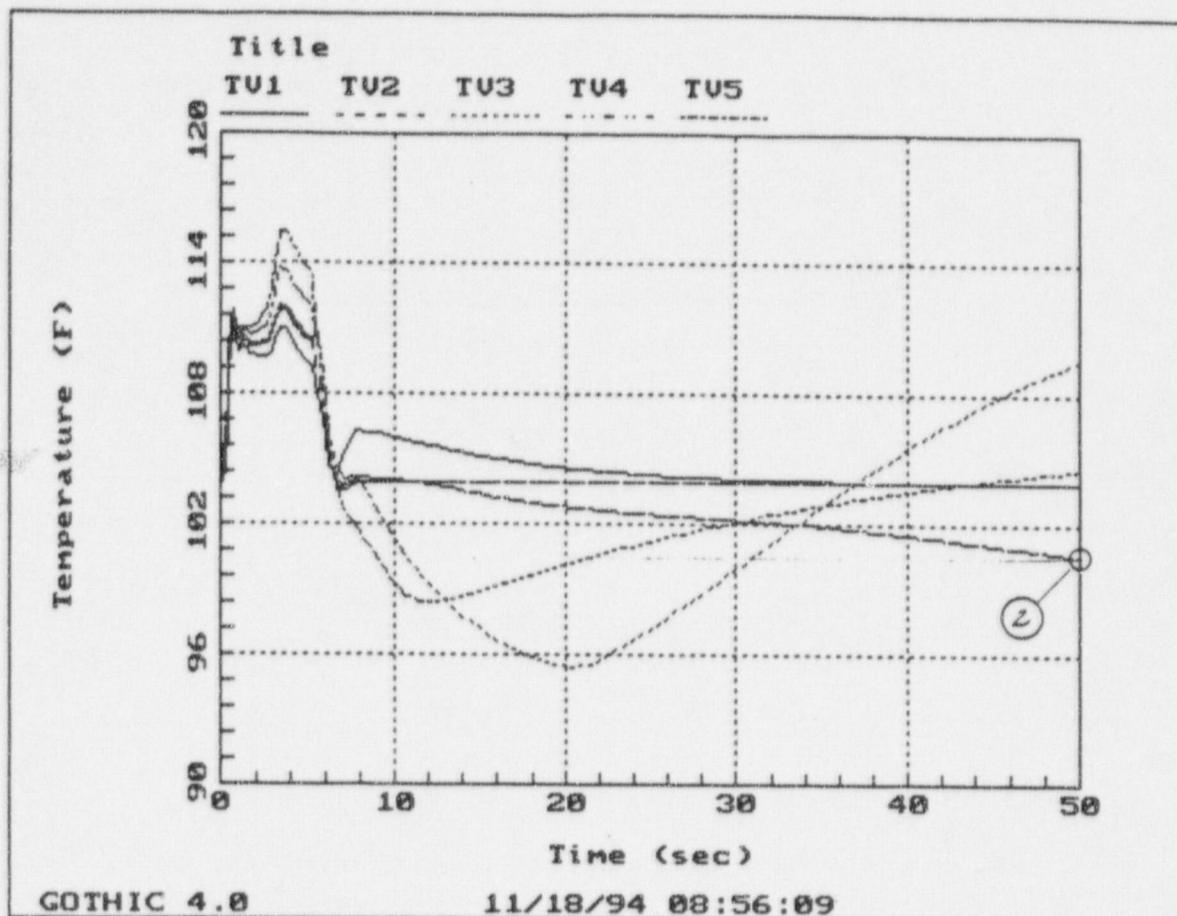
12



	<u>A (NOTE 1)</u>	<u>B (NOTE 1)</u>
①	110.4 @ 4 sec	111 @ .68 sec
②		112.2 @ 3.5 sec
③	112.2 @ 3 sec	113.9 @ 3.5 sec
④	111.4 @ 4 sec	111.7 @ 3.5 sec
⑤	111.4 @ 2 sec	115.4 @ 3.5 sec

NOTE 1 - "A" COL. TEMP. PEAKS AT TIME OF  
REENTRY MODEL PEAKS (Ref. 2)  
"B" COL. MAX TEMP PEAK ON CURVE

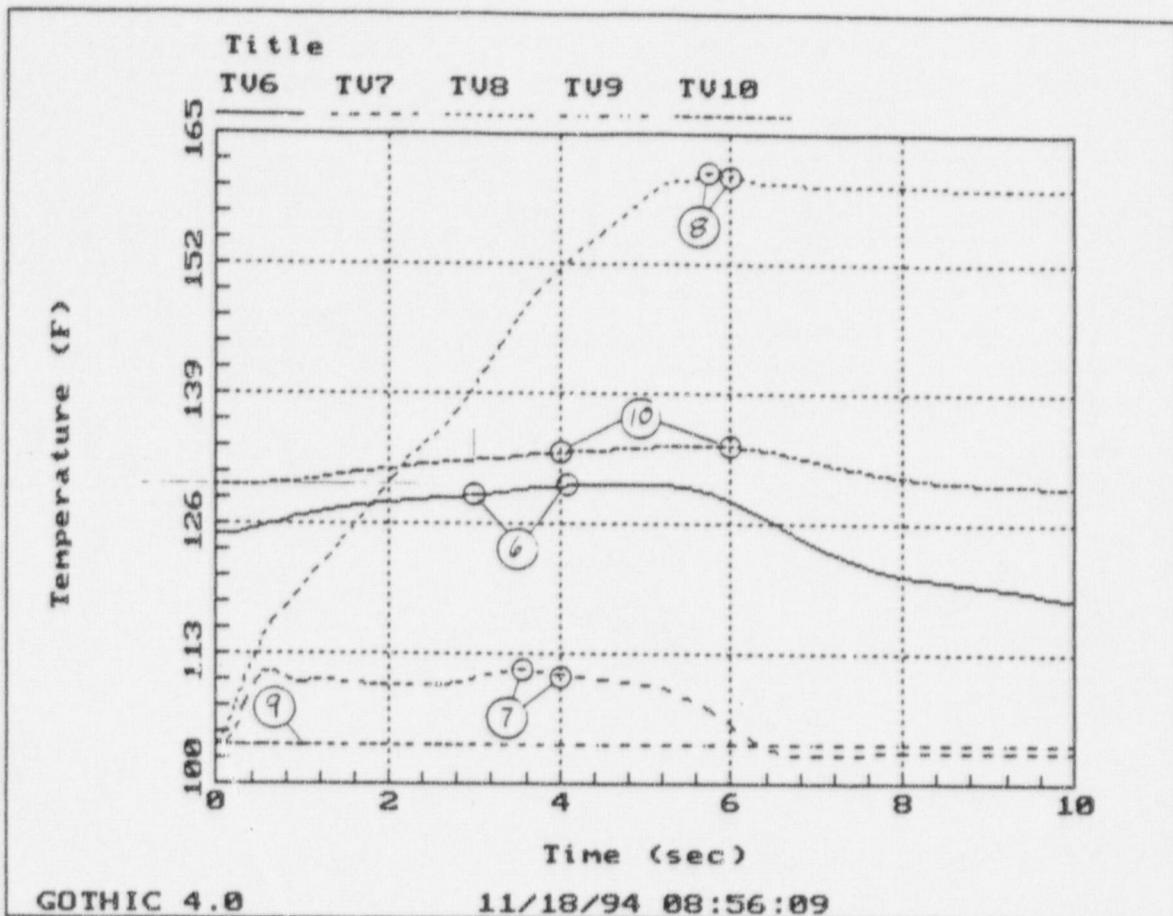
model5a/5.5 sec bk. in stm. tunnel  
09:26:19 18-NOV-94  
GOTHIC Version 4.0 - August 1993



4 (NOTE 1)  
② 101 ° @ 50 sec

A3  
CE

14



A (NOTE 1)

⑥ 128.6 @ 3 sec

B (NOTE 1)

129.9 @ 4 sec

⑦ 110.4 @ 4 sec

111.7 @ 3.5 sec

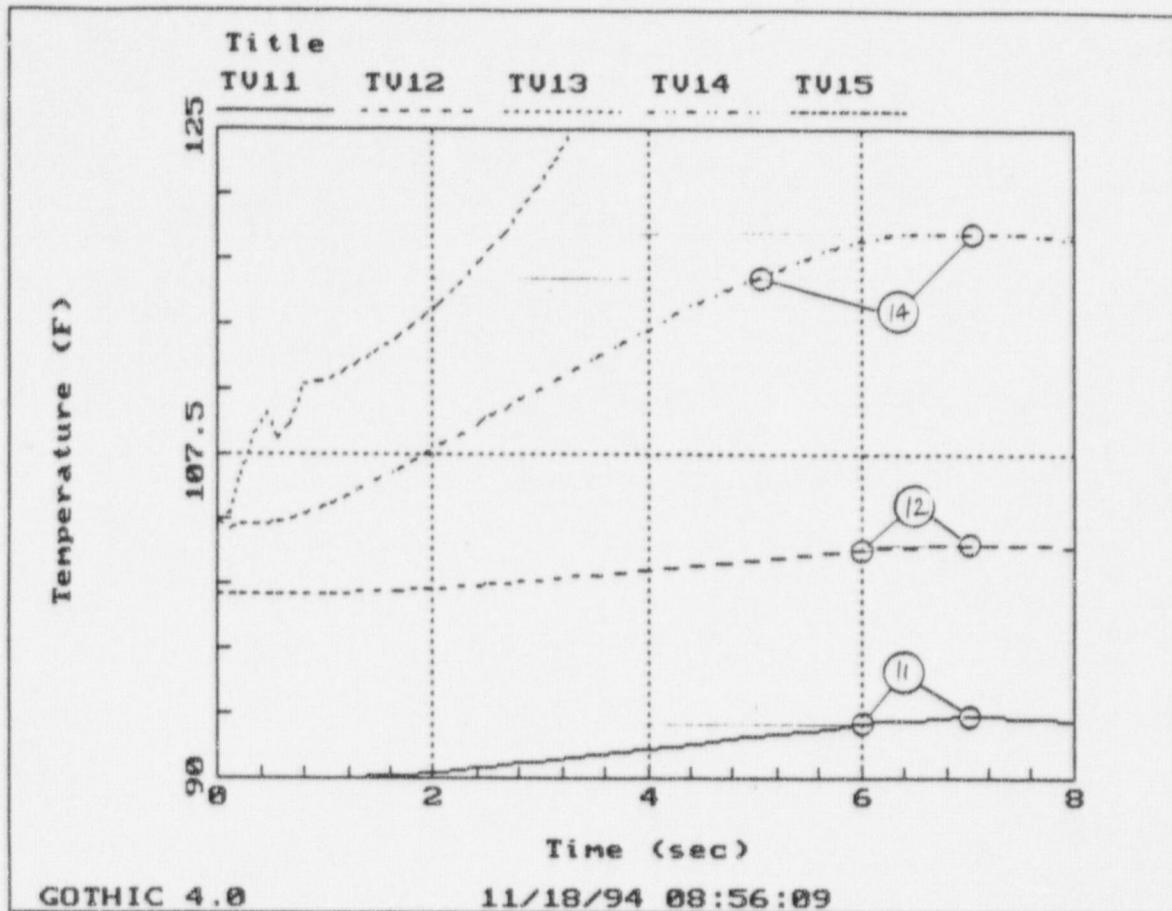
⑧ 160.3 @ 6 sec

161.1 @ 5.7 sec

⑨ 104

⑩ 133.5 @ 4 sec 133.8 @ 6 sec

A4  
OK  
7



A (NOTE 1)

(11) 92.8 ° at 6 sec

(12) 102.3 ° at 6 sec      102.6 ° at 7 sec

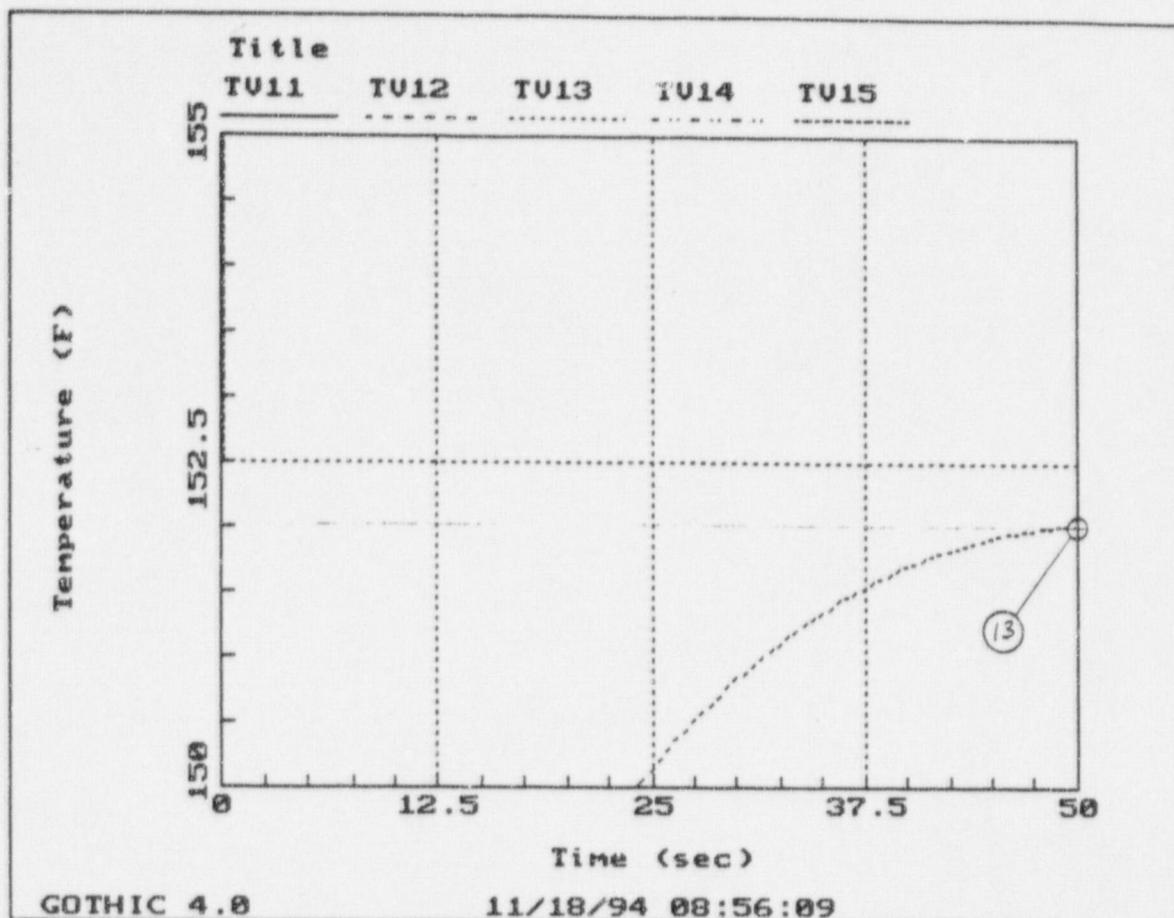
(13) 152 ° at 50 sec

(14) 116 ° at 5 sec      119 ° at 7 sec

(15) 288 ° at 2 sec      292.5 ° at 2.25 sec

A5  
OF  
7

model5a/5.5 sec bk. in stm. tunnel  
13:12:14 18-NOV-94  
GOTHIC Version 4.0 - August 1993

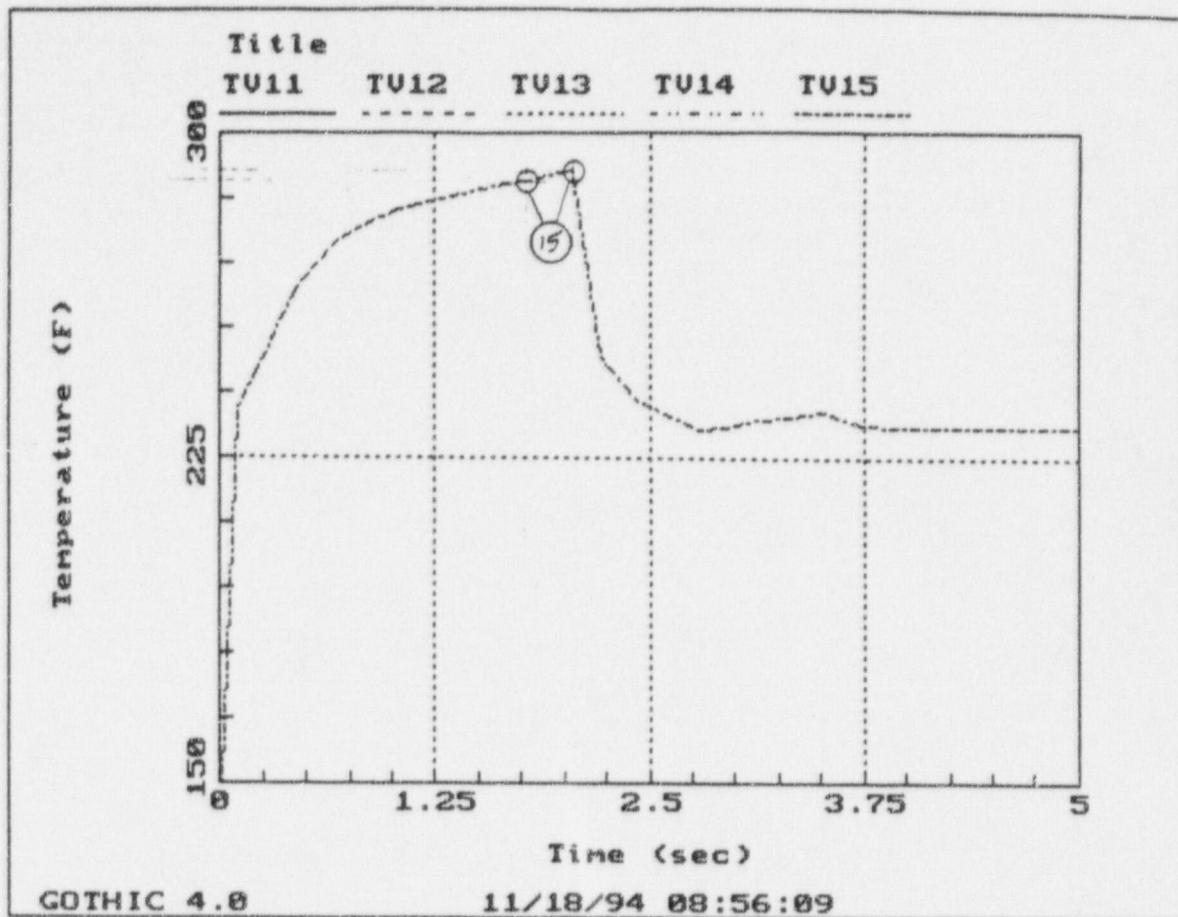


A6

OF  
7

17

model5a/5.5 sec bk. in stm. tunnel  
13:33:52 18-NOV-94  
GOTHIC Version 4.0 - August 1993



A1  
OF  
?

18

ATTACHMENT B

INPUT TABLES

GOTHIC VERIFICATION				
0	11/30/94	12/21/94	 VECTRA	JOB NO 0091-19407.000
REV	BY	DATE		CHECKED
				CALC NO 091-19407-C-3
				PAGE B 1 OF 1

model5a/5.5 sec bk. in stm. tunnel  
 14:19:19 17-NOV-94  
 GOTHIC Version 4.0 - August 1993

Control Volumes						
Vol #	Description	Vol (ft <sup>3</sup> )	Elev (ft)	Ht (ft)	Hyd. D. (ft)	Pl Area (ft <sup>2</sup> )
1	Plant Attend Ar	1700.	931.	19.	7.42	89.47
2		19040.	931.	19.	9.2	1002.11
3	MCC	6548.	931.	19.	10.4	344.63
4		26080.	931.	19.	5.79	1372.63
5		11808.	931.	19.	13.5	621.47
6	Cond/Drain/Htrs	410000.	907.	43.	35.71	9534.88
7	MCC	65090.	910.	30.	7.32	2169.67
8	Turbine Deck	1400000.	950.	54.5	52.34	25688.0
9	Atmosphere	1e+12	911.	200.	0.01	5e+09
10	Air Ejct. Rm.	24916.	911.	20.	5.5	1245.8
11	Sw. Gr. Rm.	31575.	911.	19.	10.76	1661.84
12	MCC	7411.	911.	19.	9.64	390.05
13	RR Track Area	115000.	911.	40.	17.8	2875.
14	Plenum	22000.	950.	50.	56.11	440.
15	Steam Tunnel	20317.	931.	28.	16.44	725.61

Fluid Boundary Conditions - Table 1								
BC#	Description	Press. (psia)	Temp. FF	Temp. (F)	Flow FF	Flow (lbm/s)	ON FF	OFF Trip
1F	Break	20.		E1	1		1	2
2P		14.7		104				
3P		14.7		104				
4P		14.7		104				
5P		14.7		104				
6P		14.7		104				
7P		14.7		104				
8P		14.7		104				

Fluid Boundary Conditions - Table 2								
BC#	Liq. V Frac.	Stm. FF	Drop P.R.	D FF (in)	Cpld FF BC#	Flow Frac.	Heat FF (Btu/s)	FF
1F			1.	0	0.0008			
2P								
3P								
4P								
5P								
6P								
7P								
8P								

B2  
CF  
11

20

Fluid Boundary Conditions - Table 3 Gas Pressure Ratios									
BC#	Air	FF	Ar	FF	He	FF	H2	FF	
1F	1.								
2P	1.								
3P	1.								
4P	1.								
5P	1.								
6P	1.								
7P	1.								
8P	1.								

Fluid Boundary Conditions - Table 4 Gas Pressure Ratios								
BC#	Kr	FF	N2	FF	O2	FF	Xe	FF
1F								
2P								
3P								
4P								
5P								
6P								
7P								
8P								

B3  
OP  
11

21

Flow Paths - Table 1

F.P. #	Description	Vol A	Elev (ft)	Ht (ft)	Vol B	Elev (ft)	Ht (ft)
1		1	932.	10.	2	932.	10.
2		1	932.	3.74	7	912.	3.74
3		1	932.	1.39	6	910.	1.39
4		2	932.	17.0	3	932.	17.
5		2	932.	7.55	8	952.	7.55
6		2	932.	18.	4	932.	18.
7		7	912.	18.	5	932.	18.
8		3	932.	10.	8	952.	10.
9		8	952.	11.2	4P	912.	11.2
10		5	932.	15.	8	952.	15.
11		1	932.	1.32	6	910.	1.32
12		13	912.	31.6	8	952.	31.6
13		13	912.	15.9	2P	912.	15.9
14		11	912.	12.1	12	912.	12.1
15		11	912.	12.1	12	912.	12.1
16		10	912.	1.03	11	912.	1.03
17		10	912.	7.	11	912.	7.
18		10	912.	1.46	6	910.	1.46
19		10	912.	7.33	6	910.	7.33
20		6	908.	7.	13	912.	7.
21		6	908.	5.39	14	952.	5.39
22		6	908.	6.32	8	952.	6.32
23		14	952.	9.48	3P	912.	9.49
24		6	908.	29.1	8	952.	29.1
25		10	912.	5.48	13	912.	5.48
26		8	952.	7.07	5P	952.	7.07
27		8	952.	7.07	6P	952.	7.07
28		8	952.	7.07	7P	952.	7.07
29		8	952.	7.07	8P	952.	7.07
30		15	932.	12.2	8	952.	12.2
31		15	952.	1.	1F	912.	1.

PA  
OF  
11

22

Flow Paths - Table 2								
Flow Path #	Flow Area (ft <sup>2</sup> )	Hyd. Diam. (ft)	Inertia Length (ft)	Friction Length (ft)	Critical Flow Model	De-Entrmt Frac.	Mom Trn Opt	
1	100.	2.5	26.3	1.	NO		-	
2	14.	1.04	55.5	1.	NO		-	
3	1.92	0.22	33.3	1.	NO		-	
4	291.	7.25	29.01	1.	NO		-	
5	57.	2.7	44.3	1.	NO		-	
6	446.5	9.25	47.	1.	NO		-	
7	432.	5.2	57.5	1.	NO		-	
8	100.	2.5	37.8	1.	NO		-	
9	127.2	2.82	26.5	1.	NO		-	
10	536.	5.79	37.	1.	NO		-	
11	1.74	0.33	33.3	1.	NO		-	
12	1000.	7.9	61.8	1.	NO		-	
13	255.	4.	35.3	1.	NO		-	
14	147.	3.03	29.82	1.	NO		-	
15	147.	3.03	29.82	1.	NO		-	
16	1.07	0.26	48.6	1.	NO		-	
17	21.	1.05	48.6	1.	NO		-	
18	2.14	0.37	56.11	1.	NO		-	
19	22.	3.14	56.1	1.	NO		-	
20	21.	3.	60.1	1.	NO		-	
21	29.	5.39	32.1	1.	NO		-	
22	40.	6.32	51.3	1.	NO		-	
23	90.	9.49	7.3	1.	NO		-	
24	850.	29.15	51.3	1.	NO		-	
25	30.	5.48	66.6	1.	NO		-	
26	50.	7.07	26.5	1.	NO		-	
27	50.	7.07	26.5	1.	NO		-	
28	50.	7.07	26.5	1.	NO		-	
29	50.	7.07	26.5	1.	NO		-	
30	150.	12.25	41.9	1.	NO		-	
31	1.	1.	15.39	1.	NO		-	

B5  
C1

23

model5a/5.5 sec bk. in stm. tunnel  
 14:19:19 17-NOV-94  
 GOTHIC Version 4.0 - August 1993

Flow Paths - Table 3

Flow Path #	Fwd. Loss Coeff.	Rev. Loss Coeff.	Comp. Opt.
1	0.67	0.42	OFF
2	2.41	2.26	OFF
3	2.5	2.4	OFF
4	1.5	1.5	OFF
5	2.67	2.46	OFF
6	0.34	0.03	OFF
7	1.5	1.5	OFF
8	1.5	1.5	OFF
9	1.5	1.5	OFF
10	1.5	1.5	OFF
11	2.5	2.4	OFF
12	1.93	1.14	OFF
13	2.65	2.35	OFF
14	0.34	0.52	OFF
15	0.34	0.52	OFF
16	2.84	2.84	OFF
17	2.71	2.65	OFF
18	2.84	2.83	OFF
19	2.78	2.66	OFF
20	2.8	2.83	OFF
21	2.78	2.82	OFF
22	2.84	2.83	OFF
23	2.78	2.65	OFF
24	2.62	2.48	OFF
25	2.7	2.58	OFF
26	2.79	2.79	OFF
27	2.79	2.79	OFF
28	2.79	2.79	OFF
29	2.79	2.79	OFF
30	2.47	2.47	OFF
31	1.5	1.5	OFF

Thermal Conductors

Cond #	Description	Vol A	HT Co	Vol B	HT Co	Cond Type	S. A. (ft <sup>2</sup> )	Init. T. (F)	Or
1	VOL 1	1	1	1	2	1	1290.	104.	I
2	VOL 6	6	1	6	2	1	43448.	125.	I
3	VOL 7	7	1	7	2	1	26875.	104.	I
4	VOL 8	8	1	8	2	1	24665.	104.	I
5	VOL 10	10	1	10	2	1	5565.	130.	I
6	VOL 15	15	3	15	2	1	34736.	135.	I

model5a/5.5 sec bk. in stm. tunnel  
 14:19:20 17-NOV-94  
 GOTHIC Version 4.0 - August 1993

Heat Transfer Coefficient Types									
Type		Heat Release	Peak Time	Const	Curv	Cond	Scnd.	Phase	
#	Option	(Btu)	(s)	Value	#	Opt.	HTC	HT Opt.	
1	Constant		0.	0.	5.	0			VAP
2	Constant		0.	0.	0.01	0			VAP
3	Constant		0.	0.	40.	0			VAP

Thermal Conductor Types									
Type		Description	Geom	Thick.	O.D.	Regions	Heat (Btu/ft <sup>3</sup> -s)	Heat FF	
#				(in)	(in)				
1	CONCRETE		WALL		3.	0.	3	0.	

Thermal Conductor Type						
1 CONCRETE						
Region	Mat. #	Bdry. (in)	Thick (in)	Sub-regs.	Heat Factor	
1	1	0.	1.	1	0.	
2	1	1.	1.	1	0.	
3	1	2.	1.	1	0.	

Materials	
Type #	Description
1	CONCRETE

Material Type				
1 CONCRETE				
Temp. (F)	Density (lbm/ft <sup>3</sup> )	Cond. (Btu/hr-ft-F)	Sp. Heat (Btu/lbm-F)	
0.	140.		0.92	0.161
1000.	140.		0.92	0.161

B7  
OF  
41

Valves & Doors							
Valve #	Description	Flow Path		Open Trip	Close Trip	Valve Type	Disch.
		#	#	#	#	#	Vol.
1V		1	1			1	1
2V		19	2			2	10
3V		17	3			3	10
4V		13	4			4	2P
5V		20	5			5	6
6V		24	6			6	6
7V		25	7			7	10
8V		26	8			8	5P
9V		27	8			8	6P
10V		28	10			8	7P
11V		29	10			8	8P
12V		30	9			10	15

Valve/Door Types				
Valve Type #	Valve Option	Stem Travel Curve	Loss Coeff. Curve	Flow Area (ft <sup>2</sup> )
1	QUICK OPEN	0	0	100.
2	QUICK OPEN	0	0	22.
3	QUICK OPEN	0	0	21.
4	QUICK OPEN	0	0	255.
5	QUICK OPEN	0	0	21.
6	QUICK OPEN	0	0	850.
7	QUICK OPEN	0	0	30.
8	QUICK OPEN	0	0	50.
9	QUICK OPEN	0	0	100.
10	QUICK OPEN	0	0	150.

B8  
CF  
26

model5a/5.5 sec bk. in stm. tunnel  
 14:19:20 17-NOV-94  
 GOTHIC Version 4.0 - August 1993

Component Trips										
Trip #	Sense Var.	Sensor 1 Loc.	Sensor 2 Loc.	Var. Limit	Set Point	Delay Time	Rset Trip	Cond Trip	Cond Type	
1	PRESS	1	2	UPPER	0.3	0.			AND	
2	PRESS	6	10	UPPER	0.2	0.			AND	
3	PRESS	10	11	UPPER	0.65	0.			AND	
4	PRESS	13	9	UPPER	0.5	0.			AND	
5	PRESS	14	13	UPPER	0.5	0.			AND	
6	PRESS	6	8	UPPER	0.2	0.			AND	
7	PRESS	10	13	UPPER	5.	0.			AND	
8	PRESS	8	7P	UPPER	0.5	0.			AND	
9	PRESS	15	8	UPPER	0.25	0.			AND	
10	PRESS	8	8P	UPPER	0.51	0.			AND	

Functions				
FF#	Description	Ind. Var.	Dep. Var.	Points
0	Constant	-	-	0
1	BRK ENTHALPY	TIME (SEC)	ENTHALPY (	11
2	BRK FLOW	TIME (SEC)	FLOW (LBM/	11

Function 1 BRK ENTHALPY Ind. Var.: TIME (SEC) Dep. Var.: ENTHALPY (BTU/LBM)				
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.	
0.	1186.7	0.001	1186.7	
2.	1194.3	2.001	633.3	
3.5	633.3	3.501	633.3	
5.	633.3	5.001	633.3	
5.5	633.3	5.501	633.3	
1000.	633.3			

B9  
 CF

27

model5a/5.5 sec bk. in stm. tunnel  
 14:19:20 17-NOV-94  
 GOTHIC Version 4.0 - August 1993

Function 2 BRK FLOW Ind. Var.: TIME (SEC) Dep. Var.: FLOW (LBM/SEC)			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	0.	0.001	3650.
2.	3650.	2.001	9670.
3.5	9670.	3.501	8100.
5.	8100.	5.001	3800.
5.5	3800.	5.501	0.
1000.	0.		

Volume Initial Conditions							
Vol #	Pressure (psia)	Temp. (F)	Relative Humidity (%)	Liquid Volume Fractio	Ice Volume Fract.	Ice Surf. A.	(ft <sup>2</sup> )
def	14.7	104.	50.	0.	0.	0.	0.
6	14.7	125.	50.	0.	0.	0.	0.
10	14.7	130.	50.	0.	0.	0.	0.
11	14.7	90.	50.	0.	0.	0.	0.
12	14.7	100.	50.	0.	0.	0.	0.
15	14.7	135.	50.	0.	0.	0.	0.

Initial Gas Pressure Ratios									
Vol #	Air	Ar	He	H	Kr	N	O	Xe	
def	1.	0.	0.	0.	0.	0.	0.	0.	
6	1.	0.	0.	0.	0.	0.	0.	0.	
10	1.	0.	0.	0.	0.	0.	0.	0.	
11	1.	0.	0.	0.	0.	0.	0.	0.	
12	1.	0.	0.	0.	0.	0.	0.	0.	
15	1.	0.	0.	0.	0.	0.	0.	0.	

B10

28

model5a/5.5 sec bk. in stm. tunnel  
14:19:20 17-NOV-94  
GOTHIC Version 4.0 - August 1993

Run Control Parameters (Seconds)									
Time Int	DT Min	DT Max	DT Ratio	End Time	Print Int	Graph Int	Max CPU	Dump Int	
1	0.001	0.05	1.	1.	0.2	0.1	600.	0.	
2	0.000	0.25	1.	10.	1.	0.1	3600.	0.	
3	0.025	0.5	1.	50.	1.	0.1	3600.	0.	

Control Parameters Menu	
Parameter	Value
Restart Time (sec)	0
Restart Time Step #	0
Restart Time Control	NEW
Revap. Fraction	0
Min. NC HT Coeff.	0
Reference Pressure	0
Ice Temperature	0
Ice Density	0

Graphs									
Graph #	Title	Mon	Curve Number						
			1	2	3	4	5		
1			TV1	TV2	TV3	TV4	TV5		
2			TV6	TV7	TV8	TV9	TV10		
3			TV11	TV12	TV13	TV14	TV15		
4			PR11	PR12	PR10	PR6	PR7		
5	Steam Tunnel Te		TV15						
6	Turbine Deck Te		TV8						

B11  
OK  
11

29

ATTACHMENT C

MODEL VOLUMES AND FLOW PATHS

GOTHIC VERIFICATION					
0	2014	11/30/94	11/11/94		JOB NO 0091-19407.000
REV	BY	DATE	CHECKED	DATE	CALC NO
					091-19407-C-3
					PAGE C1 OF 3

No.	TEMP ref. 2	VOLUME INPUT										Pw eq. 2 ft	Dh eq. 1 ft		
		V ref. 2	ZVOL ft3	FLOWA ref. 2	ELEV ft	W eq. 5	Ap ft2	I ft2	S eq. 8 ft						
1	104	1700	19	100	931	5.26	89.47	17.00	1024.95	53.94	7.42				
2	104	19040	19	536	931	28.21	1002.11	35.52	4426.06	232.95	9.20				
3	104	6548	19	291	931	15.32	344.63	22.50	2126.33	111.91	10.40				
4	104	26080	19	446.5	931	23.50	1372.63	58.41	5857.84	308.31	5.79				
5	104	11808	19	562.3	931	29.59	621.47	21.00	3165.53	166.61	13.50				
6	125	4.10E+05	43	8283	907	192.63	9534.88	49.50	39892.68	927.74	35.71				
7	104	65090	30	693	910	23.10	2169.67	93.92	11360.83	378.69	7.32				
8	104	1.40E+06	54.5	26400	950	484.40	25688.07	53.03	1.10E+05	2017.55	52.34				
9	104	note 1	note 1	note 1	note 1	note 1	note 1	note 1	note 1	note 1	note 1				
10	130	24916	20	398	911	19.90	1245.80	62.60	5791.72	289.59	5.50				
11	104	31575	19	915	911	48.16	1661.84	34.51	6465.00	340.26	10.76				
12	104	7411	19	295	911	15.53	390.05	25.12	2324.74	122.35	9.64				
13	104	1.15E+05	40	1630	911	40.75	2875.00	70.55	14654.17	366.35	17.80				
14	104	2.20E+04	50	1500	950	30.00	440.00	14.67	5346.67	106.93	56.11				
15	135	20317	28	660	931	23.57	725.61	30.78	4495.08	160.54	16.44				

Notes:

1. Atmospheric volume used in ref. 2, replaced with "boundary volumes" in GOTHIC model

C2  
OF  
3

(3)

No.	IW1 Ref. 2	FLOW PATH INPUT							Lj eq. 14 ft	
		IW2 Ref. 2	AJUN		wp eq. 11 ft	Dh eq. 10 ft	La ft	Lb ft		
			wj eq. 12 ft	fl2 ft						
1	1	2	100	10.00	40.00	10.00	17.00	35.52	26.26	
2	1	7	14	3.74	14.97	3.74	17.00	93.92	55.46	
3	1	6	1.92	1.39	5.54	1.39	17.00	49.50	33.25	
4	2	3	291	17.06	68.23	17.06	35.52	22.50	29.01	
5	2	8	57	7.55	30.20	7.55	35.52	53.03	44.28	
6	2	4	446.5	24.81	18.00	99.24	18.00	35.52	58.41	
7	7	5	432	24.00	18.00	96.00	18.00	93.92	21.00	
8	3	8	100	10.00	40.00	10.00	22.50	53.03	37.77	
9	8	9	127.2	11.28	45.11	11.28	53.03	na	26.52	
10	5	8	536	35.73	15.00	142.92	15.00	21.00	53.03	
11	1	6	1.74	1.32	5.28	1.32	17.00	49.50	33.25	
12	13	8	1000	31.62	126.49	31.62	70.55	53.03	61.79	
13	13	9	255	15.97	63.87	15.97	70.55	na	35.28	
14	11	12	147	12.12	48.50	12.12	34.51	25.12	29.82	
15	11	12	147	12.12	48.50	12.12	34.51	25.12	29.82	
16	10	11	1.07	1.03	4.14	1.03	62.60	34.51	48.56	
17	10	11	21	3.00	7.00	12.00	7.00	62.60	34.51	
18	10	6	2.14	1.46	5.85	1.46	62.60	49.50	56.05	
19	10	6	22	3.00	7.33	12.00	7.33	62.60	49.50	
20	6	13	21	3.00	7.00	12.00	7.00	49.50	70.55	
21	6	14	29	5.39	21.54	5.39	49.50	14.67	32.08	
22	6	8	40	6.32	25.30	6.32	49.50	53.03	51.26	
23	14	9	90	9.49	37.95	9.49	14.67	na	7.33	
24	6	8	850	29.15	116.62	29.15	49.50	53.03	51.26	
25	10	13	30	5.48	21.91	5.48	62.60	70.55	66.58	
26	8	9	50	7.07	28.28	7.07	53.03	na	26.52	
27	8	9	50	7.07	28.28	7.07	53.03	na	26.52	
28	8	9	50	7.07	28.28	7.07	53.03	na	26.52	
29	8	9	50	7.07	28.28	7.07	53.03	na	26.52	
30	15	8	150	12.25	48.99	12.25	30.78	53.03	41.91	
31	0	15	1	1.00	4.00	1.00	na	30.78	15.39	

C3  
11.11

32

ATTACHMENT D

RELAP INPUT

GOTHIC VERIFICATION				
0	11/30/94	12/1/94	DATE	DATE
REV	BY	DATE	CHECKED	DATE
 VECTRA				
			JOB NO	0091-19407.000
			CALC NO	091-19407-C-3

LISTING OF INPUT DATA FOR CASE 1

```

1 *NSP MONTICELLO TURB. BLDG. ENV STUDY, STEAMLINE BREAK IN STEAM TUNNEL
2 * JOB 09101271374 **** ASSUME HATCH IN ROOF REMAINS INTACT
3 * TURBINE BUILDING SIDING BLOWSDOUT AT 0.5 PSID AT 100 FT2 INCREMENTS
4 * PROBLEM DIMENSIONS CARD
5 *      ME NT TP NY NB      NJ      NCK      HS GE MT      CONT
6 010001 0 9 5 12 15 1 0 31 0 10 0 1 6 2 2 0 0 3
7 *
8 * PROBLEM CONSTANTS CARD
9 010002 0. 1.0
10 *
11 * MINOR EDIT
12 070000 AT 6 AP 6 AT 11 AP 15 AT 15 AT 1 AT 3 AP 8 AT 8
13 *
14 * TIME STEP DATA
15 030001 1 2 5 0 .050 0.001 1. 900. *TRIP ON CPU
16 030002 2 2 5 0 0.25 0.0005 10.
17 030003 4 2 5 0 0.5 0.025 100.
18 030004 10 5 5 0 1.0 0.025 300.
19 030005 5 4 4 0 5.0 0.025 2000.
20 *
21 * TRIP CONTROL CARDS
22 040001 1 1 0 0|50.0 0. * TERMINATE TRANSIENT
23 040002 2 4 1 2 0.3 0. * NORTH WALL COLLAPSE
24 040003 3 1 0 0 0. 0. * FILL
25 040004 4 4 6 10 0.2 0. * PIPE CHASE AIR EJECTOR RM-COND AREA
26 040005 5 4 10 11 0.65 0. * DOOR TO SWITCHGEAR RM.
27 040006 6 4 13 9 0.5 0. * RAILROAD AREA DOOR TO ATMOSPHERE
28 040007 7 4 14 13 0.5 0. * RAILROAD AREA DOOR TO CONDENSER AREA
29 040008 8 4 6 8 0.2 0. * HATCHES FROM TB. DECK-CONDENSER AREA
30 040009 4 4 10 13 5.0 0. * HATCH IN ROOF OF AIR EJECTOR ROOM-INTACT
31 040100 10 4 8 9 0.50 0. * TURBINE BUILDING SIDING TO ATMOSPHERE
32 040101 11 4 8 9 0.51 0. * TURBINE BUILDING SIDING TO ATMOSPHERE
33 040102 12 4 15 8 0.25 0. * STEAM TUNNEL BLOWDOWN PANEL TO TURBINE BLDG
34 *
35 * VOLUME DATA CARDS
36 * PRES. TEMP RH VOL. DZ AF Z
37 050011 0 0 14.7000 104. 0.5 1700. 19. 0 0 100. 0. 931. 0.
38 050021 0 0 14.7000 104. 0.5 19040. 19. 0 0 536. 0. 931. 0.
39 050031 0 0 14.7000 104. 0.5 6548. 19. 0 0 291. 0. 931. 0.
40 050041 0 0 14.7000 104. 0.5 26080. 19. 0 0 446.5 0. 931. 0.
41 050051 0 0 14.7000 104. 0.5 11808. 19. 0 0 562.3 0. 931. 0.
42 050061 1 0 14.7055 125. 0.5 4.1E5 43. 0 0 8283. 0. 907. 0.
43 050071 0 0 14.7075 104. 0.5 65090. 30. 0 0 693. 0. 910. 0.
44 050081 0 0 14.6623 104. 0.5 1.4E6 54.5 0 0 26400. 0. 950. 0.
45 050091 0 0 14.6661 104. 1.0 1.0E12 200. 0 0 1.0E5 0. 911. 0.
46 050101 0 0 14.7005 130. 0.5 24916. 20. 0 0 398. 0. 911. 0.
47 050111 0 0 14.7007 90. 0.5 31575. 19. 0 0 915. 0. 911. 0.
48 050121 0 0 14.7007 100. 0.5 7411. 19. 0 0 295. 0. 911. 0.
49 050131 0 0 14.6921 104. 0.5 1.15E5 40. 0 0 1630. 0. 911. 0.
50 050141 0 0 14.6799 104. 0.5 22000. 50. 0 0 1500. 0. 950. 0.
51 050151 0 0 14.7000 135. 0.5 20317. 28. 0 0 660. 0. 931. 0.
52 *
53 * BUBBLE DATA
54 060011 0.44 9.0E5
55 * JUNCTION DATA CARDS
56 * FR TO V A Z I KF KR V/H
57 080011 1 2 0 1 0. 100. 940. 0.133 0.67 0.42 1 5 0 0 0. 0. 4 0 0. 0
58 080021 1 7 0 0 0. 14.0 931. 0.056 2.41 2.26 0 5 0 3 0. 0. 4 0 0. 0

```

59	080031	1	6	0	0	0.	1.92	939.9	0.056	2.50	2.40	1	5	0	0	0.	0.	4	0	0.	0
60	080041	2	3	0	0	0.	291.0	940.5	0.059	1.5	1.5	1	5	0	3	0.	0.	4	0	0.	0
61	080051	2	8	0	0	0.	57.	950.	0.019	2.67	2.46	0	5	0	3	0.	0.	4	0	0.	0
62	080061	2	4	0	0	0.	446.5	940.5	0.064	0.34	0.03	1	5	0	3	0.	0.	4	0	0.	0
63	080071	7	5	0	0	0.	432.0	931.0	0.076	1.5	1.5	0	5	0	3	0.	0.	4	0	0.	0
64	080081	3	8	0	0	0.	100.	950.	0.005	1.5	1.5	0	5	0	3	0.	0.	4	0	0.	0
65	080091	8	9	0	0	0.	127.2	1004.5	0.001	1.5	1.5	0	5	0	3	0.	0.	4	0	0.	0
66	080101	5	8	0	0	0.	536.0	450.0	0.020	1.5	1.5	0	5	0	3	0.	0.	4	0	0.	0
67	080111	1	6	0	0	0.	1.74	934.8	0.056	2.50	2.40	1	5	0	0	0.	0.	4	0	0.	0
68	080121	13	8	0	0	0.	1000.	951.	0.023	1.93	1.14	1	5	0	0	0.	0.	4	0	0.	0
69	080131	13	9	0	4	0.	255.	943.	0.010	2.65	2.35	1	5	0	0	0.	0.	4	0	0.	0
70	080141	11	12	0	0	0.	147.	915.8	0.094	0.34	0.52	1	5	0	0	0.	0.	4	0	0.	0
71	080151	11	12	0	0	0.	147.	925.4	0.094	0.34	0.52	1	5	0	0	0.	0.	4	0	0.	0
72	080161	10	11	0	0	0.	1.07	928.	0.048	2.84	2.84	1	5	0	0	0.	0.	4	0	0.	0
73	080171	10	11	0	3	0.	21.	914.	0.048	2.71	2.65	1	5	0	0	0.	0.	4	0	0.	0
74	080181	10	6	0	0	0.	2.14	922.	0.911	2.84	2.83	1	5	0	0	0.	0.	4	0	0.	0
75	080191	10	6	0	2	0.	22.	925.	0.090	2.78	2.66	1	5	0	0	0.	0.	4	0	0.	0
76	080201	6	13	0	5	0.	21.	914.	0.025	2.80	2.83	1	5	0	0	0.	0.	4	0	0.	0
77	080211	6	14	0	0	0.	29.	950.	0.008	2.78	2.82	1	5	0	0	0.	0.	4	0	0.	0
78	080221	6	8	0	0	0.	40.	950.	0.089	2.84	2.83	1	5	0	0	0.	0.	4	0	0.	0
79	080231	14	9	0	0	0.	90.	1000.	0.020	2.78	2.65	1	5	0	0	0.	0.	4	0	0.	0

D2  
C5  
11

34

71 080151 11 12 0 0 0. 147. 925.4 0.094 0.34 0.52 1 5 0 0 0. 0. 4 0 0. 0  
 72 080161 10 11 0 0 0. 1.07 928. 0.048 2.84 2.84 1 5 0 0 0. 0. 4 0 0. 0  
 73 080171 10 11 0 3 0. 21. 914. 0.048 2.71 2.65 1 5 0 0 0. 0. 4 0 0. 0  
 74 080181 10 6 0 0 0. 2.14 922. 0.911 2.84 2.83 1 5 0 0 0. 0. 4 0 0. 0  
 75 080191 10 6 0 2 0. 22. 925. 0.090 2.78 2.66 1 5 0 0 0. 0. 4 0 0. 0  
 76 080201 5 13 0 5 0. 21. 914. 0.025 2.80 2.83 1 5 0 0 0. 0. 4 0 0. 0  
 77 080211 5 14 0 0 0. 29. 950. 0.008 2.78 2.82 1 5 0 0 0. 0. 4 0 0. 0  
 78 080221 6 8 0 0 0. 40. 950. 0.089 2.84 2.83 1 5 0 0 0. 0. 4 0 0. 0  
 79 080231 14 9 0 0 0. 90. 1000. 0.020 2.78 2.65 1 5 0 0 0. 0. 4 0 0. 0  
 80 080241 6 8 0 6 0. 850. 950. 0.005 2.62 2.48 1 5 0 0 0. 0. 4 0 0. 0  
 81 080251 10 13 0 7 0. 30. 931. 0.010 2.70 2.58 0 5 0 0 0. 0. 4 0 0. 0  
 82 080261 8 9 0 8 0. 50. 963.6 0.010 2.79 2.79 1 5 0 0 0. 0. 4 0 0. 0  
 83 080271 8 9 0 8 0. 50. 990.9 0.010 2.79 2.79 1 5 0 0 0. 0. 4 0 0. 0  
 84 080281 8 9 0 9 0. 50. 963.6 0.010 2.79 2.79 1 5 0 0 0. 0. 4 0 0. 0  
 85 080291 8 9 0 9 0. 50. 990.9 0.010 2.79 2.79 1 5 0 0 0. 0. 4 0 0. 0  
 86 080301 15 8 0 10 0. 150. 954.5 0.1097 2.47 2.47 1 5 0 0 0. 0. 4 0 0. 0  
 87 080311 0 15 1 0 0. 1.0 940. 0.001 1.5 1.5 1 5 0 0 0. 0. 4 0 0. 0  
 88 \*  
 89 \* VALVE DATA CARDS  
 90 110010 -2 0 0 0. 0. 0. 0.  
 91 110020 -4 0 0 0. 0. 0. 0.  
 92 110030 -5 0 0 0. 0. 0. 0.  
 93 110040 -6 0 0 0. 0. 0. 0.  
 94 110050 -7 0 0 0. 0. 0. 0.  
 95 110060 -8 0 0 0. 0. 0. 0.  
 96 110070 -9 0 0 0. 0. 0. 0.  
 97 110080 -10 0 0 0. 0. 0. 0.  
 98 110090 -11 0 0 0. 0. 0. 0.  
 99 110100 -12 0 0 0. 0. 0. 0.  
 100 \*  
 101 \* FILL TABLE DATA CARD  
 102 130100 3 4 11 4 LBS/SEC 1125. 559. 0.001  
 103 130101 0. 0. 1186.7 0.001 3650. 1186.7 2.0 3650. 1194.3  
 104 130102 2.001 9670. 633.3 3.5 9670. 633.3 3.501 8100. 633.3  
 105 130103 5.0 8100. 633.3 5.001 3800. 633.3 5.5 3800. 633.3  
 106 130104 5.501 0. 633.3 1000. 0. 633.3  
 107 \*  
 108 \*  
 109 \* HEAT SLAB DATA  
 110 \*  
 111 150011 0 1 1 0 0 0 0 0. 1290. 323. 0. 1.E08 0 0 0 0 0 0  
 112 150021 0 6 1 0 0 0 0 0. 43448. 10862. 0. 1.E08 0 0 0 0 0 0  
 113 150031 0 7 1 0 0 0 0 0. 26875. 6720. 0. 1.E08 0 0 0 0 0 0  
 114 150041 0 8 1 0 0 0 0 0. 24665. 6166. 0. 1.E08 0 0 0 0 0 0  
 115 150051 0 10 1 0 0 0 0 0. 5565. 1392. 0. 1.E08 0 0 0 0 0 0  
 116 150061 0 15 2 0 0 0 0 0. 34736. 8684. 0. 1.E08 0 0 0 0 0 0  
 117 \*  
 118 \* SLAB GEOMETRY  
 119 170101 1 1 1 6 0 0.25 0.  
 120 170201 1 1 2 6 0 0.25 0.  
 121 \* THERMAL CONDUCTIVITY  
 122 +180100 1 70. 0.92  
 123 180200 1 70. 0.115  
 124 \* HEAT CAPACITY  
 125 190100 1 70. 22.6  
 126 190200 1 70. 2.825  
 127 \*

D3  
OF  
3

35

ATTACHMENT E

RELAP OUTPUT

GOTHIC VERIFICATION				
0	11/11/94	11/21/94		VECTRA
REV	BY	DATE	CHECKED	DATE
				JOB NO 0091-19407.000 CALC NO 091-19407-C-3
				PAGE E1 OF 16

36

## RELAP TEMPERATURE DATA

VOLUME	TIME (SEC)						0.5	0.6	0.7	0.8	0.9
	0	0.1	0.2	0.3	0.4	0.5					
1	104	104.1	105.3	107	108.3	109.1	107.4	102.4	98.8	98.4	
2	104	104.6	105.9	107.1	108.3	109.4	105.8	101.7	99.8	98.1	
3	104	104.7	105.9	107.2	108.4	109.6	105.2	102.3	100.1	98.3	
4	104	104.3	105.9	107.2	108.3	109.4	106.3	101.4	99.6	98.2	
5	104	104.6	105.9	107.3	108.6	109.7	105.5	102.2	99.7	98.2	
6	125	125	125.1	125.3	125.5	125.7	125.8	123.9	121	119.1	
7	104	104.1	105.5	107.3	108.6	109.4	107.3	101.7	97.9	97.4	
8	104	105.1	107.2	109.4	111.6	113.7	110.1	108.3	107.7	107.1	
9	104	104	104	104	104	104	104	104	104	104	
10	130	130	130	130	130.2	130.2	130.3	130.3	130.1	129.8	
11	90	90	90	90	90	90	90.1	90.1	90.1	90.1	
12	100	100	100	100	100	100	100.1	100.1	100.1	100	
13	104	104.6	106.2	107.4	108.4	109.6	105.3	103.2	101.4	99.3	
14	104	104.1	104.1	104.2	104.3	104.5	104.7	104.4	104.4	104.2	
15	135	225.9	248.5	260.5	269.8	276.7	279.6	281.5	283.9	286.1	

6/2  
OF  
2.6

RELAP TEMPERA		TIME (SEC)									
VOLUME		1	2	3	4	5	6	7	8	9	10
1		97.9	107.9	110.7	111.3	110.6	106	104.6	104.9	105.1	105.2
2		96.5	107.2	110.1	110.2	108.2	94.3	95.2	96.2	96.8	97.2
3		96.6	109.6	109.9	104	103.5	100.8	99.6	99.5	99.5	99.5
4		96.5	106.6	109.7	110.5	109.8	105.4	103.6	103.6	103.6	103.6
5		96.8	110.7	110.2	106.1	105.5	102.6	101.5	101.4	101.3	101.2
6		117.4	127.2	128.9	124.7	117.1	111.8	110.2	110.3	110.4	110.5
7		96.8	106.8	109.7	110.3	109.3	104.7	103.1	103.2	103.2	103.3
8		106.7	129.1	141	151.5	158.4	159.6	159	158.9	158.8	158.7
9		104	104	104	104	104	104	104	104	104	104
10		129.5	131.9	135.5	136.3	135.4	131	128.9	128.7	128.6	128.6
11		90.1	89.9	90.9	92.1	93.2	93.7	93.2	92.7	92.2	91.9
12		100	99.8	100.4	101.2	101.9	102.1	101.2	100.4	99.7	99
13		97.8	108.8	109.9	124.7	135.9	141.6	142.6	143	143.3	143.7
14		104.1	105.6	109.3	112.8	114.4	113.9	113.5	113.2	112.8	112.4
15		287.9	302.1	236.5	232.5	232.2	210.9	209.8	209.7	209.6	209.4

53  
38

RELAP TEMPERA		TIME (SEC)			VOLUME								
		14	18	22	26	30	34	38	42	46	50		
1		105.8	106.3	106.7	107	107.3	107.1	106.6	106.5	106.2	106.1		
2		98.3	99.5	100.9	102.5	104.3	106.3	108.3	110.3	112.3	114		
3		99.4	99.4	99.4	99.5	99.8	100.1	100.7	101.4	102.3	103.4		
4		103.6	103.6	103.6	103.6	103.6	103.6	103.6	103.6	103.6	103.6		
5		100.9	100.6	100.2	99.9	99.6	103.7	99.8	101.3	101.2	100.9		
6		111	111.5	111.9	112.3	112.7	113	113.4	113.7	114	114.2		
7		103.4	103.5	103.5	103.6	103.7	103.7	103.8	103.9	103.9	103.9		
8		158.3	157.9	157.5	157.1	156.8	156.4	156	155.7	155.3	154.9		
9		104	104	104	104	104	104	104	104	104	104		
10		128.4	128.5	128.6	128.7	128.8	128.9	128.9	129	129	129.1		
11		91.3	91.4	91.6	91.7	91.9	91.9	92	92.1	92.1	92.13		
12		97	96	95.2	94.6	94.1	93.7	93.5	93.3	93.1	93		
13		144.8	145.8	146.6	147.3	147.8	148.2	148.5	148.8	149	149.1		
14		111.2	110.1	109.2	108.4	107.7	107.1	106.6	106.2	105.9	105.6		
15		208.9	208.4	208	207.6	207.2	206.8	206.4	206.1	205.8	205.5		

64  
08  
26

39

RELAP4-4U'S OUTPUT FILE (L) IMPILL 100% TURB. BLDG. 1 VS ST. Y. STREAMLINE BREAK IN STEAM TUNNEL

ONTRUL 1,  
8/1/08/09

L, M, T, Nt, \*  
, TANGLD TIME STEP NUMBER U, ACTUA TIME STEP NUMBER 0, TIME = 0.

SEC.

TOTAL SYSTEM QUANTITY	NETH PUMP (LBS)	HEAT REM (BTU/HRS)	ENGY LEAK (BTU)	MASS LEAK (LBS)	ENGY AL. (BTU)	MASS BAL. (LBS)	LAST DT (S)	REAL SEC.
1. 0000E+00	0.	0.	0.	0.	9.0634	7E+12	3.19397E+19	0.
A. IN. PRES	TOT. MASS	Avg. Dens	Avg. Temp	Avg. UAL	BUBB MASS	MIXT LEVEL		
P.LB	H2O	(LB/LB)	(LB/FT3)	(LB)	(LB)	(FT)		
1. 9700E+01	1.90E+1	1.57688E+02	6.94315E-02	1.04000E+02	1.0000E+00	0.		
1. 9700E+01	3.0	1.57688E+02	6.94315E-02	1.04000E+02	1.0000E+00	0.		
1. 9700E+01	1.0	1.57688E+02	6.94315E-02	1.04000E+02	1.0000E+00	0.		
1. 9700E+01	4.1	1.57688E+02	6.94315E-02	1.04000E+02	1.0000E+00	0.		
1. 9700E+01	1.8	1.57688E+02	6.94315E-02	1.04000E+02	1.0000E+00	0.		
1. 9700E+01	1.1	1.57688E+02	6.94315E-02	1.04000E+02	1.0000E+00	0.		
1. 9700E+01	1.0	1.57677E+02	6.94675E-02	1.04000E+02	1.0000E+00	0.		
1. 9700E+01	2.2	1.57716E+02	6.93468E-02	1.04000E+02	1.0000E+00	0.		
1. 96823E+01	3.1	1.57784E+02	6.83067E-02	1.04000E+02	1.0000E+00	0.		
1. 96661E+01	3.1	1.57840E+02	6.53796E-02	1.30000E+02	1.0000E+00	0.		
1. 97005E+01	7.4	1.00E+	1.88994E+02	7.15471E-02	9.00000E+01	1.0000E+00	0.	
1. 97007E+01	3.3	4.8E+	1.46454E+02	7.04066E+02	1.06020E+02	1.0000E+00	0.	
1. 97007E+01	1.3	5.5E+	1.54105E+02	7.04066E+02	1.06020E+02	1.0000E+00	0.	
1. 96921E+01	1.0	4.52E+	1.57700E+02	6.93937E+02	1.04000E+02	1.0000E+00	0.	
1. 96799E+01	3.5	4.51E+	1.57719E+02	6.93353E+02	1.04000E+02	1.0000E+00	0.	
1. 97303E+01	7.2	5.04E+	1.97188E+02	6.45592E+02	1.35030E+02	1.0000E+00	0.	

VOLUME

HAZ LAB VOL	HEAT TRAN	SUR FLUX	CRT FLUX	H,T, COEF	SURF TEMP	Avg. JUAL	POWR H2O
HAZ BACK NUM	NUDE	BTU /HR/F	BTU/H/FT2/F	(BTU/H/FT2)	(BTU/H/HR/F2/F)	(BTU/H/HR)	
1. WEIGHT L	0.	9.00000E+04	5.00000E+00	1.04000E+02	1.0000E+00	0.	
2. WEIGHT b	0.	9.00000E+04	5.00000E+00	1.04000E+02	1.0000E+00	0.	
3. WEIGHT t	0.	9.00000E+04	5.00000E+00	1.04000E+02	1.0000E+00	0.	
0.4 WEIGHT d	0.	9.00000E+04	5.00000E+00	1.04000E+02	1.0000E+00	0.	
0.5 WEIGHT l	0.	9.00000E+04	5.00000E+00	1.30000E+02	1.0000E+00	0.	
0.5 WEIGHT r	0.	9.00000E+04	5.00000E+00	3.50000E+02	1.0000E+00	0.	

KIL:PP/MOS 09/03/76 (2) IMPELL. VEN 1.0; RELAP4 THERMAL HYDRAULIC CODE CONTAINMENT CONTROL YRS  
NRP MINTICLU TUNL. LDG. ENV. TUDY. STEAMLINE BREAK IN 'TEA' TUNNEL

LNU TIME = 024

JUNCTION NUMBER	CONNECTING VOLUME'S	JCT. FLW	JCT. ENTH	JCT. SPPL	P H E S	S U R E	D I F F	E R E N T	ACCL P,S	PUP
		LBST/L81	LBST/L81	LBST/L81	STAG PSI	ELEV PSI	FRIC PSI	PSI	PSI	PSI
1	1 TU	2 C 4 0.	1.576689E+02	1.60751E-02	0.	-2.4969E-03	0.	0.	0.	0.
2	1 TU	7 C 4 0.	1.57669E+02	1.44027E+01	7.50000E-03	7.47503E-03	0.	0.	0.	0.
3	1 TU	6 C 4 0.	1.576689E+02	1.44027E+01	5.50000E-03	5.53055E-03	0.	0.	0.	0.
4	2 TU	3 C 4 0.	1.576689E+02	1.44027E+01	0.	0.	0.	0.	0.	0.
5	2 TU	6 C 4 0.	1.57751E+02	1.44027E+01	1.77000E-02	1.77035E-02	0.	0.	0.	0.
6	2 TU	4 C 4 0.	1.576689E+02	1.44027E+01	0.	0.	0.	0.	0.	0.
7	7 TU	7 C 4 0.	1.57669E+02	1.43952E+01	7.50000E-03	7.47503E-03	0.	0.	0.	0.
8	3 TU	8 C 4 0.	1.57751E+02	1.44027E+01	1.77000E-02	1.77035E-02	0.	0.	0.	0.
9	6 TD	9 C 4 0.	1.80793E+02	1.440203E+01	1.62000E-02	1.62062E-02	0.	0.	0.	0.
10	7 TU	8 C 4 0.	1.57751E+02	1.44027E+01	1.77000E-02	1.77035E-02	0.	0.	0.	0.
11	1 TU	6 C 4 0.	1.57696E+02	1.44027E+01	5.5000001-03	5.64481E-03	0.	0.	0.	0.
12	13 TU	8 C 4 0.	1.57749E+02	1.44105E+01	9.800001-03	10.22794E-02	0.	0.	0.	0.
13	13 TU	9 C 4 0.	1.80872E+02	1.60751E-02	0.	0.	0.	0.	0.	0.
14	11 TU	12 C 4 0.	1.46460E+02	1.39768E+01	0.	0.	0.	0.	0.	0.
15	11 TU	12 C 4 0.	1.54158E+02	1.39768E+01	0.	0.	0.	0.	0.	0.
16	10 TU	11 C 4 0.	1.88985E+02	1.52953E+01	-2.0100001-04	5.48234E-04	0.	0.	0.	0.
17	10 TU	11 C 4 0.	1.45463E+02	1.61469E-01	0.	0.	0.	0.	0.	0.
18	10 TU	6 C 4 0.	1.81606E+02	1.52953E+01	-5.030001-03	-3.4427E-03	0.	0.	0.	0.
19	10 TU	b 4 0.	1.81602E+02	1.61469E-01	0.	0.	0.	0.	0.	0.
20	b TU	13 C 4 0.	1.81616E+02	1.61319E-02	0.	0.	0.	0.	0.	0.
21	b TU	14 C 4 0.	1.81570E+02	1.51045E+01	2.560001-02	-2.19222E-02	0.	0.	0.	0.
22	b TU	8 C 4 0.	1.81570E+02	1.51045E+01	2.320001-02	-2.30077E-02	0.	0.	0.	0.
23	15 TU	9 C 4 0.	1.80799E+02	1.49227E+01	1.380001-02	-1.72552E-02	0.	0.	0.	0.
24	b TU	8 C 4 0.	1.81570E+02	1.61319E-02	0.	0.	0.	0.	0.	0.
25	10 TU	13 C 4 0.	1.80981E+02	1.61469E-01	0.	0.	0.	0.	0.	0.
26	8 TU	9 C 4 0.	1.57733E+02	1.60757E-02	0.	0.	0.	0.	0.	0.
27	8 TU	8 C 4 0.	1.57698E+02	1.60757E-02	0.	0.	0.	0.	0.	0.
28	8 TU	9 C 4 0.	1.57733E+02	1.60757E-02	0.	0.	0.	0.	0.	0.
29	6 TU	9 C 4 0.	1.57698E+02	1.60757E-02	0.	0.	0.	0.	0.	0.
30	15 TU	8 C 4 0.	1.97176E+02	1.61635E-02	0.	0.	0.	0.	0.	0.
31	6 TU	15 C 4 0.	1.97194E+02	0.	0.	0.	0.	0.	0.	0.

66  
67

47

RELAP4 THERMAL HYDRAULIC CODE  
RELAP4 THERM. & HYD. STUDY, STEAMLINE BREAK IN STEAM TUNNEL

CONTAINMENT  
86/08/09

TIME = "97"  
JANU TIME : P NUMBER 2+ ACTUAL TIME STEP NUMBER 20+ TIME = \*100000E+00 :C. LAST DT = \*223999E-0 SEC.

IN. SYSTEM GU. FLOW	VOLUME (MM)	PWR (MW)	HEAT REM (BTU/HR)	ENGY LEAK (BTU)	MASS LEAK (LB)	MASS BAL. (LB)	TOT. WT C (LB)	Avg. T (EC.)	CONT. VTS
1.000 30E+00	0.	0.	0.	0.	0.	3.19397E+09	0.	0.	
Avg. RES	FRT	MASS	Avg. ENTH	Avg. DFNS	Avg. TEMP	Avg.	BURB MASS	MIXT LFL	TO. MASS
1.471 35E+01	2.71325E+00	1.527718E+02	6.94663E-02	1.04112E+02	1.000 0E+00	0.	0.	0.	
1.472 30E+01	3.45556E+01	1.57836E+02	6.96175E-02	1.04598E+02	1.000 0E+00	0.	0.	0.	
1.473 38E+01	1.04662E+01	1.57868E+02	6.96573E-02	1.04126E+02	1.000 0E+00	0.	0.	0.	
1.474 38E+01	4.16662E+01	1.527770E+02	6.95359E-02	1.04233E+02	1.000 0E+00	0.	0.	0.	
1.475 75E+01	1.88905E+01	1.57843E+02	6.96260E-02	1.04625E+02	1.000 0E+00	0.	0.	0.	
1.476 78E+01	1.4591E+03	1.81601E+02	6.62131E-02	1.25023E+02	1.003 0E+00	0.	0.	0.	
1.477 14E+01	1.03904E+02	1.527714E+02	6.95146E-02	1.04514E+02	1.000 0E+00	0.	0.	0.	
1.478 26E+01	2.28941E+03	1.58498E+02	6.95178E-02	1.05132E+02	1.000 0E+00	0.	0.	0.	
1.468 31E+01	3.19397E+09	1.80784E+02	6.83067E-02	1.04000E+02	1.000 0E+00	0.	0.	0.	
1.479 20E+01	7.90350E+01	1.88998E+02	6.53846E-02	1.30017E+02	1.000 0E+00	0.	0.	0.	
1.480 10E+01	3.03705E+01	1.46456E+02	7.15481E-02	9.00044E+01	1.000 0E+00	0.	0.	0.	
1.481 11E+01	1.05656E+01	1.56165E+02	7.00417E-02	1.00003E+02	1.000 0E+00	0.	0.	0.	
1.482 34E+01	1.43914E+02	1.57838E+02	6.93671E-02	1.04538E+02	1.000 0E+00	0.	0.	0.	
1.483 49E+01	3.51176E+01	1.57744E+02	6.93506E-02	1.04062E+02	1.000 0E+00	0.	0.	0.	
1.484 58E+01	3.67220E+02	4.32926E+02	6.70418E-02	2.25942E+02	1.000 0E+00	0.	0.	0.	

AIR - ASS

AT SURF	YJL	HEAT	SURF FLUX	CRIT FLUX	H.T. COEF	SURF TEMP	Avg. JUAL	POWR H2C
48E+00	NJL	MDE	BTU/HR/FT2)	BTU/HF2/F1	(F)			
1.481	1.	1.	-1.2784E-01	9.00077E+04	5.00000E+00	1.04000E+02	1.000 30E+00	-1.58392E+02
2.481	1.	1.	-3.58956E-02	9.00012E+04	5.00000E+00	1.25000E+02	1.000 30E+00	-1.55959E+03
3.481	1.	1.	-2.15092E-01	9.00394E+04	5.00000E+00	1.04000E+02	1.000 30E+00	-5.78060E+03
4.481	1.	1.	-3.52533E+00	9.00026E+04	5.00000E+00	1.04000E+02	1.000 30E+00	-8.69523E+04
5.481	1.	1.	-5.8112E-02	9.00044E+04	5.00000E+00	1.30000E+02	1.000 30E+00	-3.05361E+02
6.481	1.	1.	-4.10230E+02	9.74070E+04	5.00000E+00	1.35126E+02	1.000 30E+00	-1.42998E+07

RELAP4-SCD U9f03/76 L 21 IMPELL VER 1.00 THERMAL HYDRAULIC CODE  
NYP = INITIATED TURB. BLDG. ENV STUDY, STEAMLINE BREAK IN STEAM TUNNEL

CONTAINMENT  
06/08/09

TIME \* 98

UNITS	UNFC	VOLUME	JCT. FLOW (LB/SEC)	JCT. ENTH (BTU/LB)	JCT. SPVL (FT3/LB)	STAG PSI	ELEV PSI	SUSURE	DIFFERENCE	ACCL PSI	FRIC PSI	PUMP PSI	TIALE		
1	1 10	2	0	4	0.	-3.05820E-02	-3.59014E-07	0.	0.	0.	0.	0.	0.		
2	1 11	7	3	4	-8.40406E+00	1.57836E+02	1.67186E-02	-1.60515E-04	-1.56491E-03	0.	0.	0.	0.		
3	1 10	6	3	4	3.31295E+00	1.43925E+02	1.43925E+01	-9.20152E-03	7.47609E-03	6.63003E-05	0.	0.	0.		
4	2 10	3	0	4	-5.03777E+01	1.57716E+02	1.44011E+01	-3.98084E-03	5.53078E-03	-1.48364E-03	0.	0.	0.		
5	2 11	8	0	4	-9.35799E+01	1.58688E+02	1.43766E+01	-1.00822E-02	0.	2.47491E-05	-1.00575E-02	0.	0.	0.	
6	2 10	4	8	4	-8.22625E+01	1.57836E+02	1.43797E+01	2.28930E-02	0.	-4.93469E-06	2.28881E-02	0.	0.	0.	
7	7 10	5	0	4	-1.06437E+02	1.57855E+02	1.43779E+01	-2.38888E-02	-7.48347E-03	2.79899E-05	-3.13442E-02	0.	0.	0.	
8	3 10	8	0	4	-7.39505E+01	1.57533E+02	1.43956E+01	1.54748E-02	-1.77347E-02	6.55602E-04	-1.60435E-03	0.	0.	0.	
9	8 10	9	0	4	-6.98801E+01	1.56463E+02	1.43956E+01	6.13475E-02	-1.62279E-02	-4.42353E-04	-1.60435E-04	0.	0.	0.	
10	5 10	8	0	4	-1.45918E+02	1.54533E+02	1.43965E+01	7.90681E-03	-1.77330E-02	6.20107E-05	-9.77020E-03	0.	0.	0.	
11	1 10	6	0	4	3.03093E+00	1.57723E+02	1.44011E+01	-3.98081E-03	5.64522E-03	-1.56415E-03	1.00269E-04	0.	0.	0.	
12	1 10	8	0	4	-4.33345E+02	1.54531E+02	1.43965E+01	-9.0882CE-03	-2.23126E-02	1.57453E-04	-3.12433E-02	0.	0.	0.	
13	1 10	9	0	4	0.	1.57190E+02	5.23103E-02	-3.80462E-02	0.	0.	0.	0.	0.	0.	
14	1 10	12	0	4	3.06962E-01	1.45462E+02	1.39767E+01	-2.85940E-06	4.91662E-05	-1.47541E-09	4.63053E-05	0.	0.	0.	
15	1 11	10	12	0	4	-1.86040E-01	1.54159E+02	1.42773E+01	-2.86006E-06	-5.12584E-05	6.71271E-10	-5.41178E-05	0.	0.	0.
16	10 10	11	0	4	6.13806E-01	1.64989E+02	1.52945E+01	5.78146E-04	5.48112E-04	-1.09209E-03	3.41640E-05	0.	0.	0.	
17	10 10	11	0	4	0.	1.69007E+02	1.67186E-02	5.78134E-04	-3.12529E-05	0.	0.	0.	0.	0.	
18	10 10	6	0	4	-2.56245E+00	1.61609E+02	1.51040E+01	4.73867E-03	-3.44559E-03	5.13164E-03	-3.04962E-03	0.	0.	0.	
19	10 10	6	0	4	0.	1.61609E+02	1.67186E-02	-4.73867E-03	-3.44559E-03	0.	0.	0.	0.	0.	
20	6 10	13	0	4	0.	1.78597E+02	1.67187E-02	-1.21716E-02	-1.53615E-03	0.	0.	0.	0.	0.	
21	6 10	14	0	4	1.19763E+01	1.5773E+02	1.51040E+01	2.25641E-02	-2.19245E-02	-1.54724E-04	4.84744E-04	0.	0.	0.	
22	6 10	8	0	4	-1.05649E+02	1.53531E+02	1.43956E+01	-2.12341E-02	-2.30298E-02	8.70495E-03	-3.55589E-02	0.	0.	0.	
23	1 10	9	0	4	8.65356E+00	1.7712E+02	1.44202E+01	1.75745E-02	-1.72573E-02	-4.26575E-06	3.12995E-04	0.	0.	0.	
24	6 10	8	0	4	0.	1.85331E+02	1.67186E-02	-4.73867E-03	-3.44559E-03	0.	0.	0.	0.	0.	
25	10 10	13	0	4	0.	1.79387E+02	1.67186E-02	-1.69102E-02	-4.54048E-03	0.	0.	0.	0.	0.	
26	6 10	9	3	4	0.	1.8515E+02	1.67192E-02	6.13475E-02	-1.58999E-02	0.	0.	0.	0.	0.	
27	6 10	9	0	4	0.	1.6480E+02	1.67192E-02	6.13475E-02	-1.61188E-02	0.	0.	0.	0.	0.	
28	6 10	9	0	4	0.	1.8515E+02	1.67192E-02	6.13475E-02	-1.58999E-02	0.	0.	0.	0.	0.	
29	6 10	9	0	4	0.	1.8480E+02	1.67192E-02	6.13475E-02	-1.61188E-02	0.	0.	0.	0.	0.	
30	15 10	8	0	4	5.08715E+03	4.2914E+02	1.456693E+01	4.79671E+00	-1.55013E-02	-3.92481E+01	8.56391E-01	0.	0.	0.	
31	0 10	15	0	4	3.65000E+03	1.8704E+03	0.	0.	0.	0.	0.	0.	0.	0.	0.

43

WILSON/400, UNIFORM THERMAL HYDRAULIC CODE  
RELAP5/400, UNIFORM THERMAL HYDRAULIC CODE  
CONTAINMENT  
86/08/09

END TIME = 1.12  
STANDARD TIME: STEP NUMBER 4. ACTUAL TIME STEP NUMBER 32. TIME = 200000E+00 SEC. LAST DT = .231492E-01 SEC.

TOTAL SYSTEM QUANTITIES	NORM PWR	PWR (MW)	HEAT REM (BTU/HR)	ENGY LEAK (BTU)	ENGY LEAK (LB)	ENGY BAL. (BTU)	MASS BAL. (LB)	TOT. REAC (S)	REAC SEC.
	1.00000E+00	0.	0.	0.	0.	9.63487E+12	3.19397E+09	0.	0.
YUL04t NUMBER	Avg. Pres PSIA	Total Mass LB	Avg. Enth BTU/LB	Avg. Dens LB/FT <sup>3</sup>	Avg. Temp IF	Avg. Qual LB	Bubb Mass LB	Mixt Lvl IF	Liq. Mass LB
1	1.48194E+01	2.72763E+00	1.58005E+02	6.90351E-02	1.05294E+02	1.00000E+00	0.	0.	0.
2	1.48277E+01	3.06401E+01	1.58157E+02	7.00133E-02	1.05878E+02	1.00000E+00	0.	0.	0.
3	1.48764E+01	1.58192E+02	7.00235E-02	1.05929E+02	1.00000E+00	0.	0.	0.	0.
4	1.48761E+01	1.9601E+01	1.58155E+02	7.00263E-02	1.05908E+02	1.00000E+00	0.	0.	0.
5	1.48705E+01	1.0322E+01	1.58195E+02	7.00202E-02	1.05872E+02	1.00000E+00	0.	0.	0.
6	1.47197E+01	1.14623E+03	1.81616E+02	6.62536E-02	1.25141E+02	1.00000E+00	0.	0.	0.
7	1.48422E+01	1.04515E+02	1.58034E+02	6.99224E-02	1.05459E+02	1.00000E+00	0.	0.	0.
8	1.46659E+01	2.46144E+03	1.60656E+02	6.97226E-02	1.07222E+02	1.00000E+00	0.	0.	0.
9	1.46661E+01	3.19397E+09	1.80784E+02	6.83067E-02	1.04000E+02	1.00000E+00	3.19397E+09	2.00000E+02	2.11335E+01
10	1.47052E+01	7.00452E+01	1.89005E+02	6.53948E-02	1.30051E+02	1.00000E+00	0.	0.	0.
11	1.47017E+01	3.17046E+01	1.46459E+02	7.15502E-02	9.00134E+01	1.00000E+00	0.	0.	0.
12	1.47017E+01	1.56575E+01	1.54166E+02	7.00442E-02	1.00010E+02	1.00000E+00	0.	0.	0.
13	1.48937E+01	1.05317E+02	1.58245E+02	7.00734E-02	1.06128E+02	1.00000E+00	0.	0.	0.
14	1.46811E+01	3.1849E+01	1.57797E+02	6.93289E-02	1.04077E+02	1.00000E+00	0.	0.	0.
15	1.98310E+01	5.4212E+02	6.28214E+02	5.94597E-02	2.48504E+02	1.00000E+00	0.	0.	0.

#### AIR MASS

1	1.15992E+02
2	1.30241E+03
3	1.97984E+02
4	1.78433E+03
5	6.07552E+02
6	2.60177E+04
7	4.44674E+03
8	9.51502E+04
9	6.51127E+10
10	1.52033E+03
11	2.22549E+03
12	2.08534E+02
13	7.87312E+03
14	1.49005E+03
15	6.53830E+02

#### HEAT SLAB

NUM3ER	UN	HEAT TRAN	SURF FLUX	CRIT FLUX	H-T COEF	SURF TEMP	AVG. QUA	POWR H2O
1	RIGHT	1	-4.6647E+00	9.00785E+00	5.00000E+00	1.04000E+02	1.00000E+00	(BTU/HR)
2	KIGHT	6	-5.4503E-01	9.00036E+04	5.00000E+00	1.25030E+02	1.00000E+00	-6.01748E+03
3	KIGHT	7	-5.3044E+00	9.02770E+04	5.00000E+00	1.04000E+02	1.00000E+00	-2.36793E+04
4	KIGHT	8	-1.3628E+01	9.00028E+04	5.00000E+00	1.04001E+02	1.00000E+00	-1.42557E+05
5	KIGHT	9	-2.11210E-01	9.00069E+04	5.00000E+00	1.30000E+02	1.00000E+00	-3.36142E+05
6	KIGHT	10	-5.47043E+02	9.76689E+04	5.00000E+00	1.35355E+02	1.00000E+00	-1.17538E+03
7	KIGHT	15	-5.47043E+02	9.76689E+04	5.00000E+00	1.35355E+02	1.00000E+00	-1.90021E+07

RELAP4 THERMAL HYDRAULIC CODE  
CONTAINMENT  
STEAMLINE BREAK IN STEAM TUNNEL

CONTINUOUS

86/08.19

LPU TIME = 1.14

JUNCTION NUMBER	CONNECTING VOLUMES	CHOKES	JCT. FLOW	JCT. ENTH	JCT. SPVL	P R E S S U R E	S U R F A C E	FRICTION	ACCL. PSI	PUMP PSI
1	1 TO 2	0 4	0*	1.58158E+02	1.67206E-02	-5.74977E-02	-6.70125E-07	0.	0.	0.
2	1 TO 3	0 4	-2.74923E+01	1.58026E+02	1.43271E+01	-1.92976E-02	7.50798E-03	9.9	9.9E-0	-1.87172E-03
3	1 TO 6	0 4	1.00721E+01	1.58006E+02	1.43426E+01	6.95542E-02	5.53472E-03	7.7	12.3E-0	-2.44336E-03
4	2 TO 3	0 4	-1.15474E+02	1.58192E+02	1.42985E+01	-6.95047E-03	0.	0.	0.	-6.62074E-03
5	2 TO 8	0 4	-9.41624E+01	1.60691E+02	1.43510E+01	3.52932E-03	-1.77988E-02	1.2	15.1E-0	-1.56434E-03
6	2 TO 7	0 4	1.29046E+02	1.58157E+02	1.43030E+01	1.33643E-03	0.	-4.8	17.2E-0	1.28793E-03
7	7 TO 5	0 4	-3.77492E+02	1.58207E+02	1.43043E+01	-3.69916E-02	-7.52032E-03	1.3	14.5E-0	-9.31605E-02
8	3 TO 6	0 4	-1.59787E+02	1.60691E+02	1.43510E+01	1.04798E-02	-1.78002E-02	4.1	13.1E-0	-3.19914E-03
9	8 TO 10	0 4	1.13159E+03	1.60621E+02	1.43510E+01	1.73865E-01	-1.23305E-02	-1.5	13.5E-0	2.39862E-03
10	5 TO 6	0 4	-4.24820E+02	1.60691E+02	1.43510E+01	2.32088E-03	-1.77984E-02	1.1	16.4E-0	-1.43379E-02
11	1 TO 9	0 4	9.13619E+00	1.58012E+02	1.43426E+01	6.95562E-02	5.65776E-03	-3	7.7	17.2E-0
12	1 TO 13	0 4	-5.65776E+02	1.60690E+02	1.43510E+01	1.97139E-02	-2.24150E-02	6.4	56.6E-0	-2.05946E-03
13	13 TO 12	0 4	0*	1.58229E+02	1.67223E-02	1.93712E-01	-7.33822E-03	0.	0.	0.
14	11 TO 12	0 4	6.02435E-01	1.46465E+02	1.39763E+01	1.07666E-05	4.91572E-05	-6.6	57.0E-0	5.99169E-05
15	11 TO 14	0 4	-3.67474E-01	1.54160E+02	1.42768E+01	1.07640E-05	-5.12470E-05	4.2	11.2E-0	-6.04808E-05
16	10 TO 11	0 4	9.88210E-01	1.88996E-02	1.52924E+01	2.81617E-03	5.47767E-04	-3.3	68.7E-0	5.05671E-06
17	10 TO 11	0 4	0*	1.89014E+02	1.67187E-02	2.81614E-03	-5.08811E-05	0.	0.	0.
18	10 TO 10	0 4	-3.40378E+00	1.61627E+02	1.50960E+01	1.20881E-02	-3.44473E-03	1.2	54.4E-0	-2.54090E-03
19	10 TO 10	0 4	0*	1.81621E+02	1.67187E-02	-1.20807E-02	-3.42611E-03	0.	0.	0.
20	6 TO 10	0 4	0*	1.58266E+02	1.57190E-02	-1.43378E-01	-1.58815E-03	0.	0.	0.
21	0 TO 10	0 4	5.52404E+01	1.81589E+02	1.50960E+01	3.46972E-02	-2.19275E-02	1.2	51.3E-0	2.81830E-05
22	6 TO 6	0 4	-2.34524E+02	1.60691E+02	1.43510E+01	-1.23559E-01	-2.30767E-02	1.2	41.5E-0	-2.12202E-02
23	14 TO 14	0 4	5.499788E+01	1.57755E+02	1.44220E+01	1.56369E-02	-1.22811E-02	-1.6	37.8E-0	1.65696E-03
24	6 TO 6	0 4	0*	1.60691E+02	1.67190E-02	-1.23550E-01	-2.30767E-02	0.	0.	0.
25	10 TO 10	0 4	0*	1.58247E+02	1.67187E-02	-1.554559E-01	-4.54112E-03	0.	0.	0.
26	8 TO 8	0 4	0*	1.60671E+02	1.67218E-02	1.73865E-01	5.55300E-03	0.	0.	0.
27	8 TO 9	0 4	0*	1.60638E+02	1.67218E-02	1.73865E-01	-7.05107E-03	0.	0.	0.
28	8 TO 9	0 4	0*	1.60673E+02	1.67218E-02	1.73865F-01	5.53300E-03	0.	0.	0.
29	8 TO 9	0 4	0*	1.60634E+02	1.67218E-02	1.73865t-01	-7.05107E-03	0.	0.	0.
30	15 TO 15	0 4	5.06302E+03	6.28201E+02	5.06231E+00	-1.50377E-02	-5.1	74.9E+0	-1.20217L-01	0.
31	0 TO 15	0 4	3.65000E+03	1.18741E+03	0.	0.	0.	0.	0.	0.

45

NOV 4/1970 09:03:16 (2) IMPULL VTR 1.00 DELAP4 THERMAL HYDRAULIC CODE CONTAINMENT CUMINC RES  
NUP NUCITLU TUNH. BLUG. LNU STUDY. STEAMLINE BREAK IN STEAM TUNNEL

SLAB NUMBER	VUL	HEAT TRANS MODE	SURF FLUX (BTU/HR/FT2)	CRTI FLUX (BTU/HR/FT2)	H.T. COEF (BTU/H/FT2/°F)	SURF TEMP (°F)	Avg. QUAL	POWR H2O (BTU/HR)
1	RIGHT	1	-1.30160E+01	9.01017E+04	5.00000E+00	1.00000E+00	1.04001E+02	1.00000E+00
2	RIGHT	6	-1.31599E+01	9.00045E+04	5.00000E+00	1.25000E+02	1.00000E+00	1.6707E+04
3	RIGHT	7	-1.43545E+01	9.03564E+04	5.00000E+00	1.04001E+02	1.00000E+00	3.7170E+04
4	RIGHT	8	-2.43138E+01	9.00030E+04	5.00000E+00	1.04002E+02	1.00000E+00	3.8585E+05
5	RIGHT	10	-4.31667E+01	9.00094E+04	5.00000E+00	1.30000E+02	1.00000E+00	5.9910E+05
6	RIGHT	15	-6.12236E+02	9.73977E+04	5.00000E+00	1.35624E+02	1.00000E+00	2.1266E+07
1	VOLUME							
1	1		1.416888E+02					
2			1.30969E+03					
3			4.50278E+02					
4			1.379634E+03					
5			8.012040E+02					
6			2.60404E+04					
7			8.48352E+03					
8			9.51232E+04					
9			6.51127E+10					
10			1.55057E+03					
11			2.22558E+03					
12			5.08558E+02					
13			7.91378E+03					
14			1.48971E+03					
15			5.222976E+02					
1	WEIGHT							
1	1							
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

11  
12  
13

-6+12736t+02 9+73977t+04 5+00000E+00 1 ~4627t+02 1+00000E+00 -2+12666t+02

WELAPYRNU'S QV/0376 t 21 IMPELL VER 1.00 RELAP4 THERMAL HYDRAULIC CODE  
NYP MUNTICLU TURB. BUG. TNY STUDY: STEAMLINE BREAK IN STEAM TUNNEL

LPU TIME = 1.e29

JUNCTION NUMBER	CONNECTING VOLUME's	JCT. FLOW FLU/SEC)	JCT. ENTH (BTU/LB)	JCT. SPVL (FT3/LB)	P R E S		S U R E ELEV PSI	STAG PSI ACCL PSI	FRICTION PUMP PSI ACCL PSI
					P	R			
1	1 TU	2 0 4	0.	1.58483E+02	1.57242E-02	-2.10746E-02	-2+35226E-07	0.	0.
2	1 TU	2 0 4	-3.63754E+01	1.58478E+02	1.42114E+01	-3+25062E-02	7.56622E-03	2+36562E-02	-1+08381E-03
3	1 TU	6 0 4	1+24259E+01	1.58426E+02	1.42356E+01	2+09341E-01	5.54103E-03	-2+15191E-01	-3+08846E-04
4	2 TU	3 0 4	-1+36811E+02	1.58586E+02	1.42244E+01	1+33224E-03	0.	3+29410E-04	1.66165E-03
5	2 TU	6 0 4	-5.44712E+01	1.63577E+02	1.43184E+01	1+24408E-02	-1.78550E-02	4.09352E-03	-1+32070E-03
6	2 T0	4 0 4	-9.01091E+01	1.58482E+02	1.42219E+01	-5+37311E-03	0.	-2+43508E-03	-5+39746E-03
7	7 TU	5 0 4	-3+96345E+02	1.58716E+02	1.42235E+01	9+27236E-03	-7+57019E-03	2+14878E-03	3+85066E-03
8	3 TU	6 0 4	-1+30899E+02	1.63577E+02	1.43184E+01	1+11086E-02	-1+78542E-02	4+16144E-03	-2+58420E-03
9	6 TU	9 0 4	1+43629E+03	1.63507E+02	1.43184E+01	2+83722E-01	-1+33604E-02	-2+67291E-01	3+07102E-03
10	5 TU	8 0 4	-4+42958E+02	1+63577E+02	1+43184E+01	1+46004E-02	-1+78545E-02	1+74127E-03	-1+51269E-03
11	1 TU	6 0 4	1+40124E+01	1.58432E+02	1.42356E+01	2+09347E-01	5+68099E-03	-2+15387E-01	-3+58995E-04
12	1 J TU	8 0 4	-3+24947E+02	1.62575E+02	1.43184E+01	2+94625E-02	-2+25036E-02	2+55728E-04	7.21462E-03
13	1 J TU	9 0 4	0.	1.58531E+02	1.67251E-02	3+13257E-01	-7+37166E-03	0.	0.
14	11 TU	12 0 4	8+88635E-01	1.39758E+02	1.45470E+01	1+05709E-05	4+91408E-05	5+97015E-05	0.
15	1 J TU	14 0 4	-5+45946E-01	1.54161E+02	1.42762E+01	1+05709E-05	-5+12319E-05	1+09572E-06	-4+63006E-05
16	10 FU	11 0 4	1+34354E+00	1+89006E+02	1.52893E+01	5+94271E-03	5+47269E-04	-6+47674E-03	1+32166E-05
17	10 TU	11 0 4	0.	1.89024E+02	1.671188E-02	5+94265E-03	-5+3774E-05	0.	0.
18	10 TU	5 0 4	-5+24140E+00	1+81648E+02	1.50841E+01	-2+34457E-02	-3+44669E-03	2+43175E-02	-2+52087E-03
19	10 TU	6 0 4	0.	1+81644E+02	1.671188E-02	-2+34454E-02	-3+42815E-03	0.	0.
20	0 TU	13 0 4	0.	1.58568E+02	1.671193E-02	-2+47535E-01	-1+63094E-03	0.	0.
21	0 TU	14 0 4	7+64039E+01	1+81612E+02	1.50841E+01	5+95163E-02	-2+19333E-02	-2+74849E-02	9+81507E-05
22	6 TU	8 0 4	-3+32491E+02	1.63577E+02	1.43184E+01	-2+18032E-01	-2+31145E-02	2+26280E-01	-1+48668E-02
23	14 TU	9 3 4	7+35230E+01	1.57877E+02	1.44255E+01	1+62056E-02	-1+22790E-02	-2+89913E-03	1+02740E-03
24	6 TU	8 0 4	0.	1+63577E+02	1.671193E-02	-2+18001E-01	-2+31145E-02	0.	0.
25	10 TU	13 0 4	0.	1.58546E+02	1.671188E-02	-2+70981E-01	-4+54203E-03	0.	0.
26	8 TU	9 0 4	0.	1+63559E+02	1.672244E-02	2+83722E-01	5+56891E-03	0.	0.
27	6 TU	9 3 4	0.	1+63524E+02	1.67244E-02	2+83722E-01	-7+66608E-03	0.	0.
28	6 TU	9 3 4	0.	1.63559E+02	1.67244E-02	2+83722E-01	5+56891E-03	0.	0.
29	6 TU	9 3 4	0.	1+63524E+02	1.67244E-02	2+83722E-01	-7+66608E-03	0.	0.
30	12 TU	6 0 4	4+64941E+03	7+86584E+02	1+81723E+01	4+70715E+00	-1+46626E-02	-4+84912E+00	-1+56633E-01
31	3 TU	15 0 4	3+65000E+03	1.18784E+03	0.	0.	0.	0.	0.

10-4840

RELAP4 THERMAL HYDRAULIC CODE CONTAINMENT CONTROL STEPS  
86/08/09

STEP 1, PRELIMINARY ENV STUDY, STEAMLINE BREAK IN STEAM TUNNEL  
LAST DT = 500000E-01 SEC.

	TOTAL SYSTEM WATER FLOW,	WATER PRESSURE 1.00000E+00	PLATE (in)	HEAT REM (BTU/in/s)	ENGY LEAK (BTU)	MASS LEAK (LB)	ENGY BAL. (BTU)	MASS BAL. (LB)	TOT. R-A.C (lb)	REAC. T SEC.	LIQ. MASS (LB)
	WATER FLOW :	WATER PRESSURE	BTU/LB	BTU/LB	BTU	0.	9.63487E+12	3.19397E+09	0.	0.	0.
1	1.50904E+01	2.70405E+00	1.58729E+02	7.07696E-02	1.08254E+02	1.00000E+00	0.	0.	0.	0.	0.
2	1.50976E+01	3.10178E+01	1.58734E+02	7.07595E-02	1.08289E+02	1.00000E+00	0.	0.	0.	0.	0.
3	1.50959E+01	1.07657E+01	1.59025E+02	7.07377E-02	1.08401E+02	1.00000E+00	0.	0.	0.	0.	0.
4	1.50948E+01	4.24015E+01	1.58730E+02	7.07623E-02	1.08254E+02	1.00000E+00	0.	0.	0.	0.	0.
5	1.51054E+01	1.95517E+01	1.59223E+02	7.07528E-02	1.08573E+02	1.00000E+00	0.	0.	0.	0.	0.
6	1.47561E+01	1.14734E+03	1.81671E+02	6.63772E-02	1.25508E+02	1.00000E+00	0.	0.	0.	0.	0.
7	1.51331E+01	1.35494E+02	1.58797E+02	7.09036E-02	1.08561E+02	1.00000E+00	0.	0.	0.	0.	0.
8	1.50838E+01	2.70406E+03	1.66821E+02	6.99873E-02	1.11574E+02	1.00000E+00	0.	0.	0.	0.	0.
9	1.46661E+01	3.14919E+01	1.80784E+02	6.83067E-02	1.04000E+02	1.00000E+00	3.19397E+09	2.00000E+12	2.99243E+00	0.	0.
10	1.47151E+01	7.96774E+01	1.89028E+02	6.54272E-02	1.30160E+02	1.00000E+00	0.	0.	0.	0.	0.
11	1.47040E+01	3.3179E+01	1.46471E+02	7.15571E-02	9.00431E+01	1.00030E+00	0.	0.	0.	0.	0.
12	1.47040E+01	1.35660E+01	1.54169E+02	7.00524E-02	1.00030E+02	1.00000E+00	0.	0.	0.	0.	0.
13	1.51004E+01	1.857479E+02	1.58832E+02	7.07649E-02	1.08424E+02	1.00000E+00	0.	0.	0.	0.	0.
14	1.46484E+01	3.54760E+01	1.58054E+02	6.93061E-02	1.04338E+02	1.00000E+00	0.	0.	0.	0.	0.
15	1.43411E+01	7.455760E+02	9.12097E+02	4.99424E-02	2.69037E+02	1.00000E+00	0.	0.	0.	0.	0.

### AIR MASS

	WATER FLOW :	WATER PRESSURE	BTU/LB	HEAT TRAN BTU/H	WJL RJW	WJL RJW	SUM FLUX BTU/H/FT <sup>2</sup>	CRIT FLUX (BTU/H/FT <sup>2</sup> )	H.T. COEF (BTU/H/FT <sup>2</sup> /F)	SURF TEMP (F)	AVG. QUAL	POWR (1/2) (BTU/HR)
1	WJL	1	1.0268E+01	9.00002E+04	5.00000E+00	1.04002E+02	1.25000E+02	1.00000E+00	1.00000E+00	-2.40215E+00		
2	WJL	1	1.0212E+00	9.00050E+04	5.00000E+00	1.25000E+02	1.04002E+02	1.00000E+00	1.00000E+00	-8.7819E+00		
3	WJL	1	1.0147E+01	9.02898E+04	5.00000E+00	1.04003E+02	1.00000E+02	1.00000E+00	1.00000E+00	-5.4147E+00		
4	WJL	1	1.0192E+01	9.00111E+04	5.00000E+00	1.30000E+02	1.00000E+00	1.00000E+00	1.00000E+00	-8.01217E+00		
5	WJL	1	1.0192E+02	9.73396E+04	5.00000E+00	1.35926E+02	1.00000E+00	1.00000E+00	1.00000E+00	-2.24812E+00		

50

WILAPPS/BLUS WORKS IN 2D IMPULS VFR 1.00 WILAPPS THERMAL HYDRAULIC CODE CONTAINMENT CONTROL VES

86/08/09

LPU TIME = 1.41

SECTION	CONNECTING	CHUNK	JCT. FLOW	JCT. ENTH	JCT. SPVL	P R E S U R E	S U R F E	D I F F E R E N C E	ACC	PSI	PUMP PSI
1	1 TU	2	0 4	0.	1.58730E+02	1.67266E-02	2.03307E-03	5.20107E-08	0.	0.	0.
2	1 TU	7	0 4	-8.35674E+01	1.58730E+02	1.41375E+01	-3.622557E-02	7.50439E-03	2.83062E-02	-3.4	-40E-34
3	1 TU	6	0 4	1.82804E+01	1.58730E+02	1.41640E+01	3.00709E-01	5.54728E-03	-3.05683E-01	5.7	-32E-34
4	2 TU	3	0 4	-1.02565E+02	1.59025E+02	1.41699E+01	-5.82141E-04	0.	2.95743E-9C	-2.8	1.98E-34
5	2 TU	8	0 4	-5.43034E+01	1.66856E+02	1.42989E+01	1.22693E-02	-1.78511E-02	3.58280E-02	-2.0	1.98E-33
6	2 TU	10	4 0	9.04711E+01	1.58730E+02	1.41670E+01	7.87399E-04	0.	-2.06912E-01	7.6	-0.8E-34
7	2 TU	5	3 4	-2.61270E+02	1.59236E+02	1.41666E+02	2.95888E-02	-7.6014E-03	1.32530E-03	2.3	.99E-32
8	2 TU	8	0 4	-1.24230E+02	1.66656E+02	1.42989E+01	1.20513E-02	-1.78502E-02	3.866852E-03	-1.1	1.8E-33
9	2 TU	4	0 4	1.67697E+03	1.666786E+02	1.42989E+01	3.65332E-01	-1.33785E-02	-3.50251E-01	1.7	1.20E-33
10	2 TU	8	3 4	-3.00035E+02	1.66656E+02	1.42989E+01	2.17694E-02	-1.78512E-02	1.11987E-03	4.5	1.99E-03
11	1 TU	6	0 4	1.65710E+01	1.58736E+02	1.41640E+01	3.00717E-01	-5.69112E-03	-3.05874E-01	5.4	-1.37E-34
12	1 TU	8	0 4	-1.97326E+02	1.66656E+02	1.42989E+01	1.70782E-01	-2.22531E-02	2.37424E-04	-5.4	-1.52E-03
13	1 TU	9	0 4	0.	1.58816E+02	1.67267E-02	3.82481E-01	-7.39194E-03	0.	0.	0.
14	1 TU	12	0 4	1.17435E+00	1.464477E+02	1.39753E+01	1.04364E-05	4.91145E-05	-2.53326E-08	5.4	1.56E-05
15	1 TU	12	0 4	-8.04642E-01	1.54163E+02	1.42755E+01	1.04276E-05	-5.1249E-05	1.80945E-08	-4.4	-9.2E-05
16	1 TU	11	0 4	1.69648E+00	1.89019E+02	1.52864E+01	8.89119E-03	5.46105E-04	-9.40752E-03	3.4	-8.5E-05
17	1 TU	11	0 4	0.	1.89937E+02	1.67189E-02	8.89111E-03	-4.98533E-05	0.	0.	0.
18	1 TU	6	0 4	-6.48644E+00	1.81679E+02	1.50733E+01	-3.35972E-02	-3.4491E-03	3.46745E-02	-2.4	1.57E-03
19	1 TU	6	0 4	0.	1.81676E+02	1.67189E-02	-3.35964E-02	-3.4264E-03	0.	0.	0.
20	6 TU	13	0 4	0.	1.58854E+02	1.67196E-02	-3.02797E-01	-1.65148E-03	0.	0.	0.
21	6 TU	14	0 4	9.62187E+01	1.81643E+02	1.50733E+01	6.21025E-02	-2.01988E-02	-3.99742E-02	1.	5.36E-04
22	6 TU	8	0 4	-3.23066E+02	1.66856E+02	1.42989E+01	-2.85681E-01	-2.3198E-02	2.97000E-01	-1.	.04E-02
23	1 TU	9	0 4	9.92270E+01	1.58022E+02	1.44273E+01	1.75816E-02	-1.22775E-02	-4.29020E-03	1.	1.87E-03
24	6 TU	8	0 4	0.	1.66856E+02	1.67196E-02	-2.85648E-01	-2.3198E-02	0.	0.	0.
25	10 TU	13	0 4	0.	1.58832E+02	1.67189E-02	-3.36393E-01	-4.5489E-03	0.	0.	0.
26	6 TU	9	0 4	0.	1.67263E+02	1.67263E-02	3.65332E-01	5.57797E-03	0.	0.	0.
27	6 TU	9	0 4	0.	1.66804E+02	1.67263E-02	3.65332E-01	-7.0714E-03	0.	0.	0.
28	6 TU	9	0 4	0.	1.66804E+02	1.67263E-02	3.65332E-01	5.57797E-03	0.	0.	0.
29	6 TU	9	0 4	0.	1.66804E+02	1.67263E-02	3.65332E-01	-7.0714E-03	0.	0.	0.
30	15 TU	8	0 4	4.35191E+03	9.12085E+02	1.93472E+01	4.42536E+00	-4.57516E+00	-1.44576E-02	2.55E-01	0.
31	0 TU	15	0 4	3.65000E+03	1.18822E+03	0.	0.	0.	0.	0.	0.

49

APR/15 09:03:76 (2) NPIII VER 1.0.0 NELAPS THERMAL HYDRAULIC UDE CONTAINMENT  
NPII MUNIFICENT FLOW, HLDG. FLOW STUDY, STEAMLINE BREAK IN STEAM TUNNEL

CONTINUOUS  
86/08/09

REL TIME = 1.033  
REL TIME STEP NUMBER 1.0. ACTUAL TIME STEP NUMBER 42. TIME = .500000E+00 SEC. LAST DT = .0000001-01 SEC.

	REL TIME	ACTUAL TIME	STEP NUMBER	42.	TIME = .500000E+00 SEC.	LAST DT = .0000001-01 SEC.
1	REL SYSTEM	NORM PWR	PWR	HEAT RLM	ENG LEAK	F1SS LEAK
	UNITS	(BTU/HR)	(BTU/HR)	(BTU/HR)	(BTU/HR)	(BTU/HR)
		1.00000E+00	0.	0.	0.	9.63487E+12
2	AIR	PSIA	TUT. MASS	Avg. ENTH	Avg. DENS	BUBB MASS
		1.51768E+01	1.87112E+00	1.58930E+02	7.10347E-02	1.00100E+00
		1.51496E+01	3.32183E+01	1.59095E+02	7.11048E-02	1.09411E+02
		1.51497E+01	1.09152E+01	1.59527E+02	7.10652E-02	1.09517E+02
		1.52005E+01	4.26155E+01	1.59006E+02	7.11168E-02	1.09378E+02
		1.52036E+01	1.98368E+01	1.59736E+02	7.10605E-02	1.09720E+02
		1.47783E+01	1.14814E+03	1.81710E+02	6.64513E-02	1.25733E+02
		1.52133E+01	1.06410E+02	1.59004E+02	7.11746E-02	1.09399E+02
		1.51682E+01	3.29151E+03	1.70366E+02	7.00611E-02	1.13720E+02
		1.46661E+01	3.14397E+09	1.80784E+02	6.83067E-02	1.04000E+00
		1.47217E+01	7.90987E+01	1.89044E+02	6.54486E-02	1.30233E+02
		1.47055E+01	3.37272E+01	1.46479E+02	7.15619E-02	9.00635E+01
		1.47055E+01	1.05661E+01	1.54172E+02	7.00581E-02	1.00045E+02
		1.52091E+01	1.88777E+02	1.59160E+02	7.33252E-02	1.095497E+02
		1.46869E+01	3.56719E+04	1.58227E+02	6.92891E-02	1.04513E+02
		1.92107E+01	7.93366E+02	1.00315E+03	4.74431E-02	1.76722E+02
3	AIR					1.00000E+00
						0.

AIR MASS

	AT'S AB	VOL	HEAT TRAN	SURF FLUX	CRIT FLUX	H,T COEF	URF TEMP	Avg. Qual	POWR H21:
1	1.00000E+00	1.32262E+03	MUD	1BTU/HR/FT2	1BTU/HR/FT2	1BTU/HR/FT2	(F)	1.00000E+00	4BTU/HR
2	1.54419E+02	4.52635E+03		-2.34353E+01	9.00500E+04	1.0403E+02	1.25000E+02	1.00000E+00	-3.02316E+04
3	1.81211E+03	9.48010E+04		-3.39031E+00	9.00056E+04	5.00000E+00	1.0403E+02	1.00000E+00	-1.34268E+05
4	8.19246E+02	2.60965E+04							
5	2.60965E+04	4.52635E+03							
6	9.48010E+04	6.51127E+10							
7	6.51127E+10	1.55162E+03							
8	1.55162E+03	2.22584E+02							
9	2.22584E+02	5.08635E+02							
10	5.08635E+02	7.99062E+03							
11	7.99062E+03	1.48069E+03							
12	1.48069E+03	1.70535E+02							
13	1.70535E+02	-6.085109E+02							
14		5.00000E+00							
15		5.00000E+00							

SB  
11/11

RELAP4/MUD 09/03/76 1 21 INPELL VEN 1.00 RELAP4 THERMAL HYDRAULIC CODE  
NSP MUNICILLU TURB. BLDG. ENV STUDY. STEAMLINE BREAK IN STEAM TUNNEL

LPU TIME = 1.55

CONTAINMENT

CONTROL RE,  
86/08/01

JUNCTION NUMBER	CONNECTING VOLUME'S	CHOKE	JCF. FLOW (LB/SEC)	JCT. ENTH (FTU/LB)	JCT. SPVL (FT3/LB)	P R E S S U R E (PSI)	D I F F E R E N C E (PSI)	FRICTION FACTOR	ELEV PSI	PUMP PSI
1	1 TU	2 0 4	0.	1.54095E+0,	1.67288E-02	-1.1.34978E-02	-9.89104E-08	0.	0.	0.
2	1 TU	7 0 4	-4.18684E+01	1.58998E+0,	1.40754E+01	-3.72300E-02	7.63835E-03	2.9451E-02	-1.3E-04	0.
3	1 TU	6 0 4	1.97417E+01	1.58930E+0,	1.41023E+01	3.71123E-01	5.55319E-03	-3.76216E-01	3.8E-04	0.
4	2 TU	3 0 4	-1.00896E+02	1.59527E+0,	1.41025E+01	-4.57296E-04	0.	2.92313E-04	-1.6E-04	0.
5	2 TU	8 0 4	-5.32129E+01	1.70401E+0,	1.42795E+01	1.40838E-02	-1.79323E-02	3.93946E-03	9.1E-05	0.
6	2 TU	4 0 4	9.08557E+01	1.59095E+0,	1.40967E+01	9.44086E-04	0.	-2.35242E-05	9.2E-04	0.
7	7 TU	5 0 4	-2.09455E+02	1.59749E+0,	1.41014E+01	1.84889E-02	-7.63866E-03	5.93974E-04	1.1E-02	0.
8	3 TU	8 0 4	-1.21305E+02	1.70401E+0,	1.42795E+01	1.45411E-02	-1.79303E-02	3.59335E-03	2.0E-04	0.
9	6 TU	9 0 4	1.88066E+03	1.70331E+0,	1.42795E+01	4.69303E-01	-1.33965E-02	-4.55275E-01	6.3E-04	0.
10	5 TU	8 0 4	-2.43844E+02	1.70401E+0,	1.42795E+01	2.33260E-02	-1.79307E-02	5.30577E-04	3.9E-03	0.
11	1 TU	6 3 4	1.78950E+01	1.58937E+0,	1.41023E+01	3.71133E-01	5.71243E-03	-3.76442E-01	3.6E-04	0.
12	13 TU	8 0 4	-4.05519E+02	1.70399E+0,	1.42795E+01	2.03447E-02	-2.26200E-02	3.19932E-03	-1.9E-03	0.
13	13 TU	9 0 4	0.	1.59145E+0,	1.57292E-02	4.89731E-01	-7.52067E-03	0.	0.	0.
14	11 TU	12 3 4	1.45802E+00	1.46483E+0,	1.39744E+01	1.07708E-05	4.90972E-05	-4.12756E-08	5.9E-05	0.
15	11 TU	12 0 4	-1.01499E+00	1.54165E+0,	1.42745E+01	1.075569E-05	-5.11865E-05	3.05143E-06	-4.0190E-05	0.
16	10 TU	11 0 4	2.02717E+00	1.89033E+0,	1.52818E+01	1.35903E-02	5.46066E-04	-1.41023E-02	3.4E-05	0.
17	10 TU	11 3 4	0.	1.89053E+0,	1.67190E-02	1.35902E-02	-4.91257E-05	0.	0.	0.
18	10 TU	6 0 4	-7.59114E+00	1.50572E+01	1.85037E-02	-4.85037E-02	-3.45226E-03	4.98370E-02	-2.1E-03	0.
19	10 TU	6 0 4	0.	1.81714E+0,	1.57190E-02	-4.85027E-02	-3.43192E-03	0.	0.	0.
20	6 TU	13 2 4	0.	1.591482E+0,	1.67201E-02	-3.89019E-01	-1.68844E-03	0.	0.	0.
21	6 TU	14 0 4	1.13864E+02	1.81682E+0,	1.50572E+01	8.10988E-02	-2.19467E-02	-5.89627E-02	3.8E-04	0.
22	6 TU	8 0 4	-3.93910E+02	1.70401E+0,	1.42795E+01	-3.68674E-01	-2.31682E-02	3.63712E-01	-6.0E-03	0.
23	14 1 0	9 0 4	1.17622E+02	1.58195E+0,	1.44305E+01	1.96129E-02	-1.22748E-02	-6.37247E-03	9.6E-04	0.
24	6 TU	8 0 4	0.	1.70401E+0,	1.57291E-02	-4.85027E-02	-3.43192E-03	0.	0.	0.
25	10 TU	13 0 4	0.	1.59160E+0,	1.57190E-02	-3.89019E-01	-1.68844E-03	0.	0.	0.
26	8 TU	9 0 4	0.	1.70383E+0,	1.67287E-02	4.69303E-01	5.58696E-03	0.	0.	0.
27	8 TU	9 0 4	0.	1.70348E+0,	1.67287E-02	4.69303E-01	-7.08413E-03	0.	0.	0.
28	8 TU	9 0 4	0.	1.70383E+0,	1.67287E-02	4.69303E-01	5.58696E-03	0.	0.	0.
29	15 TU	8 0 4	4.09413E+03	1.00314E+01	2.05984E+01	4.16110E+00	-1.42659E-02	-4.27102E+00	-1.2E-01	0.
30	0 TU	15 0 4	3.65000E+03	1.18860E+01	0.	0.	0.	0.	0.	0.

11/11/86  
5/26

RELAP4/MOD3.09/0170 (2) IMPELL VTR 1.00 RELAP4 THERMAL HYDRAULIC CODE  
NVP MULTICELL TURB. BLDG. FNU STUDY, STEAMLINE BREAK IN STEAM TUNNEL

LPU TIME = 1.67  
STANAKU TIME STEP NUMBER = 12.  
ACTUAL TIME STEP NUMBER = 45.  
TIME = .600000E+00 SEC.  
LAST BT = .685720E-01 SEC.

TOTAL SYSTEM QUANTITIES		NUM POWR THER	POWR THER	HEAT WRM (BTU/HK)	ENGY LEAK (BTU)	MASS LEAK (LB)	ENGY BAL. (BTU)	MASS HAL. (LB)	TOT. REAC (%)	CONTAINMENT 86/08/04	CONTROL VES
1.	0.00000E+00	0.	0.	0.	0.	0.	9.63487E+12	3.19397E+09	0.		
2.	Avg. Pres.	Total Mass	Avg. Dens	Avg. Temp	Avg. Qual	Bubb Mass	Mixt Level	Iftt	10.435		
3.	PSIA	(LB) H2O	(LB/FT3)	(F)							
4.	1.50170E+01	2.75380E+00	1.58510E+02	7.05081E-02	1.07362E+02	1.00000E+00	0.	0.			
5.	1.48634E+01	3.05772E+01	1.58091E+02	6.99856E-02	1.05761E+02	1.00000E+00	0.	0.			
6.	1.47992E+01	1.06212E+01	1.58256E+02	6.97403E-02	1.05196E+02	1.00000E+00	0.	0.			
7.	1.49160E+01	9.20418E+01	1.58258E+02	7.01623E-02	1.06325E+02	1.00000E+00	0.	0.			
8.	1.48139E+01	1.45032E+01	1.58486E+02	6.97693E-02	1.05465E+02	1.00000E+00	0.	0.			
9.	1.47890E+01	1.014852E+03	1.01727E+02	6.64885E-02	1.25841E+02	1.00000E+00	0.	0.			
10.	1.50182E+01	1.05430E+02	1.58487E+02	7.05229E-02	1.07293E+02	1.00000E+00	0.	0.			
11.	1.47439E+01	3.05355E+03	1.72766E+02	6.03313E-02	1.0049E+02	1.00000E+00	0.	0.			
12.	1.46666E+01	3.19397E+09	1.80784E+02	6.83067E-02	1.04000E+02	9.9999E-01	3.19396E+09	2.00000E+02	3.42142E+03		
13.	1.47288E+01	7.91213E+01	1.89060E+02	1.30310E+02	1.30310E+02	1.00000E+00	0.	0.			
14.	1.47073E+01	3.037379E+01	1.46488E+02	7.015674E-02	9.00873E+01	1.00000E+00	0.	0.			
15.	1.47073E+01	1.05662E+01	1.54374E+02	7.00648E-02	1.00063E+02	1.00000E+00	0.	0.			
16.	1.47979E+01	1.86957E+02	1.58328E+02	6.97240E-02	1.05258E+02	1.00000E+00	0.	0.			
17.	1.46919E+01	3.58896E+01	1.58423E+02	6.92797E-02	1.04733E+02	1.00000E+00	0.	0.			
18.	1.889472E+01	6.15151E+02	1.06523E+03	4.54005E-02	2.79640E+02	1.00000E+00	0.	0.			

AIR MASS VOLUME

HEAT SLAB NUM	VOL	HEAT TRAN MODE	CRT FLUX (BTU/HR/FT2)	H.T. COEF (BTU/HF2/F)	SURF TEMP (F)	Avg. Qual	POWR H2O (BTU/HR)
1. Right 1	1.30195E+03	Mode	-2.15796E+01	9.01029E+04	5.00000E+00	1.04004E+02	1.00000E+00
2. Right 1	1	-6.16008E+00	9.01029E+04	5.00000E+00	1.250016E+02	1.04005E+02	-1.80782E+03
3. Right 1	1	-2.16102E+01	9.03121E+04	5.00000E+00	1.04005E+02	1.00000E+00	-5.87225E+05
4. Right 1	1	-1.547515E+01	9.00171E+04	5.00000E+00	1.04008E+02	1.00000E+00	-8.62078E+05
5. Right 1	1	-1.40221E+01	9.00146E+04	5.00000E+00	1.30000E+02	1.00000E+00	-8.00361E+03
6. Right 1	1	-7.12572E+02	9.70565E+04	5.00000E+00	1.36572E+02	1.00000E+00	-2.47519E+07

SD

RELAP4 THERMAL HYDRAULIC CODE  
INPUT VIEW 1.00  
43P MINTICLU TURB. BUG. FV STUDY. STEAMLINE BREAK IN STEAM TUNNEL

CONTROL  
86/01/09

L.P. STATE = 1.69

J.C.J.	LINK	CONNECTING	CHIKE	JCT. FLUID	JCT. ENTH	JCT. SPWL	P-R-E	S-U-R-E	O-I-F	F-E-R-E-N	ACCL	PUMP	PSI	
SEG. NO.	LINK	VOLUME	FLD/SEC	(BTU/LB)	(BTU/LB)	STAG PSI	ELEV PSI	FRIC PS	ACCL	PUMP	PSI			
1	1 TU	2	0	0	1.58511E+02	1.36249E+02	1.62260E+02	1.41127E+01	-1.27888E+02	7.62359E+03	1.25066	0.2	5.34137E+03	
2	1 TU	7	0	0	1.58479E+02	1.41233E+02	1.58511E+02	1.41233E+01	3.17683E+01	5.55840E+03	3.25731	0.1	-2.48968E+03	
3	1 TU	6	0	4	1.52904E+01	1.58091E+02	1.58091E+02	1.42160E+01	7.06835E+02	0.	-1.37743	0.3	6.96061E+02	
4	2 TU	1	0	4	1.51530E+02	1.58079E+02	1.58079E+02	1.42159E+01	1.09506E+01	-1.76600E+02	-9.48236	0.2	-3.97738E+03	
5	2 TU	6	0	4	1.58519E+02	1.42159E+02	1.58258E+02	1.41681E+01	-7.12187E+02	0.	1.71389	0.5	-7.11996E+02	
6	2 TU	4	0	4	1.582510E+02	1.58479E+02	1.58479E+02	1.41127E+01	1.87760E+01	-7.58130E+03	2.18010	0.3	1.77999E+01	
7	3 TU	2	0	4	1.58244E+02	1.42706E+02	1.58244E+02	1.42706E+01	3.78228E+02	-1.76423E+02	-1.74231	0.2	7.57412E+04	
8	3 TU	6	0	4	1.58244E+02	1.722731E+02	1.722731E+02	1.45352E+01	1.94809E+01	-1.31635E+02	-1.37541	0.1	-1.58959E+02	
9	6 TU	4	0	4	1.581503E+02	1.58474E+02	1.58474E+02	1.52525E+01	6.97843E+02	-1.76482E+02	-2.77318	0.3	4.93629E+02	
10	1 TU	6	0	4	1.58518E+01	1.58518E+02	1.58518E+02	1.42333E+01	1.76911E+01	5.71140E+03	-3.25846	0.1	-2.44306E+03	
11	1 TU	6	0	4	1.58518E+01	1.72600E+02	1.58518E+02	1.45352E+01	-5.17611E+02	-2.22311E+02	6.14620	0.3	-6.78480E+02	
12	1 TU	9	0	4	1.581781E+03	1.583121E+02	1.58280E+02	1.43280E+01	1.41892E+01	-7.32320E+03	-4.31310	0.1	-3.28561E+01	
13	1 TU	12	0	4	1.58244E+02	1.4644E+02	1.39732E+01	1.1534E+01	4.90563E+05	-6.34982	0.8	6.01442E+05		
14	11 TU	12	0	4	-1.58228E+00	1.54168E+02	1.42729E+01	1.11322E+05	-5.11438E+05	5.32442	-0.8	-2.79613E-05		
15	10 TU	11	0	4	2.31820E+00	1.89051E+02	1.52753E+01	1.99962E+01	5.45058E+04	-2.25124	-0.2	2.91161E-05		
16	10 TU	11	0	4	0.	1.67192E+02	1.99961E+02	4.80730E+05	0.	0.	0.	0.	0.	
17	10 TU	6	0	4	-7.96944E+00	1.890669E+02	1.50410E+01	6.11388E+02	-3.45567E+03	6.388856	-0.2	-7.086884E-04		
18	10 TU	6	0	4	0.	1.81732E+02	1.67192E+02	-6.11388E+02	-3.43442E+03	0.	0.	0.	0.	
19	6 TU	13	0	4	0.	1.58349E+02	1.67206E+02	-2.41496E+02	-1.54318E+03	0.	0.	0.	0.	
20	6 TU	14	0	4	1.18484E+02	1.91700E+02	1.50410E+01	9.78369E+02	-2.19545E+02	-7.60788	-0.2	-1.96395E+04		
21	6 TU	8	0	4	-1.50139E+02	1.72801E+02	1.45352E+01	-7.40908E+02	-2.29459E+02	1.61975	-0.1	6.49386E+02		
22	14 TU	9	0	4	1.19426E+02	1.58391E+02	1.44340E+01	2.39332E+02	-1.22719E+02	-1.23933	-0.2	-7.32096E+04		
23	6 TU	8	0	4	0.	1.81700E+02	1.67206E+02	-7.29683E+02	-2.29459E+02	0.	0.	0.	0.	
24	10 TU	13	0	4	0.	1.58328E+02	1.67192E+02	-8.52878E+02	-4.54618E+03	0.	0.	0.	0.	
25	8 TU	7	1	4	6.65688E+03	1.72784E+02	1.45351E+01	1.95765E+01	5.47027E+03	1.49020	*0.0	-1.29381E+00		
26	8 TU	9	1	4	6.5428E+03	1.72749E+02	1.45351E+01	1.95773E+01	-6.96744E+03	1.45536	*0.0	-1.27142E+00		
27	8 TU	7	1	4	6.65688E+03	1.72784E+02	1.45351E+01	1.95765E+01	5.47027E+03	1.49020	*0.0	-1.29381E+00		
28	9 TU	9	1	4	6.5428E+03	1.72749E+02	1.45351E+01	1.95773E+01	-6.96744E+03	1.45536	*0.0	-1.27142E+00		
29	15 TU	8	0	4	4.34057E+03	1.06522E+03	2.17592E+01	4.16919E+00	-1.39008E+02	-4.24664	*0.0	-6.13485E+02		
30	10 TU	15	0	4	3.65003E+03	1.18898E+03	0.	0.	0.	0.	0.	0.	0.	0.

53

KELLAR SYSTEM UNITS/SEC RELAY VTR 1.00 RELAY THERMAL HYDRAULIC COD CONTAINMENT CONTROL YES  
HSP MUNTILLU "UREI" BLDG. THE STUDY, STEAMLINE BREAK IN STEAM TUNNEL

LFR TIME = 1.03  
STANDBY TIME STEP NUMBER 144 ACTUAL TIME STEP NUMBER 49 TIME = +700000E+00 SEC. LAST DT = +216076E-01 SEC.

TOTAL SYSTEM VOLUME	NORM PWR (MW)	PWR (MW)	HEAT WRM (BTU/HR)	ENGY LEAK (BTU)	MASS LEAK (LB)	ENGY BAL. (BTU)	MASS BAL. (LB)	TOT. REAL (LB)	BEAC SEC. 0.
1.000000+00	0.	0.	0.	0.	0.	9.63987E+12	3.19397E+09	0.	0.
Avg. Part S	Total Mass	Avg. Enth	Avg. Dens	Avg. Temp	Avg. Qual	Bubb Mass	Mixt Lfsl	Liq. Mass	
1	1.454001+01	1.302541+00	1.571861+00	1.571861+00	1.571861+00	1.0263E+02	1.000000E+00	0.	
2	1.450059+01	1.302541+01	1.571861+01	1.571861+01	1.571861+01	1.0263E+02	1.000000E+00	0.	0.
3	1.42313+01	1.34712E+01	1.575151+02	1.575151+02	1.575151+02	1.0279E+02	1.000000E+00	0.	0.
4	1.48673+01	6.11333E+01	1.570581+02	1.570581+02	1.570581+02	1.0126E+02	1.000000E+00	0.	0.
5	1.45001+01	1.09540E+01	1.57606E+02	1.57606E+02	1.57606E+02	1.0228E+02	1.000000E+00	0.	0.
6	1.461909+01	1.13909E+03	1.64254E+02	6.59428E+02	1.2338E+02	1.000000E+00	0.	0.	
7	1.45001+02	1.02826E+02	1.57106E+02	6.87810E+02	1.0155E+02	1.000000E+00	0.	0.	
8	1.447871+01	3.81366E+03	1.75847E+02	6.71622E+02	1.0838E+02	1.000000E+00	0.	0.	
9	1.466661+01	3.14397E+09	1.80784E+02	6.83067E+02	1.0400E+02	9.99999E+01	3.19397E+09	2.00000E+02	3.72320E+03
10	1.473061+01	7.91261E+01	1.89063E+02	6.54775E+02	1.3028E+02	1.000000E+00	0.	0.	
11	1.470431+01	3.37495E+01	1.46498E+02	7.15733E+02	9.0128E+01	1.000000E+00	0.	0.	
12	1.470431+01	1.05662E+01	1.54176E+02	7.00719E+02	1.005178E+02	1.000000E+00	0.	0.	
13	1.461051+01	1.85664E+02	1.57882E+02	6.90866E+02	1.00332E+02	1.000000E+00	0.	0.	
14	1.466661+01	3.39368E+01	1.58429E+02	6.91593E+02	1.0470E+02	1.000000E+00	0.	0.	
15	1.085548E+01	8.621880E+02	1.10647E+03	4.32918E+02	2.8116E+02	1.000000E+00	0.	0.	
VOLUME									
1	1.444444+02								
2	1.27964E+03								
3	4.43259E+02								
4	1.74916E+03								
5	7.92259E+02								
6	2.589474E+04								
7	4.37413E+03								
8	9.02132E+04								
9	6.21127E+10								
10	1.55231E+03								
11	2.22616E+03								
12	5.08737E+02								
13	7.75929E+03								
14	1.485537E+03								
15	6.76285E+01								
HEAT TRAN									
1	RIGHT 1	HUE	HTU/HR/FT2	HTU/HR/FT2	HTU/HR/FT2	SURF TEMP (F)	Avg. Qual	POWR H2O (BTU/HR)	
2	RIGHT 6	1	4.22043E+00	9.03200E+04	5.00000E+00	1.0E-05E+02	1.00000E+00	5.44435E+03	
3	RIGHT 7	1	1.25901E+00	9.01244E+04	5.00000E+00	1.2E-01E+02	1.00000E+00	5.47013E+04	
4	RIGHT 8	1	5.5419E+00	9.04948E+04	5.00000E+00	1.0E-035E+02	1.00000E+00	1.49269E+05	
5	RIGHT 10	1	-2.24453E+01	9.00188E+04	5.00000E+00	1.0E-010E+02	1.00000E+00	-5.54846E+05	
6	RIGHT 15	9	-7.20755E+02	9.70165E+04	5.00000E+00	1.3E-030E+02	1.00000E+00	-9.67085E+07	

REFLAR 4/205 09/3/76 1.00 IMPELL. VEF 1.00  
 NIP MUNICIPAL TUES. ENV STUDY. STEAMLINE BREAK IN STEAM TUNNEL  
 1. P.D. TIME = 1.05

KELAR 4/205 09/3/76 1.00 IMPELL. VEF 1.00  
 NIP MUNICIPAL TUES. ENV STUDY. STEAMLINE BREAK IN STEAM TUNNEL  
 1. P.D. TIME = 1.05

JUNCTION NUMBER	CONNECTING VOLUMES	CHORE	JCT. FLOW (LB/SEC)	JCT. ENTH (BTU/LB)	JCT. SPVL (FT3/LB)	P R E S E T	S U R E S T	O I F F E R E N T I A L S	CONTRO 86/08/01	RES
						ELEV PSI	STAG PSI	ACCL 'SI	PUMP PSI	
1	1 TU	2	0.	1.57380E+02	1.67170E-02	5.96422E-02	7.29465E-07	0.	0.	0.
2	1 TU	7	0	5.05809E+01	1.57392E+02	1.44492E+01	1.62936E-02	7.44761E-03	-2.15614E-02	2.17283E-03
3	1 TU	6	0	-1.42626E+01	1.81239E+02	1.51115E+01	-6.11452E-02	5.52722E-03	4.90116E-03	-5.07163E-02
4	2 TU	3	0	3.79322E+02	1.57146E+02	1.44930E+01	-9.76297E-03	0.	-4.52016E-03	-1.42836E-02
5	2 TU	8	0	1.46028E+02	1.57134E+02	1.44932E+01	5.24299E-02	-1.72986E-02	-6.95016E-02	-1.43735E-02
6	2 TU	4	0	-3.19463E+02	1.57058E+02	1.45112E+01	2.58464E-02	0.	3.89916E-05	2.58836E-02
7	7 TU	5	0	1.20341E+03	1.57099E+02	1.44576E+01	6.10817E-02	-1.42601E-03	-1.91618E-02	3.44889E-02
8	3 TU	8	0	4.10218E+02	1.57503E+02	1.44919E+01	6.21929E-02	-1.72959E-02	-6.86935E-02	-3.79516E-03
9	6 TU	9	0	-1.1909E+03	1.80793E+02	1.46904E+01	-1.47388E-01	-1.28908E-02	3.22233E-01	1.61924E-01
10	5 TU	10	0	1.30210E+03	1.57596E+02	1.45117E+01	3.46959E-02	-1.72909E-02	-1.47818E-02	2.62023E-03
11	1 TU	6	0	-1.681245E+01	1.812195E+02	1.51115E+01	-6.11450E-02	5.63463E-03	5.04525E-03	-5.04525E-02
12	1 TU	8	0	6.93979E+00	1.57586E+02	1.44402E+01	1.39247E-01	-1.18971E-02	-1.46803E-04	1.17203E-01
13	13 TU	9	0	1.83022E+02	1.57867E+02	1.44400E+01	-7.02044E-03	-7.277921E-03	-3.27756E-02	-4.85782E-02
14	11 TU	12	0	1.49119E+00	1.46504E+02	1.39719E+01	5.22118E-06	4.90138E-05	-8.99631E-08	5.41450E-05
15	11 TU	12	0	-1.46818E+00	1.54170E+02	1.42714E+01	5.19381E-06	-5.10995E-05	7.32619E-08	-4.58324E-05
16	10 TU	11	0	2.31929E+00	1.89054E+02	1.52711E+01	2.34728E-02	5.44508E-04	-2.40238E-02	-6.43542E-06
17	1 TU	11	0	0.	1.89072E+02	1.67193E-02	2.34729E-02	4.74798E-05	0.	0.
18	10 TU	6	0	4.12686E+00	1.890622E+02	1.51115E+01	4.03433E-02	-3.44181E-03	1.10853E-02	4.79867E-12
19	10 TU	6	0	0.	1.89038E+02	1.67193E-02	4.05574E-02	-3.42740E-03	0.	0.
20	6 TU	13	0	0.	1.81272E+02	1.57184E-02	3.26156E-02	-1.51205E-03	0.	0.
21	6 TU	14	0	-6.45026E+01	1.58461E+02	1.51115E+02	1.24623E-02	-2.18980E-02	-1.52346E-02	-2.46705E-02
22	6 TU	8	0	2.04133E+02	1.81226E+02	1.51115E+01	1.71859E-01	-2.26270E-02	-1.22504E-01	2.67280E-02
23	10 TU	9	0	-1.01053E+02	1.80798E+02	1.44463E+02	1.33826E-02	-1.22616E-02	-7.55194E-03	-6.43096E-03
24	6 TU	8	0	4.24487E+03	1.81226E+02	1.51115E+01	1.71519E-01	-2.26270E-02	-9.42396E-02	5.46520E-02
25	10 TU	13	0	0.	1.89050E+02	1.67193E-02	7.31729E-02	-4.54744E-03	0.	0.
26	8 TU	9	1	6.37099E+03	1.75863E+02	1.48461E+01	-1.46101E-01	5.33367E-03	1.53371E+00	-1.68373E+00
27	8 TU	9	1	6.36481E+03	1.75828E+02	1.48461E+01	-1.46097E-01	-6.83085E-03	1.49114E+00	-1.65333E+00
28	8 TU	10	9	6.17399E+03	1.75863E+02	1.48461E+01	-1.46101E-01	5.33367E-03	1.53371E+00	-1.68373E+00
29	8 TU	9	1	6.06481E+03	1.75828E+02	1.48461E+01	-1.46093E-01	-6.83085E-03	1.49114E+00	-1.65333E+00
30	15 TU	8	0	3.43271E+03	1.10646E+02	4.16154E+00	-1.35499E-02	-4.2151E+00	-6.75250E-12	0.
31	0 TU	15	0	3.65000E+03	1.18936E+03	0.	0.	0.	0.	0.

100  
600

55-

RELAP4/MOD3 OUTPUT FOR 1.00 IMPELL VVER 1.00 THERMAL HYDRAULIC CODE CONTAINMENT  
NSP MONTFELLO TURB. DUG. INV STUDY, STEAMLINE BREAK IN STEAM TUNNEL

STANDARD TIME = 1.99  
ACTUAL TIME STEP NUMBER 10.  
TIME = .800000E+00 : C. LAST DT = .150565E-01 : F.C.

	INITIAL SYSTEM QUANTITIES	NORM PWR	PINCH POINT	HEAT REM (BTU/HRS)	ENGY LEAK (BTU)	MASS LEAK (LB)	ENGY AL. (BTU)	MASS BAL. (LB)	VOL. REAC (LB)	REAC SEC.	Liq. Mass (LB)
1	YOL, QINT NORMTUR	1.00000E+00	0.	0.	0.	0.	9.634	3.19397E+09	0.	0.	
2	YOL, PRES PSTA	1.61847E+01	2.69436E+00	1.56869E+02	6.76030E-02	9.87952E+01	1.0000	3E+00	0.	0.	
3	YOL, H2O	1.43205E+01	2.97753E+01	1.56635E+02	6.81467E-02	9.98100E+01	1.0000	3E+00	0.	0.	
4	YOL, T	1.43339E+01	1.3629E+01	1.56966E+02	6.81649E-02	1.00095E+02	1.0000	3E+00	0.	0.	
5	YOL, P	1.43040E+01	4.8002E+01	1.56616E+02	6.80901E-02	9.96200E+01	1.0000	3E+00	0.	0.	
6	YOL, V	1.42872E+01	1.37280E+01	1.56987E+02	6.79910E-02	9.97417E+01	1.0000	3E+00	0.	0.	
7	YOL, X	1.43639E+01	1.32439E+03	1.80511E+02	6.51148E-02	1.21014E+02	1.0000	0E+00	0.	0.	
8	YOL, TURB	1.41636E+01	1.01102E+02	1.56193E+02	6.76271E-02	9.79261E+01	1.000000E+00	0.	0.	0.	
9	YOL, PUMP	1.40848E+01	4.10443E+03	1.79234E+02	6.63058E-02	1.07689E+02	1.000000E+00	0.	0.	0.	
10	YOL, H2O	1.46661E+01	3.19397E+09	1.80784E+02	6.83067E-02	1.04000E+02	9.99999E-01	3.19397E+09	2.00000E+12	2.50524E+03	
11	YOL, TURB	1.47084E+01	7.40407E+01	1.84000E+02	6.54068E-02	1.30077E+02	1.000000E+00	0.	0.	0.	
12	YOL, PUMP	1.47163E+01	3.37564E+01	1.46504E+02	7.15765E-02	9.01273E+01	1.000000E+00	0.	0.	0.	
13	YOL, H2O	1.47104E+01	1.55650E+01	1.54176E+02	7.00763E-02	1.00008E+02	1.000000E+00	0.	0.	0.	
14	YOL, TURB	1.46429E+01	1.86930E+02	1.57703E+02	6.65014E-02	1.01412E+02	1.000000E+00	0.	0.	0.	
15	YOL, PUMP	1.46521E+01	3.54100E+01	1.58720E+02	6.91198E-02	1.04370E+02	1.000000E+00	0.	0.	0.	
16	YOL, H2O	1.43258E+01	8.24189E+02	1.13454E+03	4.26641E-02	2.83871E+02	1.000000E+00	0.	0.	0.	
	YOL, VOLUME										
	YOL, AIR MASS										
1		1.12231E+02									
2		1.26774E+03									
3		4.35981E+02									
4		1.73499E+03									
5		7.84109E+02									
6		2.55727E+04									
7		4.30075E+03									
8		6.87217E+04									
9		6.51117E+10									
10		1.55064E+03									
11		2.22627E+03									
12		5.08770E+02									
13		7.69075E+03									
14		1.48643E+03									
15		4.26105E+01									
	HEAT SLAB VOL	HEAT RAN MODE	SURF FLUX (BTU/HR/FT2)	CRT FLUX (BTU/HR/FT2)	H.T. COEF (BTU/HF2/F)	SURF TEMP (F)	Avg. Temp	Avg. Qual	POWR H2O (BTU/HR)		
1	RIGHT 1	1	2.44101E+01	9.01932E+04	5.00000E+00	1.04004E+02	1.000000E+00	0.	3.14890E+04		
2	RIGHT 6	1	1.01176E+01	9.02732E+04	5.00000E+00	1.25000E+02	1.000000E+00	0.	7.87173E+05		
3	RIGHT 7	1	2.46509E+01	9.05279E+04	5.00000E+00	1.04004E+02	1.000000E+00	0.	7.69992E+05		
4	RIGHT 8	1	-1.98213E+01	9.03180E+04	5.00000E+00	1.04011E+02	1.000000E+00	0.	4.64227E+05		
5	RIGHT 10	1	-2.33401E+01	9.03471E+04	5.00000E+00	1.30000E+02	1.000000E+00	0.	-3.24685E+03		
6	RIGHT 15	0	-7.31500E+02	9.64956E+04	5.00000E+00	1.37247E+02	1.000000E+00	0.	-2.54094E+07		

OK

50

WILAP4/HUS JY/03/76 1.00 INPELL VTR 1.00 WELAP4 THERMAL HYDRAULIC CODE  
WILAP4/HUS JY/03/76 1.00 MUNICIPAL BUILDING FIRE STUDY, STEAMLINE BREAK IN STEAM TUNNEL

TIME = 2.00

JUNCTION NUMBER	CONNECTING VOLUME	CHKE	JCT. FLOW	JCT. LINH	JCT. SPYL	P.R.E.S	SHRUE	D.L.F.	F.E.W.N	T.L.A.L	S.P.U.P.P.P.S.I
	Ld/SCEI	Ld/LB1	Ld/LB1	Ld/LB1	STAG P51	ACCL P51	FRIC P51	ELEV P51			
1	1 TU	2	0	0.	1.56616E+02	1.67070E-02	-1.20972E-01	-1.67110E-06	0.	0.	0.
2	1 TU	7	0	3.44492E+01	1.56811E+02	1.47627E+01	2.56268E-02	7.29112E-03	-3.49422E-02	-2.02426E-03	0.
3	1 TU	6	0	-1.27117E+01	1.80477E+02	1.53334E+02	-1.74833E-01	5.44528E-03	1.71088E-01	1.70036E-05	0.
4	1 TU	3	0	1.30048E+02	1.56615E+02	1.46586E+01	-1.70214E-02	0.	-1.09434E-03	-1.61157E-02	0.
5	1 TU	0	0	-8.17504E+00	1.77169E+02	1.45587E+01	8.82267E-03	-1.70717E-02	-4.14456E-03	-8.29083E-03	0.
6	1 TU	3	0	-8.30861E+01	1.26616E+02	1.456764E+01	2.42114E-02	0.	2.52718E-06	2.42139E-02	0.
7	1 TU	5	0	5.17627E+02	1.56386E+02	1.47627E+01	-1.20754E-01	-7.31373E-03	-5.13650E-03	1.33204E-01	0.
8	1 TU	6	0	1.16759E+02	1.56954E+02	1.46520E+01	2.58441E-02	-1.70736E-02	-1.35477E-02	-4.75730E-03	0.
9	6 TU	9	0	1.39479E+03	1.80793E+02	1.46775E+01	-3.31199E-01	-1.27153E-02	3.50203E-01	4.28031E-03	0.
10	5 TU	8	0	5.17765E+02	1.56974E+02	1.46877E+01	-1.70220E-02	-1.70625E-02	-4.18828E-03	-3.622728E-02	0.
11	1 TU	0	0	-1.15111E+01	1.80503E+02	1.53334E+01	-1.74829E-01	5.533454E-03	1.71016E-01	1.72205E-03	0.
12	1.5 TU	6	0	2.67370E+03	1.67758E+02	1.45728E+01	3.80773E-01	-2.16401E-02	-2.02691E-02	9.61637E-02	0.
13	1.5 TU	9	0	-1.44311E+03	1.80672E+02	1.46775E+01	-1.91777E-01	-7.22646E-03	1.83100E-01	-1.39034E-02	0.
14	1.5 TU	12	0	2.55556E+00	1.465110E+02	1.39711E+01	-3.37257E-05	4.699714E-05	-1.01202E-07	1.51448E-03	0.
15	1.1 TU	12	0	-1.84622E+00	1.54170E+02	1.42702E+01	-3.37398E-05	-5.10553E-05	1.21736E-07	-8.46734E-02	0.
16	1.0 TU	11	0	3.96936E-01	1.88991E+02	1.52863E+01	1.63357E-03	5.47900E-04	-4.16085E-03	-1.97938E-03	0.
17	1.0 TU	11	0	0.	1.46512E+02	1.57189E-02	1.63184E-03	-5.08418E-05	0.	0.	0.
18	1.0 TU	6	0	1.88994E+02	1.52863E+01	1.63357E-01	-3.19813E-03	-3.05155E-01	7.78180E-03	0.	0.
19	1.0 TU	6	0	0.	1.88995E+02	1.67189E-02	3.16449E-01	-3.40231E-03	0.	0.	0.
20	6 TU	13	0	0.	1.57805E+02	1.67113E-02	-8.06419E-02	-1.533377E-03	0.	0.	0.
<1	6 TU	14	0	0.	-2.42830E+02	1.44659E+02	1.50535E+01	-2.58400E-01	-2.17387E-02	2.03326E-01	3.18763E-03
22	6 TU	8	1	1.20438E+02	1.80484E+02	1.53334E+01	6.13018E-02	-2.23084E-02	-5.77496E-02	-1.87561E-02	0.
23	1.4 TU	9	0	-2.30663E+02	1.80796E+02	1.46775E+01	-1.21503E-02	-1.22454E-02	2.35452E-02	-8.50521E-04	0.
24	6 TU	8	0	2.89791E+03	1.80484E+02	1.53334E+01	6.10881E-02	-2.23084E-02	-5.90909E-02	-2.03112E-02	0.
<5	10 TU	13	0	0.	1.88988E+02	1.67169E-02	2.35807E-01	-4.54291E-03	0.	0.	0.
<6	6 TU	9	1	6.381595E+03	1.79252E+02	1.50535E+01	-3.31936E-01	5.24573E-03	2.05072E+00	-2.37975E+00	0.
<7	8 TU	9	1	5.7638E+03	1.79217E+02	1.50535E+01	-3.31928E-01	-6.74290E-03	1.99393E+00	-2.33495E+00	0.
<8	3 TU	9	1	6.38195E+03	1.79252E+02	1.50535E+01	-3.31936E-01	5.24573E-03	2.05072E+00	-2.37975E+00	0.
<9	6 TU	9	1	5.76438E+03	1.79217E+02	1.50535E+01	-3.31979E-01	-6.74290E-03	1.99393E+00	-2.33495E+00	0.
<10	1.5 TU	9	0	3.84749E+03	2.33567E+01	4.09225E+00	-1.33194E-02	-4.12850E+00	-8.95609E-02	0.	0.
31	0 TU	15	0	3.65000E+03	1.18974E+03	0.	0.	0.	0.	0.	0.

E22  
10/16/66

5x

WILAPY/MOD 04/03/76 (2) INPELL VER 1.00 WELAPY THERMAL HYDRAULIC CODE  
NSP MULTICELL TUBE, HLUG. INV STUDY. STREAMLINE BREAK IN STEAM TUNNEL

CONTAINMENT  
26/08/09

TIME LIMIT = 2.00  
STANDARD TIME STEP = 1.00  
ACTUAL TIME STEP NUMBER = 55.  
TIME = 400000E+00 SEC.  
LAST UT = 5.00000E-11 SEC.

TEMP	HEAT RATE	ENERGY LEAK	MASS LEAK	TOI. STAC	REAC. T
SYSTEM	NUHM	BTU/HR	BTU/HR	TBL0	SEC.
1.00000E+00	0.	0.	0.	3.19397E+09	0.
Avg. Pres	F0F. MASS	Avg. Enth	Avg. Dens	Avg. Temp	Avg. Qual
PSIA	FLUID H2O	(BTU/LB)	(LB/FT3)	(F)	(LB)
1.41102E+01	2.1624E+00	1.50707E+02	6.72867E-02	9.81809E+01	1.00000E+00
1.41202E+01	2.45179E+01	1.56196E+02	6.76368E-02	9.81234E+01	1.00000E+00
1.41302E+01	1.50509E+02	6.76108E-02	9.82684E+01	1.00000E+00	0.
1.41402E+01	1.50544E+01	6.76316E-02	9.82226E+01	1.00000E+00	0.
1.41502E+01	1.50579E+01	6.75190E-02	9.81719E+01	1.00000E+00	0.
1.41602E+01	1.50614E+03	1.80012E+02	6.45728E-02	1.19079E+02	1.00000E+00
1.41702E+01	1.50638E+02	1.56060E+02	6.74496E-02	9.73800E+01	1.00000E+00
1.41802E+01	6.39194E+03	1.82680E+02	6.54886E-02	1.07137E+02	1.00000E+00
1.41902E+01	6.19397E+09	1.80784E+02	6.83067E-02	9.39999E-01	2.00000E+02
1.42002E+01	7.04683E+01	1.08932E+02	6.53318E-02	1.29614E+02	1.00000E+00
1.42102E+01	3.37479E+01	1.46497E+02	7.15696E-02	9.01037E+01	1.00000E+00
1.42202E+01	1.55037E+01	1.54168E+02	7.00695E-02	1.00060E+02	1.00000E+00
1.42302E+01	1.30806E+02	1.57799E+02	6.77767E-02	9.92581E+01	1.00000E+00
1.42402E+01	3.09949E+01	1.794075E+02	6.90576E-02	1.04207E+02	1.00000E+00
1.42502E+01	8.231715E+02	1.154086E+03	8.16302E+02	2.086092E+02	1.00000E+00
AIR MASS					0.
1	1.11609E+02				
2	1.25829E+03				
3	9.324841E+02				
4	1.724211E+03				
5	7.88671E+02				
6	2.53603E+04				
7	4.28945E+03				
8	8.729211E+04				
9	6.521277E+04				
10	1.54891E+03				
11	2.22606E+03				
12	5.08721E+02				
13	7.60246E+03				
14	1.48227E+03				
15	2.61562E+01				
AIR TEMP					
1	2.79342E+01	9.00775E+04	1.04003E+02	1.00000E+00	3.60351E+04
2	2.50497E+01	9.00563E+04	1.24999E+02	1.00000E+00	1.08662E+06
3	3.25519E+01	9.01869E+04	5.00000E+00	1.04002E+02	8.74833E+05
4	-1.04502E+01	9.00171E+04	5.00000E+00	1.04012E+02	-4.38078E+05
5	2.24872E-01	9.005446E+04	5.00000E+00	1.30000E+02	1.25141E+03
6	-1.37337E+02	9.69772E+04	5.00000E+00	1.37590E+02	-2.56421E+07

VOLUME

HEAT SLAB	VOL	HEAT TRAN	SURF FLUX	H.T. COEF	SURF TEMP	Avg. Qual	PWR H2O
NUMBER	NUM	ROUTE	BTU/HR/FT2	BTU/H/FT2/F	(F)		(BTU/HR)
1	RIGHT	1	2.79342E+01	9.00775E+04	1.04003E+02	1.00000E+00	3.60351E+04
2	RIGHT	1	2.50497E+01	9.00563E+04	1.24999E+02	1.00000E+00	1.08662E+06
3	RIGHT	1	3.25519E+01	9.01869E+04	5.00000E+00	1.04002E+02	8.74833E+05
4	RIGHT	1	-1.04502E+01	9.00171E+04	5.00000E+00	1.04012E+02	-4.38078E+05
5	RIGHT	1	2.24872E-01	9.005446E+04	5.00000E+00	1.30000E+02	1.25141E+03
6	RIGHT	1	-1.37337E+02	9.69772E+04	5.00000E+00	1.37590E+02	-2.56421E+07

CONTROL  
86/08/09

CONTAINMENT  
STEAM TUNNEL

RELAPS THERMAL HYDRAULIC CODE  
IMPULSIVE STUDY, STEAMLINE BREAK IN STEAM TUNNEL

IMPULSIVE STUDY, HLBRK. & HV STUDY.

TIME STEP NUMBER 20. ACTUAL TIME STEP NUMBER 57. TIME = .10000E+01 SEC. LAST DT = .50000E-01 SEC.

WALL UNIT	Avg. PRES	TUF. MASS	Avg. ENTH	Avg. DENS	Avg. TEMP	Avg. UAL	BUDG. MA.S	MIXT LBL	Liq. MASS
WALL R	PSIA	LB/LB	BTU/LB	BTU/LB	(F)	(LB)	MASS BR.	MASS BR.	LIQ. MASS
	1.40553E+01	2.72359E+00	1.57087E+02	6.70721E-02	9.79362E+01	1.0000E+00	0.	0.	0.
	1.40245E+01	2.3301E+01	1.55796E+02	6.71382E-02	9.64866E+01	1.0000E+00	0.	0.	0.
	1.40245E+01	1.01940E+01	1.56095E+02	6.71115E-02	9.66166E+01	1.0000E+00	0.	0.	0.
	1.40237E+01	8.02264E+01	1.55847E+02	6.71326E-02	9.64804E+01	1.0000E+00	0.	0.	0.
	1.40248E+01	1.04709E+01	1.56243E+02	6.70917E-02	9.67521E+01	1.0000E+00	0.	0.	0.
	1.40505E+01	1.10576E+03	1.79566E+02	6.6974E-02	1.17374E+02	1.0000E+00	0.	0.	0.
	1.40625E+01	1.00578E+02	1.55928E+02	6.72754E-02	9.68409E+01	1.0000E+00	0.	0.	0.
	1.40013E+01	9.07613E+03	1.86180E+02	6.47153E-02	1.05724E+02	1.0000E+00	0.	0.	0.
	1.46660E+01	3.19397E+09	1.80784E+02	6.03067E-02	1.04000E+02	9.9999E-01	3.19397E+09	2.00000E+02	1.88076E+03
	1.46595E+01	7.88386E+01	1.88850E+02	6.52521E-02	1.29514E+02	1.0000E+00	0.	0.	0.
	1.47058E+01	3.37469E+01	1.46491E+02	7.15609E-02	9.00791E+01	1.0000E+00	0.	0.	0.
	1.47058E+01	1.35614E+01	1.54158E+02	7.00619E-02	1.000030E+02	1.0000E+00	0.	0.	0.
	1.40903E+01	1.96032E+02	1.58481E+02	6.71977E-02	9.77683E+01	1.0000E+00	0.	0.	0.
	1.46258E+01	3.76643E+01	1.59488E+02	6.89978E-02	1.04062E+02	1.0000E+00	0.	0.	0.
	1.70940E+01	8.20720E+02	1.16655E+03	4.11882E-02	2.87914E+02	1.0000E+00	0.	0.	0.
AIR MASS									
	1	1.112294E+02							
	2	1.24901E+03							
	3	4.29272E+02							
	4	1.71059E+03							
	5	7.73747E+02							
	6	2.51742E+04							
	7	4.27838E+03							
	8	8.59253E+04							
	9	6.51127E+01							
	10	1.54698E+03							
	11	2.22579E+03							
	12	5.08668E+02							
	13	7.53171E+03							
	14	1.48029E+03							
	15	1.61020E+01							

WALL

HEAT TRANS	CRIT FLUX	H.T. COEF	SURF TEMP	Avg. JUAL	POWR H (I)
NUDE	BTU/HR/FT2)	BTU/HR/FT2)	(BTU/H/FT2/F)	(BTU/H/FT2)	(BTUH)
1	2.84922E+01	9.00263E+04	5.00000E+00	1.04001E+02	3.67553E+04
2	1	3.39375E+01	9.00435E+04	1.24997E+02	1.47454E+05
3	1	3.38422E+01	9.00727E+04	1.04000E+02	1.00000E+00
4	1	-1.44744E+01	9.00164E+04	1.04013E+02	9.095011E+05
5	1	1.66622E+00	5.00000E+00	1.30000E+02	1.00000E+00
6	1	-7.45501E+02	5.00000E+00	1.37937E+02	-2.58951E+07

EZ4  
OF  
SG

RELAP4/MOD3 09/03/76 (2) IMPELL VERR 1.00 RELAP4 THERMAL HYDRAULIC CODE  
NSP NUCLEAR TURB. BLDG. ENR STUDY, STEAMLINE BREAK IN STEAM TUNNEL

CONTAINMENT  
08/08/09

LPH TIME = 2.023

JUNCTION NUMBER	CURRENT	CURRENTING	CHOKED	JCT. FLOW	JCT. ENTH	JCT. SPVL	P R E S TAG PSI	S U R E S E L E V PSI	O I F F F RIC PSI	E R T N I A L S ACCL PSI	PUMP PSI
1	1.10	2	0	4	0.	1.57088E+02	1.67039E-02	-3.95828E-03	-6.15727E-07	0.	0.
2	1.10	7	0	4	8.94550E+00	1.57099E+02	1.48791E+01	-2.55160E-03	7.24218E-03	-3.75435E-03	-2.06377E-03
3	1.10	6	0	4	-2.24652E+00	1.79552E+02	1.55448E+01	-2.92717E-02	5.37284E-03	3.72201E-02	1.33213E-02
4	1.10	3	0	4	1.52099E+02	1.55796E+02	1.48400E+01	8.86281E-04	0.	-6.83632E-04	2.02649E-04
5	1.10	2	0	4	7.89185E+01	1.55784E+02	1.48400E+01	2.34435E-02	-1.67639E-02	-6.59899E-03	-1.91941E-03
6	1.10	9	0	4	7.89185E+01	1.55784E+02	1.48400E+01	-3.57671E-03	0.	5.36356E-06	-3.57136E-03
7	1.10	5	0	4	1.70264E+02	1.55920E+02	1.48369E+01	1.02166E-02	-7.24874E-03	-8.10277E-03	2.88673E-03
8	1.10	9	0	4	1.83998E+02	1.56083E+02	1.48467E+01	2.25572E-02	-1.67619E-02	-8.51910E-03	-2.72380E-03
9	1.10	8	0	4	-2.15517E+03	1.80793E+02	1.46699E+01	-5.92809E-01	-1.24625E-02	6.09275E-01	4.00300E-03
10	1.10	9	0	4	2.12129E+02	1.56231E+02	1.48572E+01	1.48202E-02	-1.67587E-02	-1.40572E-04	-2.07912E-03
11	1.10	6	0	4	-1.99696E+00	1.79558E+02	1.55448E+01	-2.92706E-02	5.47477E-03	3.70795E-02	1.32836E-02
12	1.10	9	0	4	1.811782E+03	1.58461E+02	1.48201E+01	7.68922E-02	-2.12365E-02	-4.21648E-02	1.34904E-02
13	1.10	9	0	4	-3.20150E+03	1.80872E+02	1.46699E+01	-5.11856E-01	-7.13040E-03	5.13368E-01	-5.61854E-03
14	1.10	12	0	4	2.16449E+00	1.56744E+02	1.39732E+01	6.76242E-06	4.89434E-05	-1.03051E-07	5.56328E-05
15	1.10	12	0	4	-2.76474E+00	1.584152E+02	1.42723E+01	6.80237E-06	-5.10261E-05	2.51335E-07	-4.39724E-05
16	1.10	11	0	4	-3.101814E+00	1.46482E+02	1.39732E+01	-3.44012E-02	5.53374E-04	3.48019E-02	-9.54073E-04
17	1.10	11	0	4	0.	1.46500E+02	1.67179E-02	-3.44032E-02	-5.63910E-05	0.	0.
18	1.10	0	0	4	2.4233dE+01	1.888849E+02	1.53154E+01	5.50678E-01	-3.35722E-03	-5.43684E-01	3.633484E-03
19	1.10	6	0	4	0.	1.888452E+02	1.67179E-02	5.50731E-01	-3.37729E-03	0.	0.
20	1.10	13	0	4	0.	1.58509E+02	1.67046E+02	-3.74954E-02	-1.46701E-03	0.	0.
21	1.10	14	0	4	-3.37251E+02	1.59520E+02	1.44870E+01	-5.09887E-01	-2.15888E-02	5.31462E-01	-1.37738E-05
22	1.10	8	0	4	9.75112E+01	1.79539E+02	1.55448E+01	4.74878E-02	-2.19232E-02	-2.98421E-02	-3.87746E-03
23	1.10	9	0	4	-3.24155E+02	1.80798E+02	1.46699E+01	-3.41949E-02	-1.22279E-02	4.61263E-02	-2.96528E-04
24	1.10	8	0	4	2.16837E+03	1.79539E+02	1.55448E+01	4.73795E-02	-2.19232E-02	-2.99974E-02	-4.54124E-03
25	1.10	13	0	4	0.	1.88837E+02	1.67179E-02	5.13236E-01	-5.53428E-03	0.	0.
26	1.10	9	1	4	5.94158E+03	1.86197E+02	1.53624E+01	-5.91652E-01	5.11911E-03	1.19060E-01	-1.07394E-01
27	1.10	9	1	4	5.02073E+03	1.86162E+02	1.53624E+01	-5.91643E-01	-6.61628E-03	9.35100E-02	-9.35808E-01
28	1.10	9	1	4	5.94158E+03	1.86197E+02	1.53624E+01	-5.91652E-01	5.11911E-03	1.19060E-01	-1.07394E-01
29	1.10	9	1	4	5.62073E+03	1.86162E+02	1.53624E+01	-5.91643E-01	-6.61628E-03	9.35100E-02	-9.35808E-01
30	1.10	6	0	4	3.77206E+03	2.41018E+01	4.06756E+00	-1.30212E-02	-4.09937E+00	-4.48309E-02	0.
31	1.10	15	0	4	3.65000E+03	1.19050E+03	0.	0.	0.	0.	0.

625  
OF  
6

100

RELAP4/7 04/03/76 ( ) IMPLL VER 1.00 RELAP4 THERMAL HYDRAULIC CODE CONTAINMENT  
432' AUSTELL TUNNEL HDG. ENV STUDY, STEAMLINE BREAK IN STEAM TUNNEL

CPU TIME = 2.24

TIME CPU TOTAL TIME = 2.26 SEC

SUB-CRITICAL NAME	CPU TIME (SEC)	PERCENT	NO. OF CALLS
MAL4	0.00	0.00	1
TRPJT	*.21	9.29	1
TRZ4	*.07	2.12	1
DAI	*.56	24.73	58
DLT	*.33	15.47	21
FLCWH	*.18	7.92	57
TSI	*.02	.66	57
PKT4	*.30	13.27	59
PUR4S	*.00	*.09	53
SLIGHT	*.16	7.21	57
NITE	*.47	20.64	57

#### TIME STEP CONTROL SUMMARY

NUMBER OF TIMES TEST CONTROLLED TIME STEP	TIME V--LQ N: 55							
UT	LIMIT	PRESSURE CH.	ZERO FLOW CROSSING	MASS CH. /VOLUME	ENERGY CH. /VOLUME	MASS VOL. FLOW	SAT. LINE CROSSINGS	TIME V--LQ N: 55
3	0	1.5	0	0	0	0	0	0

#### VOLUMES CONTROLLING PRESSURE CHANGE MINIMUM (VOLUME INDEX TIMES CONTROLLING)

1	3	0	3	0	4	2	5	0	6	0	7	3	0	1	2	0	10	0
11	0	12	3	1.3	1	14	0	15	0									

#### JUNCTIONS CONTROLLING FLOW CROSSING MINIMUM (JUNCTION INDEX TIMES CONTROLLING)

1	0	2	0	3	0	4	0	5	0	6	0	7	0	6	0	9	0	10	0
11	0	12	0	1.1	0	14	0	15	0	16	0	17	0	16	0	19	0	20	0
21	0	22	0	2.1	0	24	0	25	0	26	0	27	0	26	0	29	0	30	0
31	0																		

E26  
6/25/76