Attachment
Calculation SMNH-94051

Calculation Cover Sheet

Southern Company Services

	Calculation Number SMNH - 94051
Project Hatch, Units 1 and 2	Discipline Mech/Nuclear
Objective Assess the temperature response to a leak in the main steam lines.	REA Number HT 94621

Subject/Title

Turbine Building Leak Detection

Design Engineer's Signature	Date	Last Page Number
J. N. McLeod *James N. McLeod*	1/18/95	145

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Safety Related	■ Yes ☐ No	Nonsafety-Related That Could Impact Safety-Related	☐ Yes ■ No

Record of Revisions

Rev. No	Description	Originator/ Date	Reviewer/ Date	Proj. Engr. Date
0	For Approval	JNM / 1-18-95	DJC / 1-24-95	SRS / 1-30-95

Notes:

Project Hatch 1 and 2	Calculation Number SMNH 94 051
Subject/Title Turbine Building Leak Detection	Sheet 1 of 145

Purpose:

The purpose of this calculation is to estimate the temperature rise which occurs in the main steam line area of the turbine building when a design basis steam leak occurs.

Criteria:

Reference 1 states that the area temperature monitoring instrumentation Allowable Value is chosen to detect a leak equivalent to between 1% and 10% of rated steam flow. The unit 2 FSAR (Reference 15), Section 7.3 states "The main steam line space temperature detection system is designed to detect leaks of from 1 to 10 percent of rated steam flow." This statement has been in the FSAR since the original issuance of the operating license. While this paragraph does not specifically state it applies to the turbine building spaces, it is reasonable to conclude that the leakage criterion for the turbine building would not be more severe than that for the reactor building.

The unit 2 FSAR states in section 5.2 that the saturated steam leakage from a critical crack (e.g. a crack which will not propagate into a full pipe rupture) is 14.6 lbm/sec/in^2 at 1000 psig. For a 24 inch line that section states that the length of a critical crack is 34.8 in for steam service with a crack displacement of 0.1 to 0.2 inches. This would result in a minimum crack flow area of about (0.1)(34.8)/2 = 1.74 in^2, or a flow of (1.74)(14.6) = 25.4 lbm/sec. This flow would be representative of a crack which opened in a diamond shape with the 0.1 inch displacement occurring only at the center of the crack. For a 0.2 inch displacement crack with displacement occurring essentially across the length of the crack, the flow area would be (0.2)(34.8) = 6.96 in^2. The flow from such a crack would be (6.96)(14.6) = 101.6 lbm/sec

The unit 1 FSAR states in section 4.10 that the saturated steam leakage from a critical crack is 14.0 lbm/sec/in^2 at 1000 psig. For a 24 inch line that section states that the length of a critical crack is 34.8 in. for steam service with a crack displacement of 0.1 to 0.2 inches. This would result in a minimum crack flow area of (0.1)(34.8)/2 = 1.74 in^2, or a flow of (1.74)(14.0) = 24.4 lbm/sec. This flow would be representative of a crack which opened in a diamond shape with the 0.1 inch displacement occurring only at the center of the crack. For a 0.2 inch displacement crack with displacement occurring essentially across the length of the crack, the flow area would be (0.2)(34.8) = 6.96 in^2. The flow from such a crack would be (6.96)(14.0) = 97.4 lbm/sec.

A 1% main steam leak corresponds to a crack flow of (0.01)(10.044E06) = 100,044 lbm/hr or 27.9 lbm/sec for unit 1 (slightly higher for unit 2). The cracks addressed in the FSARs are for schedule 80 carbon steel pipe. Since the minimum flows from the critical cracks addressed in the FSAR are only slightly less than 1% of main steam flow under the most severe assumptions regarding crack geometry and far exceeds 1% of main steam flow under other assumptions, it is concluded that a leak of 1% of unit 1 main steam flow at the location in the condenser bay at which it will be most difficult for the instrumentation to detect the leak is appropriate for this analysis.

Conclusions:

The temperature in the turbine building would reach at least the temperatures shown in the figures on pages 7 through 11 under the leakage conditions applicable to each figure.

Major Equations:

Equations used in the analysis are internal to the GOTHIC code. Reference 11 contains an explanation of the internal GOTHIC solver equations.

Methodology:

This analysis was performed using the GOTHIC computer code run on a Dell 466/L desktop computer. GOTHIC was developed under EPRI contract from the older NRC code, FATHOMS. GOTHIC has been developed under a fully qualified quality assurance program and has undergone extensive peer review. The code has been validated for safety related applications at Southern Company Services as documented in reference 10. The test cases have been executed on the machine used in this calculation and found to perform identically to those run in the validation cases.

Copies of the directory listings for the C:\GOTHIC\BIN\ and C:\GOTHIC\LIB\ directories (containing the GOTHIC executable and library files, respectively) are included. The executable and library files (except for the zinc material file) utilized in this analysis have been compared to those in reference 10 and found to be identical.

Assumptions:

The following generally applicable assumptions apply to the analysis. Additional assumptions regarding specific data are included as they occur in the analysis.

1. Heat load data from reference 12 were used in the analysis. The total heat load from reference 12 was apportioned among the cells of the subdivided volume in proportion to the length of steam piping in the cells. It is assumed that the original data accurately represents the passive heat load in the space and that this distribution among the cells is appropriate.

2. Steam lines are assumed to be three feet wide when their insulation is included.

3. Heat sinks in the model are limited to the building concrete. Omission of the other heat sink materials (such as structural steel) will have little effect on a flow driven problem such as this one. In any event, the inclusion of the other materials would only affect the rate of temperature rise and would not affect the total temperature increase for a given steam leak.

4. GOTHIC's internal material properties were used for the heat sink material.

Assumptions (continued):

5. In order to assure a conservative analysis, the calculations were run under "winter" temperature conditions. Data from unit 2 for summer and autumn conditions were available (references 13 and 14, attachments A and B). The summer data showed an average temperature of 168.5^{O}F; the autumn average was 151.6^{O}F. (See "Condenser Bay Temperature" spreadsheet.) No direct winter measurements were available, so a value for the winter average temperature was obtained by assuming that the variation of inside average temperature was linear with outside temperature. A set of boundary temperatures was then selected to yield equilibrium temperature prior to the leak which was consistent with the projected winter average in the cells containing the instrumentation. This was assumed applicable to both units even though the data were available for only unit 2.

Body of Calculation:

Model Description:

The computational model used in this analysis is illustrated in figures 1 through 4. The geometry was developed from references 2 through 6. The model consists of the open space at the northeast corner of the unit 2 turbine building. The same geometric model was applied to both units since unit 1 is essentially a mirror image of unit 2. GOTHIC's capability to automatically subdivide large volumes into smaller calculational nodes was used to break the computational volume into smaller computational cells. Cell boundaries were placed such that the vertical planes divided the space at major building features such as the mezzanine edge. Around the steam lines the vertical cell boundaries were placed such that only two steam lines are within a single cell. Horizontal boundaries above the mezzanine were placed at four foot intervals. This approximates the actual plant design in which the space below the lines is clear, the next level includes the steam lines and the space above the lines includes the temperature detectors.

Detection of the leak depends upon the temperature rising in the cell immediately above the leak. The presence of the large diameter steam lines and their insulation restricts the ability of the heated air and water vapor to rise up into the detector volume. This vertical flow restriction by the steam lines is modeled through use of GOTHIC's variation tables. Level 4 of the model is at the level of the steam lines. The flow area at that level is reduced by the area of the steam lines plus their insulation. Horizontal flow restriction is not modeled. This is conservative since any horizontal restriction of flow will tend to raise the local temperature through restriction of horizontal flow which will reduce the removal of heated gas from the cell.

Model Description (continued):

Areas of the turbine building adjacent to the model space are approximated through the use of pressure boundary conditions. Pressures associated with the boundary conditions are adjusted for the static head of air to avoid excessive induced flows at the boundary of the problem. The pressure boundary conditions were developed in an early version of the problem model which used 120°F boundary condition temperatures. This is not significant in the problem because the relative pressures of the boundary conditions are not significantly affected by temperature.

Boundary conditions along the two easternmost rows of cells are attached to the model by flow pathways which have been developed to approximate the flow restrictions presented by the presence of the vertical feedwater heaters and building columns. Other boundary condition flow paths are unrestricted. This has the effect of reasonably modeling the eastern side of the model, but will yield conservatively low temperatures for the western cells. This effect occurs because the insertion of the flow transient into the leak cells creates inlet flows at the boundary condition temperatures for those cells with unrestricted boundaries.

The steam leak is modeled as two separate leaks, one directed downward in the affected channel at level 4 and the other directed upward in the affected channel at level 3. It was necessary to model the leak in this manner to avoid insertion of excessive momentum terms into the problem. GOTHIC analyzes momentum in a "momentum cell." A vertical momentum cell consists of the top half of a lower cell and the bottom half of the cell above.

When equal and opposite flows are inserted into the upper and lower components of the momentum cell the net effect is to cancel out all momentum and insert the steam flow isotropically. Insertion of the leakage flow into the problem in this manner is the equivalent of placing the leak at the bottom of the pipe in the selected cell.

Of major interest in the determination of the operability requirements for the instruments is the placement of the leak. The "worst case" leak has been taken as occurring in cell 119. That location corresponds to the inlet elbow on the southernmost steam line. This location was chosen for the following reasons:

a. A leak occurring at this location will be close to the pressure boundary condition and will thus lose much of the injected energy to the boundary condition.

b. Preliminary runs showed that any leak which occurred on the mezzanine areas would be easily detected, even at flow rates substantially below the design basis value of 1% of main steam flow. Thus, placement of the design basis leak over the floor would not present the maximum challenge to the detection instruments. Although cell 119 represents the most difficult location for leak detection, the runs for leaks below cell 113 and on the mezzanine are presented for completeness.

c. Examination of the placement of the detection instruments shows that there are fewer instruments in the cell associated with the inlet elbow. This is an artifact of the geometry of the steam line routing and the instrument placement on the lines.

Model Description (continued):

d. The east side of the space was chosen as worst case over the west side because of the presence of the large turbine stop valves, turbine inlet and extraction piping and high pressure turbine on the west side of the analysis space. The model is not designed to accurately model a leak on the west side of the space. Further, modeling the west side of the space would involve a significant effort due to the complexity of the structures on that side. Thus, the west side is included in the model only as an open space to permit a reasonable evaluation of conditions on the east side and mezzanine spaces.

The detailed development of the control volumes, flow pathways, boundary conditions, and heat sinks is included on the following pages.

Individual Model Descriptions:

Filename: DB19_BCS (Unit 2)

This is the unit 2 design basis analysis with the leak occurring in the worst case location (cell 119). The main steam lines enter the turbine building from the east and extend into the building for varying distances before turning north and entering the control building portion of the condenser bay. This leak location corresponds to the point at which the southernmost line turns north. At that point it is extended off the mezzanine floor and is thus least likely to produce a sufficient temperature rise to reach the detectability setpoint for the instrument.

Filename: DB13_BCS (Unit 2)

This file is identical to DB19_BCS except that the leak is located in cell 113. This places the leak over the floor atop the east cableway.

Filename: DBAS122 (Unit 2)

This file is identical to DB19_BCS except that the leak is located in cell 122. This places the leak over the mezzanine. In this model the flow paths from the eastern cells to the boundary conditions are modeled as unobstructed.

Filename: DB19U1BC (Unit 1)

This is the design basis analysis with the leak occurring in the worst case location (cell 119) for Unit 1. Unit 1 differs from unit 2 in that it contains HVAC registers on the mezzanine. The only difference in this model and that for DB19_BCS is the addition of flow boundary conditions to represent these registers.

Individual Model Descriptions (continued):

Filename: DB13U1BC (Unit 1)

This file is identical to DB19U1BC except that the leak is located in cell 113. This models the unit 1 HVAC effect for the cell 113 leak.

Identified Conservatisms in the Model:

1. Any energy which flows out of the model into the boundary conditions is lost. In the actual turbine building, this energy would heat the adjacent space air and components. That energy essentially has nowhere to go except to eventually return to the problem space as higher temperature air. Thus, in the real space a leak would cause the adjacent turbine spaces to heat up. This would result in higher temperatures in these adjacent spaces which would eventually contribute to the temperature rise in the space above the leak. Similarly, as the leakage-induced flows exit the model space, the mass is made up by pulling air into the model from the boundary conditions. Since this air is at a constant temperature and humidity the effect is to insert artificial cooling into the model.

2. The results of this analysis are based upon the results obtained for a leak which occurs in the small portion of the steam lines which is not above the mezzanine. Any leak which occurs above the mezzanine will have a significantly greater effect than this worst case condition.

3. This analysis was based upon winter temperatures in the condenser bay. The mild climate in southeast Georgia produces cold winter conditions only a few days each year.

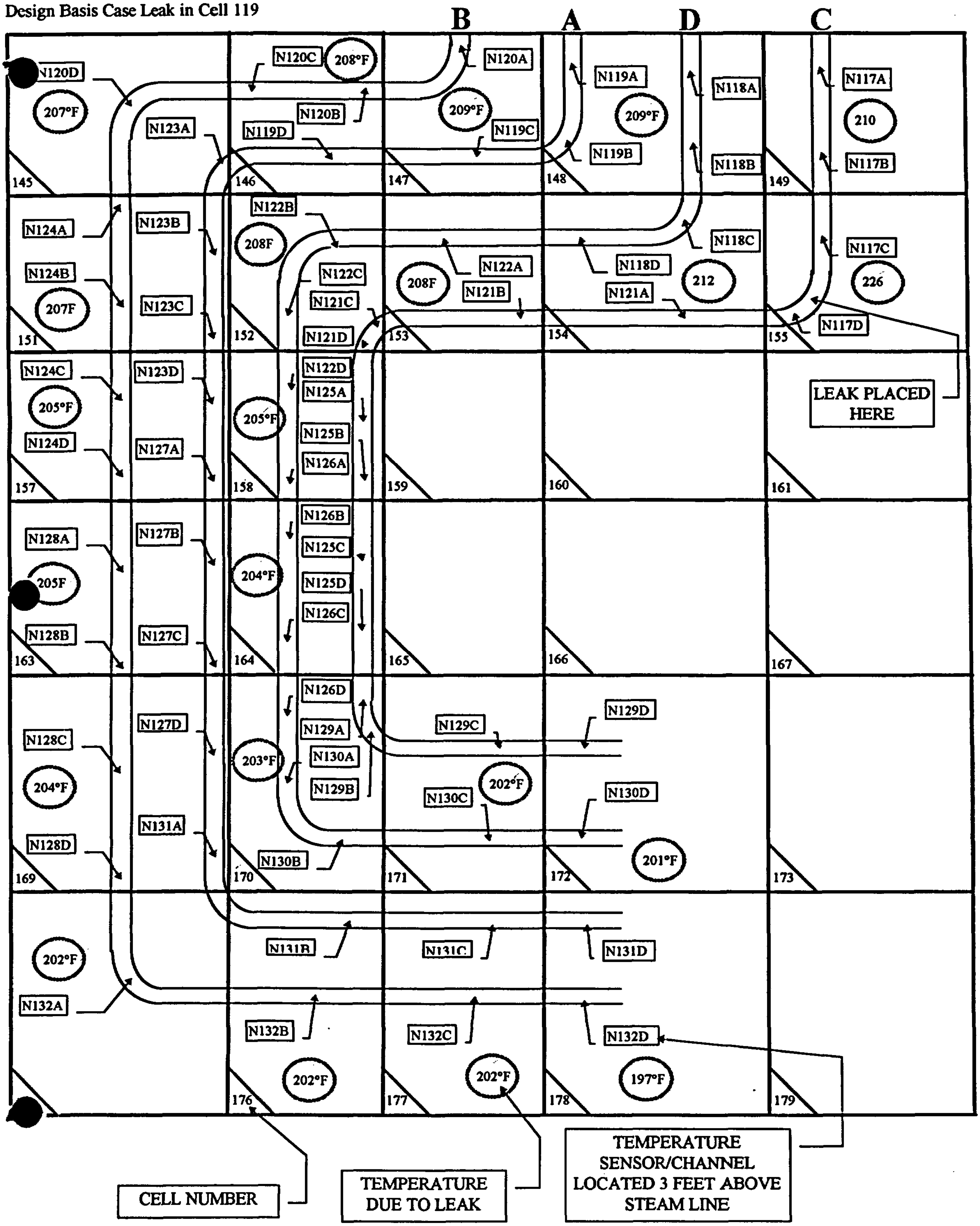
4. As described in the Assumptions section above, the boundary conditions were set up to achieve an average temperature of 142.3^{o}F in the cells of interest. The actual model yielded an average temperature of 139.6^{o}F. Thus, the model is based upon conditions slightly cooler than the projected conditions and is thus slightly conservative in its boundary conditions.

Results:

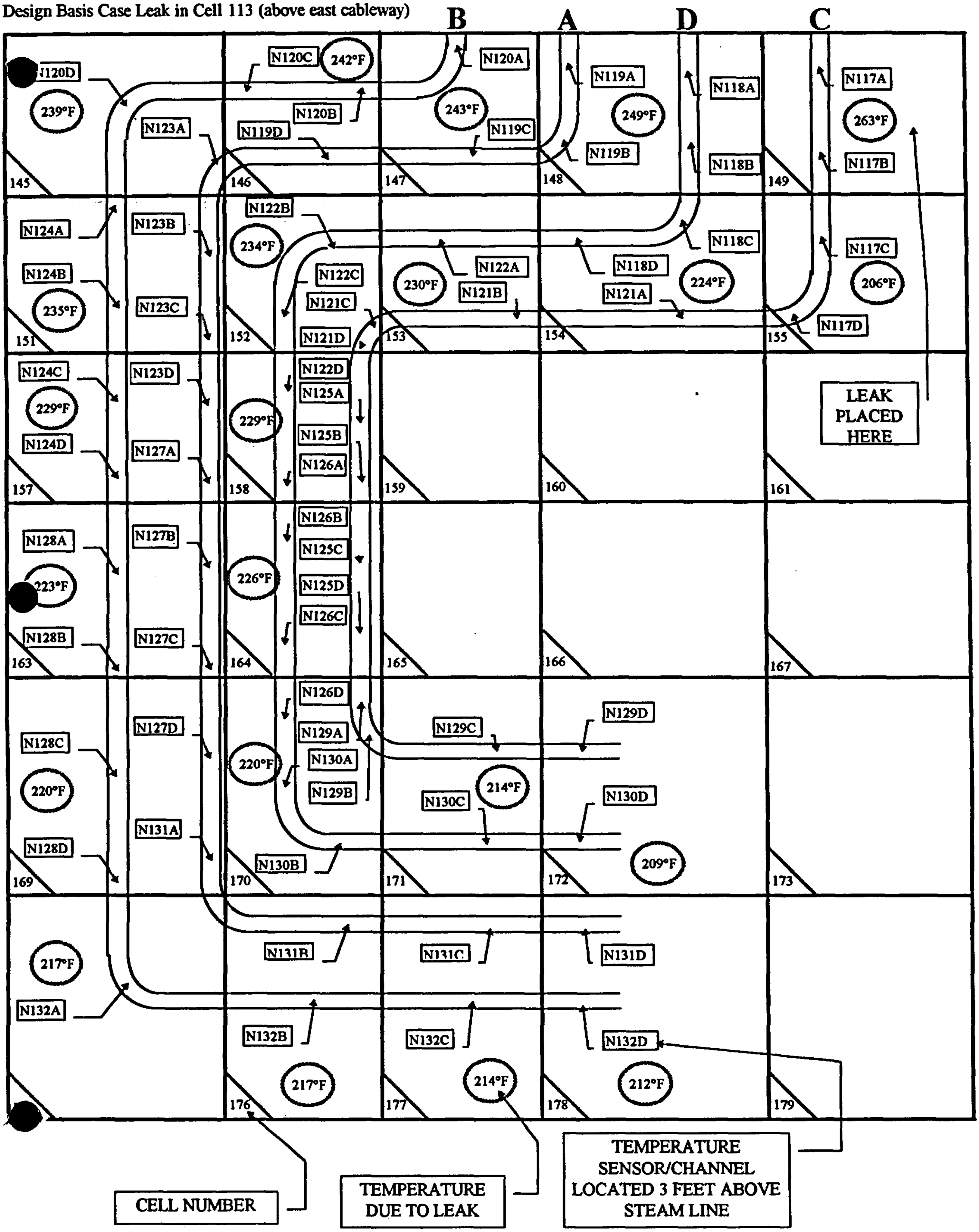
Detailed results of each of the analysis are presented graphically beginning on page 62. Each case listing contains a depiction of the problem space to illustrate the location of the leak. The next pages are the temperatures as a function of time in those cells near the leak. The first case presentation (DB19_BCS) contains a complete listing of the input tables. Each additional case contains only the graphic output, tables which differ from the previous case and the depiction of the leak location.

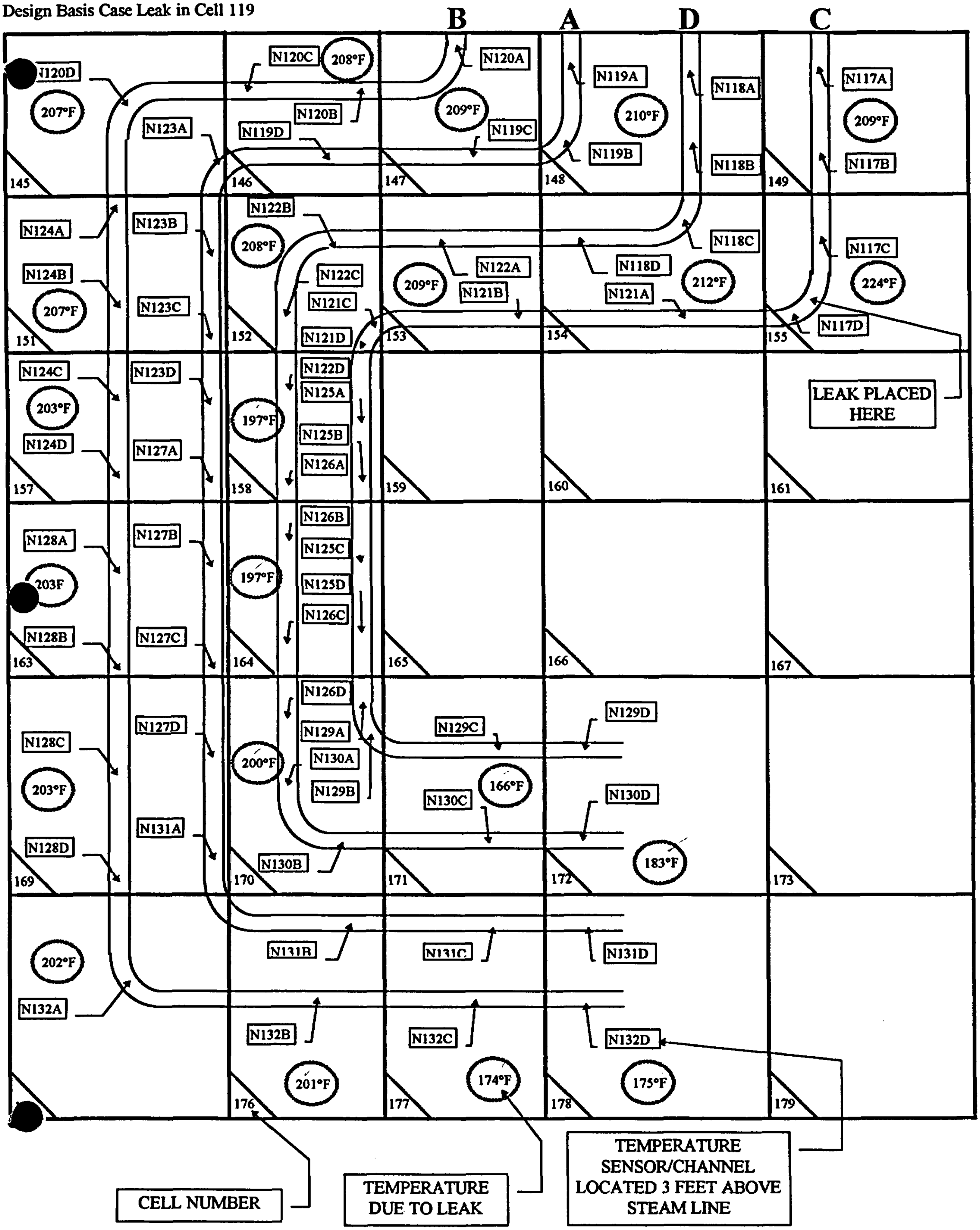
The following pages are summary illustrations of the calculational results. These drawings are not to scale. Each sketch shows the cell boundaries (at the ceiling of the model above the leak), the temperature detection instrumentation in that cell, and the cell temperature.

Plant Hatch, Unit 2
Turbine Building Leak Detection
Design Basis Case Leak in Cell 119

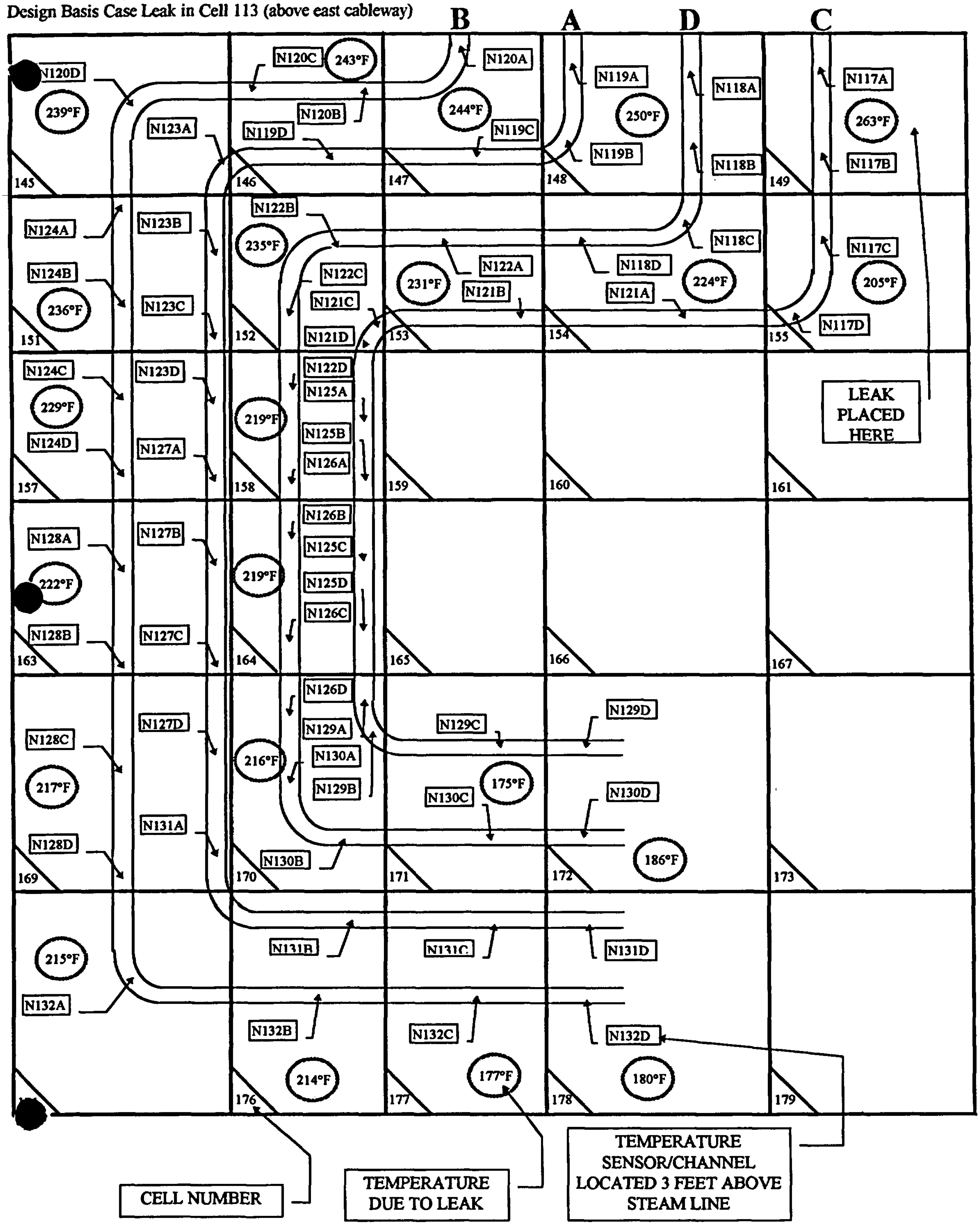


Design Basis Case Leak in Cell 113 (above east cableway)



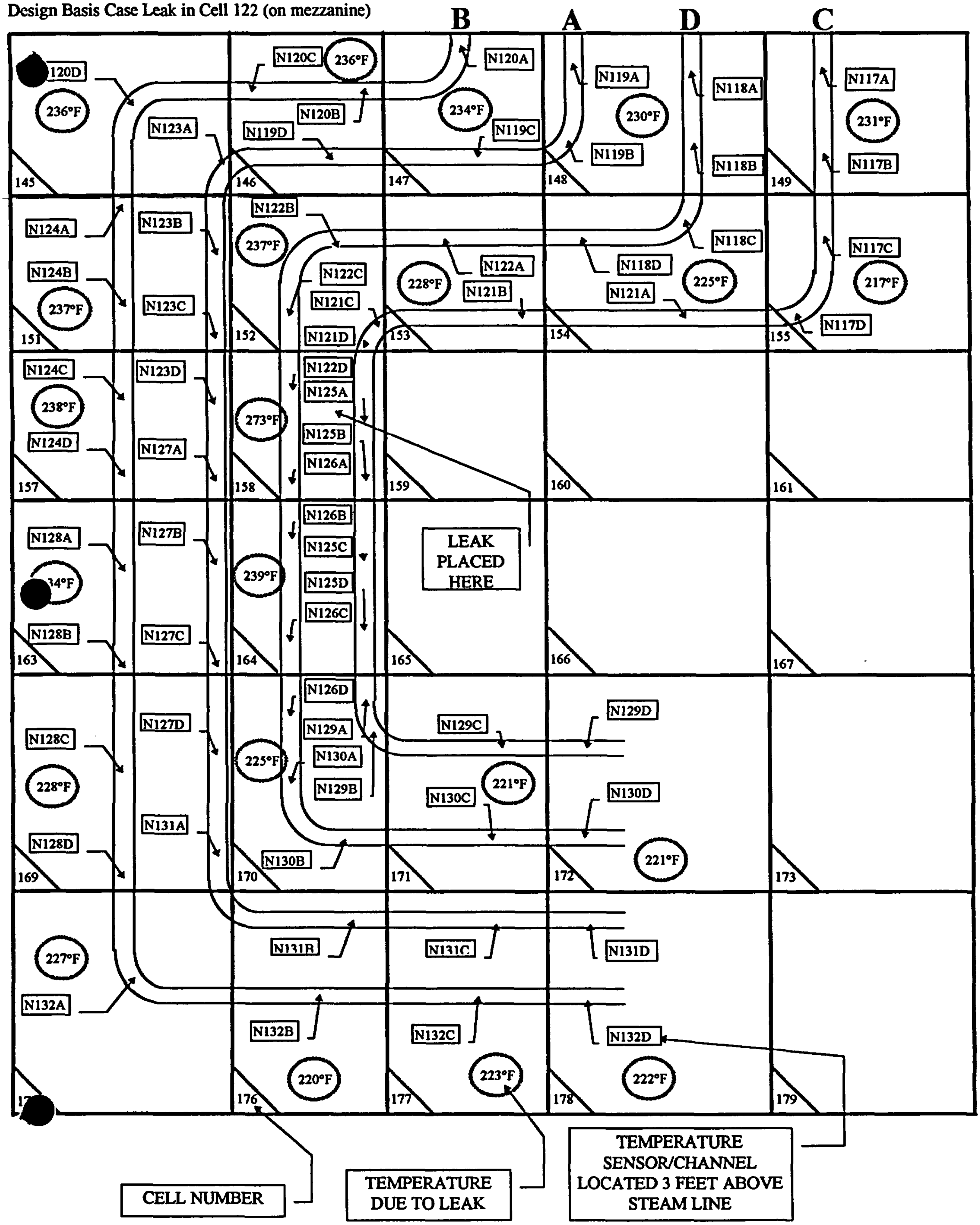

B
A
D
C
N120D
207°F
N120C
208°F
N120A
N120B
209°F
N119D
N119C
N119A
210°F
N119B
N118A
N118B
N117A
209°F
N117B
N123A
145
146
147
148
149
N124A
N123B
N122B
208°F
N118C
N117C
N124B
207°F
N123C
N122C
209°F
N122A
N118D
212°F
224°F
N121C
N121B
N121A
N117D
151
152
153
154
155
N121D
N124C
203°F
N123D
N122D
N125A
LEAK PLACED HERE
197°F
N124D
N127A
N125B
N126A
157
158
159
160
161
N128A
N127B
N126B
N125C
197°F
203F
N125D
N126C
N128B
N127C
163
164
165
166
167
N126D
N129D
N127D
N129C
N128C
N129A
N130A
200°F
203°F
166°F
N129B
N130C
N130D
N131A
N128D
N130B
183°F
169
170
171
172
173
202°F
N131B
N131C
N131D
N132A
N132B
N132C
N132D
174°F
201°F
175°F
176
177
178
179
TEMPERATURE SENSOR/CHANNEL LOCATED 3 FEET ABOVE STEAM LINE
TEMPERATURE DUE TO LEAK
CELL NUMBER

Plant Hatch, Unit 1
Turbine Building Leak Detection
Design Basis Case Leak in Cell 113 (above east cableway)



Plant Hatch, Unit 2
Turbine Building Leak Detection
Design Basis Case Leak in Cell 122 (on mezzanine)

SMNH94-051



References:

1. Plant Hatch Improved Technical Specifications (Units 1 and 2), Bases, Specification 1.e, 1.f, "Area Temperature - High"

2. Drawing H-21054, "Turbine Building Main Steam Line Leak Detection System Instrument Locations," revision 2.

3. Drawing H-22012, "Turbine Building Concrete - General Arrangements - Sections - Sheet No. 2," revision 2.

4. Drawing H-22008, "Turbine Building Concrete - General Arrangement - Floor Slab, El. 147'0"," revision 7.

5. Drawing H-22009, "Turbine Building Concrete - General Arrangement - Floor Slab, El. 164'0"," revision 6.

6. Drawing H-26217, "Turbine Building Ventilation System Plan at El. 130'0","revision 6.

7. 1989 ASHRAE Handbook, ''Fundamentals''

8. I. E. Idelchik, ''Handbook of Hydraulic Resistance", second edition, English language version, 1986, Hemisphere Publishing.

9. GOTHIC 4.0 User Manual, EPRI, 1993.

10. Calculation N-94-01, revision 0, ''Verification of GOTHIC''

11. GOTHIC 4.0 Technical Manual, EPRI, 1993.

12. Calculation Folder 2454, HNP 2, Volume 3, Binder 20A, Number 291, "Compartment Temperature Analysis (Leak Detection)," Revision 1.

13. Condenser Bay Temperature Data, E-Mail transmission from Deep Ghosh, 7/18/94 (attachment A).

14. Plant Hatch temperature data from plant (attachment B).

15. Plant Hatch, Unit 2 Final Safety Analysis Report

16. Plant Hatch, Unit 1 Final Safety Analysis Report

17. Drawing S21135, "Setting Plan for 4th Stage Heaters"

18. Drawing H-16049, "Hatch Unit 1 Ventilation Turbine Building, EL. 147'0""

Directory Listings

Directory of GOTHIC Binary Files:

```
 Volume in drive C has no label
 Volume Serial Number is 272E-0FD8
 Directory of C:\GOTHIC\BIN

.            <DIR>      01-26-93   3:00p
..           <DIR>      01-26-93   3:00p
GOTHIC   B          31711 10-05-93   5:17p
GOTHIC   DIM         4316 10-05-93   2:29p
MENU     GOT        50773 10-05-93   5:16p
GOTHIC   BAT           38 08-25-94   8:45a
GOTHIC_G BAT          148 08-25-94   8:46a
GOTHIC_S BAT          101 08-25-94   8:46a
GPRINT   BAT           48 02-17-94   7:58a
REDIM_G  BAT          352 09-12-91   7:51a
GOTHIC_G EXP       192825 10-05-93   5:13p
GOTHIC   EXP       830900 10-05-93   4:43p
GOTHIC_S EXP       933310 10-05-93   4:13p
GOTHIC   TMP            0 06-17-94   3:12p
GOTHIC   JNK            0 06-17-94   3:13p
BIN      TXT          917 02-25-94  10:35a
RUN386   EXE       172500 06-25-91   3:00p
_HUBRC                860 06-17-94   3:13p
       18 file(s)    2218799 bytes
                   106364928 bytes free
```

Directory Listings (continued):

Directory of GOTHIC Library Files:

```
 Volume in drive C has no label
 Volume Serial Number is 272E-0FD8
 Directory of C:\GOTHIC\LIB

.             <DIR>      01-26-93   3:00p
..            <DIR>      01-26-93   3:00p
ADD_PIC1 1         4434 10-05-93   5:42p
ADD_PIC3 1         6839 10-05-93   5:43p
ADD_PIC3 4         1290 10-05-93   5:43p
ADD_TAB1 1         1921 10-05-93   5:43p
ADD_TAB3 1          357 10-05-93   5:43p
ADD_TAB3 2          250 10-05-93   5:43p
CONCRETE            121 10-05-93   5:43p
FLOWFRAC            119 10-05-93   5:41p
GENERIC            3348 10-05-93   5:41p
ICE_COND          17962 10-05-93   5:41p
LARGE_DR          21349 10-05-93   5:42p
MARK_I            13984 10-05-93   5:42p
MARK_II           12143 10-05-93   5:42p
MARK_III          16025 10-05-93   5:42p
PROP1               123 10-05-93   5:43p
SS_HDM              256 10-05-93   5:43p
SS_HSP1             372 10-05-93   5:43p
SS_HSP2             306 10-05-93   5:43p
SS_HSP3             236 10-05-93   5:43p
SS_HSP4             153 10-05-93   5:43p
SS_HTP1             345 10-05-93   5:43p
SS_HTP2             192 10-05-93   5:43p
SS_HTP3             406 10-05-93   5:43p
SS_HTP4             198 10-05-93   5:43p
SS_TDM              221 10-05-93   5:43p
SS_TSP1             296 10-05-93   5:43p
SS_TSP2             302 10-05-93   5:43p
SS_TSP3             262 10-05-93   5:43p
SS_TSP4             283 10-05-93   5:43p
SS_TTP1             296 10-05-93   5:43p
SS_TTP2             302 10-05-93   5:43p
SS_TTP3             262 10-05-93   5:43p
SS_TTP4             283 10-05-93   5:43p
STEEL               123 10-05-93   5:43p
```

Directory Listings (continued):

Directory of GOTHIC Library Files (continued):

```
W_ALUMN          117 02-05-93   2:22p
W_BRASS          119 02-05-93   2:23p
W_CARSTL         113 02-05-93   2:24p
W_CONC           109 02-05-93   2:25p
W_COPPER         111 02-05-93   2:37p
W_EPDM           111 02-05-93   2:40p
W_EPR            117 02-05-93   2:41p
W_FGLASS         117 02-05-93   2:42p
W_HYPOLN         115 02-05-93   2:43p
W_NAMBLK         113 02-05-93   2:45p
W_NAMLEV         115 02-05-93   2:46p
W_NITRGN         119 02-05-93   2:48p
W_PHENLC         117 02-05-93   2:49p
W_SILCON         115 02-05-93   2:50p
W_SSTEEL         121 02-05-93   2:51p
W_XLPE           111 02-05-93   2:52p
XLPO             113 02-09-93   8:38a
MACOR            117 02-09-93   8:38a
ADD_TAB4 0       406 10-05-93   5:43p
ALUMINUM         115 08-01-94   8:13a
       56 file(s)     107950 bytes
                   106360832 bytes free
```

Design Calculations – Nuclear

Southern Company Services

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9AP 1/18/95

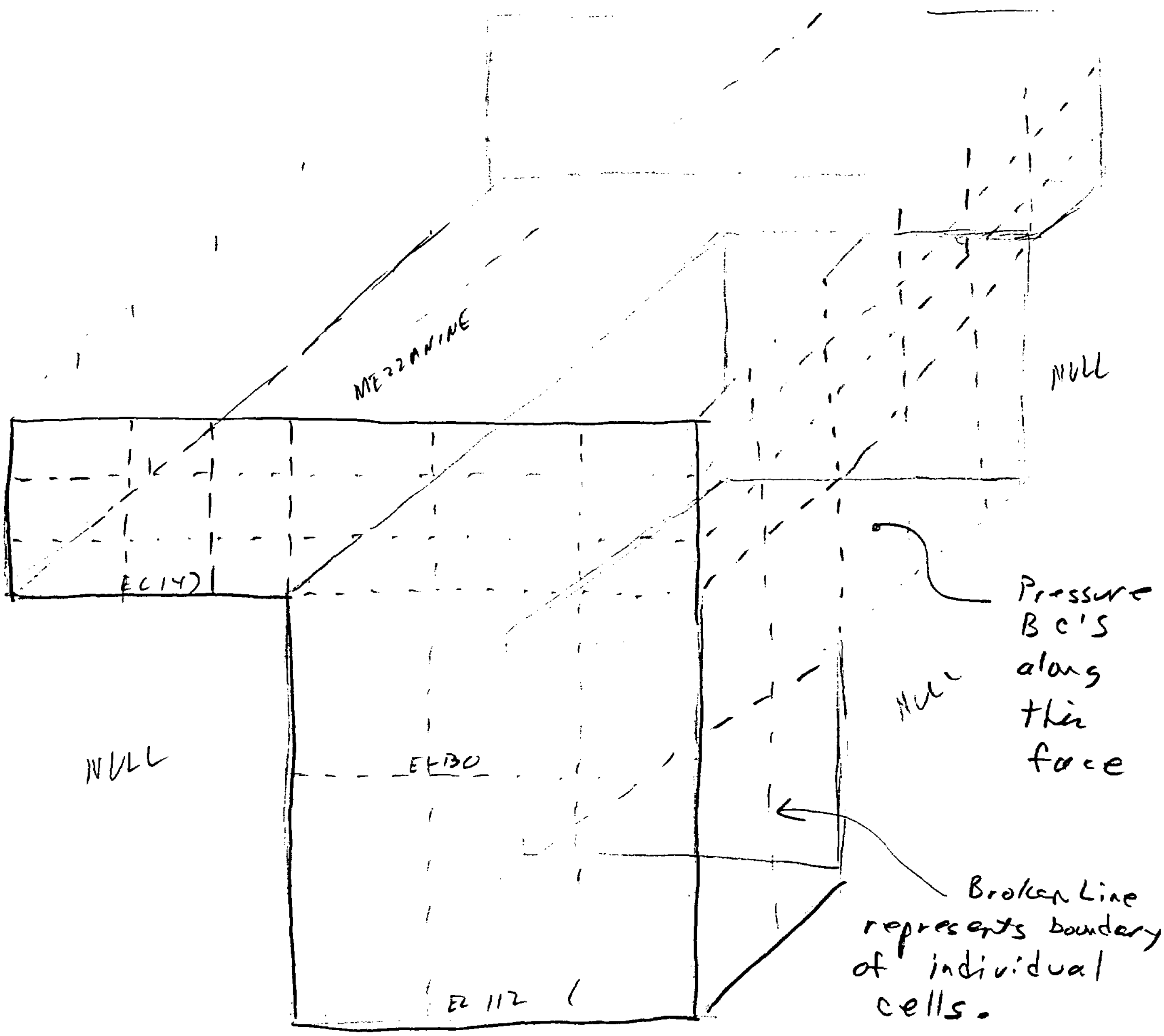
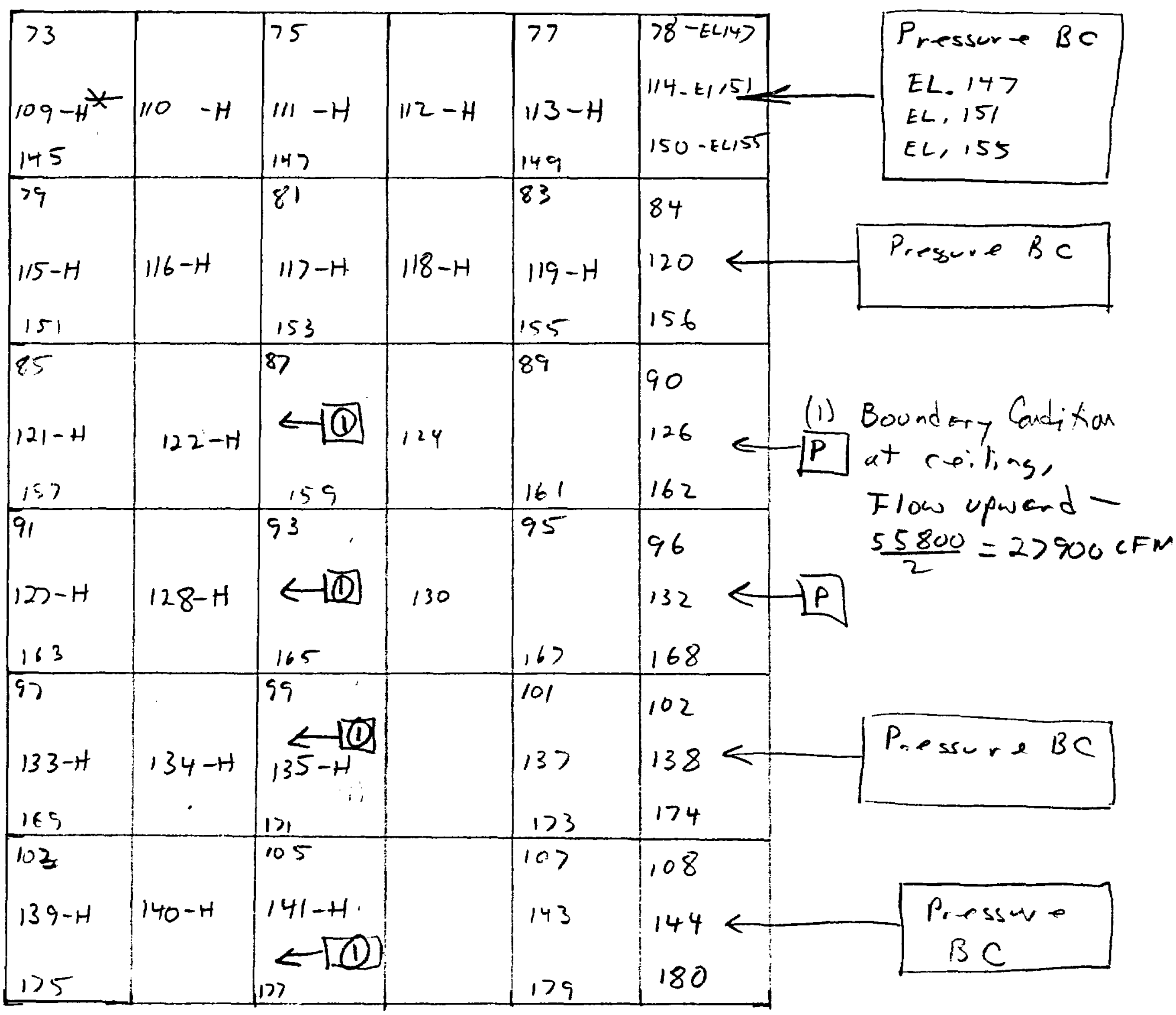


FIGURE 1
3-D Representation of MODEL

Levels 3, 4, 5 Plan



① Unit 1 HVAC Flows.

* HEAT LOADS Representing Piping Heat Loss in Cells shown

FIGURE 2
– NODALIZATION – UPPER LEVELS –

Design Calculations – Nuclear

Southern Company Services

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Level 2 Plan

JN 1/18/95

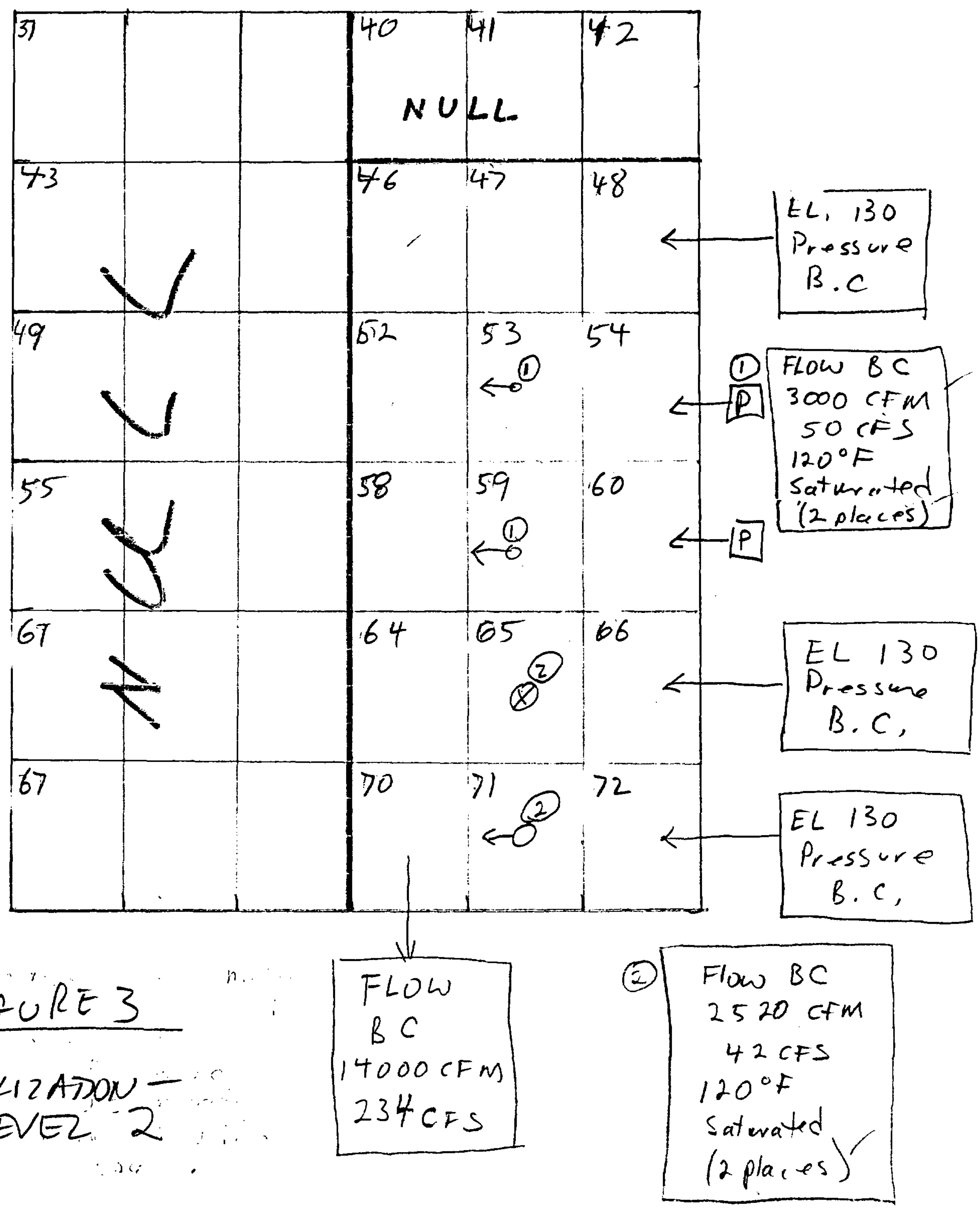

FIGURE 3

NODALIZATION – LEVEL 2

Form No. 9-2225

Design Calculations – Nuclear | **Southern Company Services**

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Level 1 PLAN

JAM 1/18/95

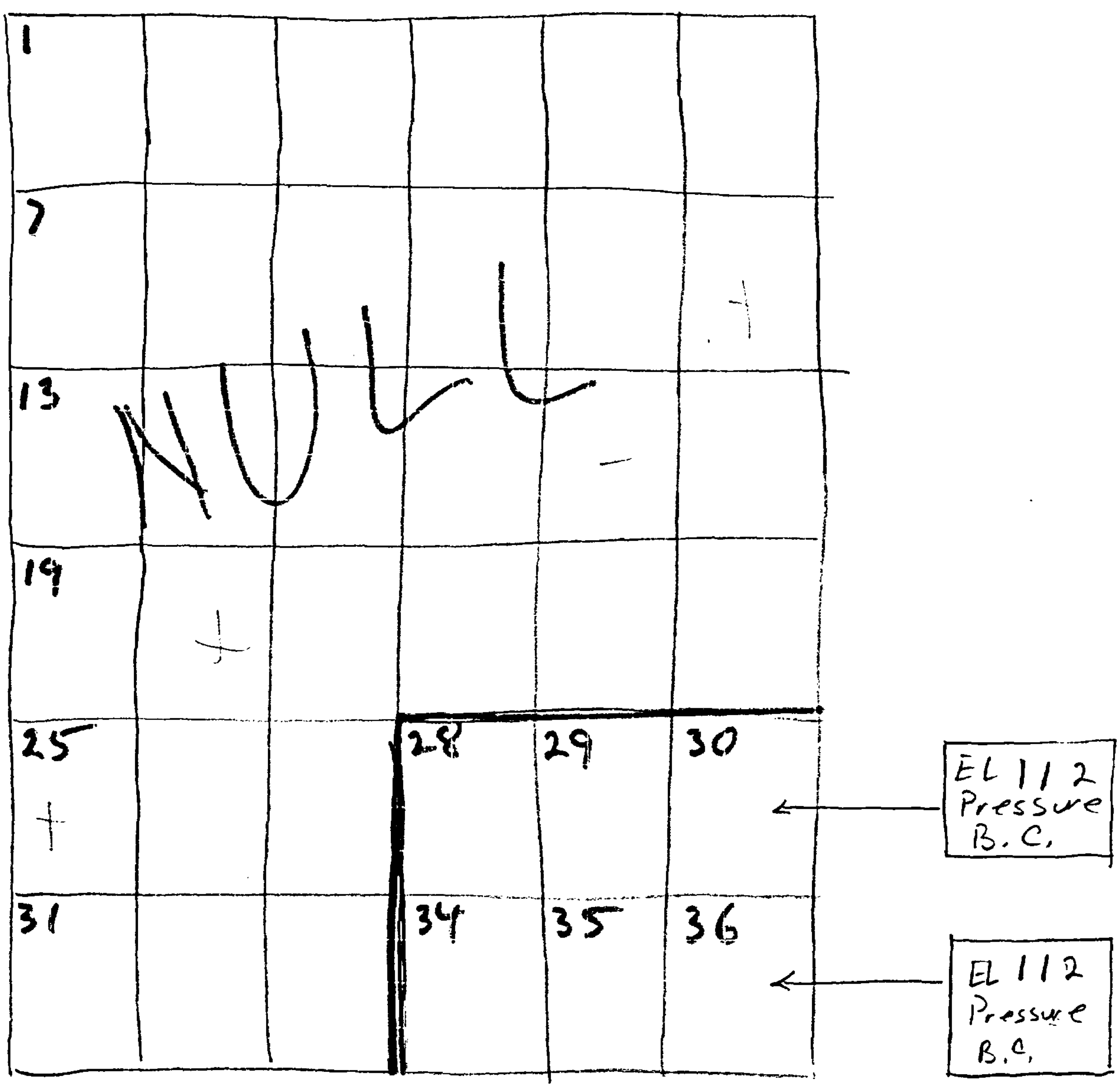

FIGURE 4

NODALIZATION – LEVEL 1

Form No. 9-2225

VOLUME CALCULATION

EL. 112: $V = (21.25 + 21.25)(14 + 10 + 10)(130 - 112)$

$V_{112} = 26010 \ ft^3$

EL. 130: $Y = 15.5 + 17.5 + 21.25 + 21.25 + 21.25$

$y = 96.75 \ ft$

$x = 14 + 10 + 10 = 34 \ ft$

$z = 147 - 130 = 17$

$V_{130} = (96.75)(34)(17) = 55922 \ ft^3$

EL. 147 - 159:

$y = 17.7 + 15.5 + 17.5 + 21.25 + 21.25 + 21.25$

$y = 114.45 \ ft$

$x = 13 + 10 + 11 + 14 + 10 + 10 = 68 \ ft$

$z = 159 - 147 = 12$

$V_{147} = (114.45)(68)(12) = 93391 \ ft^3$

Total Volume: $93391 + 55922 + 26010 = 175323 \ ft^3$

$$\boxed{V = 175323 \ ft^3}$$

Design Calculations – Nuclear

Southern Company Services

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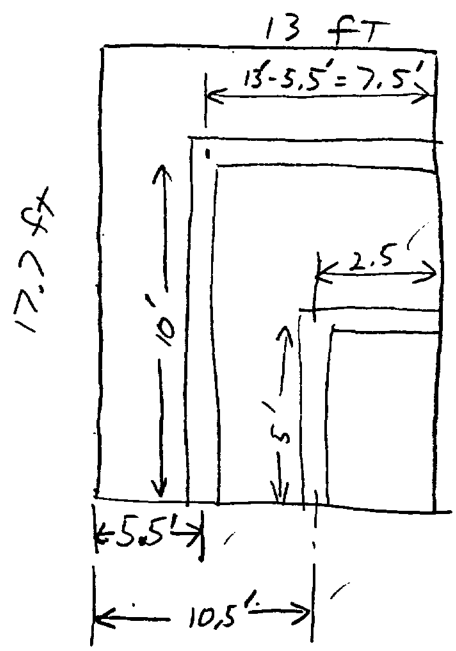
Channel 1:



Dimensions per H21054

Channel area = 230 ft^2

D_H = 100

D_H is only of importance if the flow resistance is high. For buoyancy driven problems a value of 100 is assumed as it will not affect the result.

Total length of pipe in channel: L_P = 10 + 7.5 + 2.5 + 5 = 25 ft

Pipe effective xsect width = 24 inch + 12 inch (insulation) = 3 ft

Area of pipe = 25 × 3 = 75 ft^2

Free area = (13)(17.7) − 75 = 155 ft^2

Form No. 9-2225

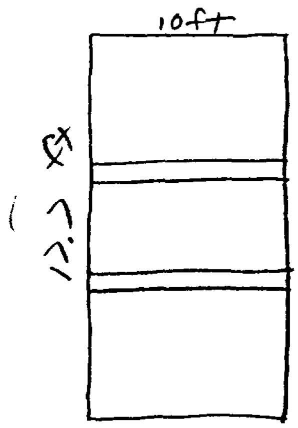
Design Calculations – Nuclear

Southern Company Services

Project	Hatch 2	Calculation Number SMNH 94-051
Subject/Title	Turbine Bldg Leak Det	Sheet ~~19~~ 22 of ~~120~~ 145

JMM 1/18/95

Channel 2:



Channel Area = 177 ft^2

$D_H = 100$

Total Length of pipe = 20 ft

Area of pipe = (3)(20) = 60 ft^2

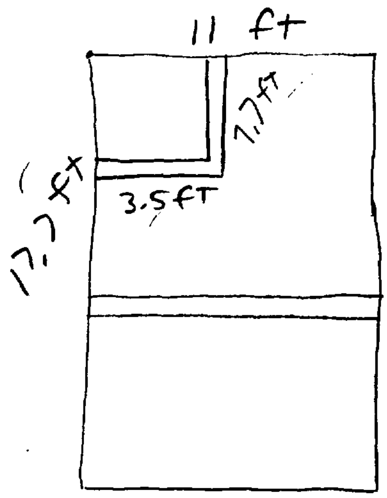
Free Area = (10)(17.7) - 60 = 117 ft^2

Design Calculations – Nuclear

Southern Company Services

Project	Hatch 2	Calculation Number SMNH 94-051
Subject/Title	Turbine Bldg Leak Det,	Sheet ~~20~~ 23 of ~~120~~ 145

Channel 3:



Channel Area = (11)(17.7) = 195 ft^2

$D_H = 100$

Total length of pipe = 7.7 + 3.5 + 11 = 22.2 ft

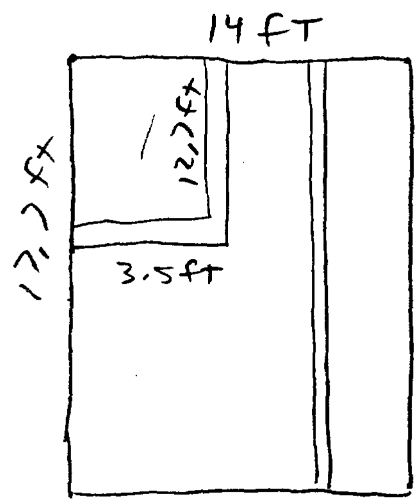
Area of Pipe = (22.2)(3) = 67 ft^2

Free Area = 195 − 67 = 128 ft^2

Form No. 9-2225

GMW 1-18-95

Channel 4:



Channel Area = (14)(17.7)

A = 248 ft²

$D_H = 100$

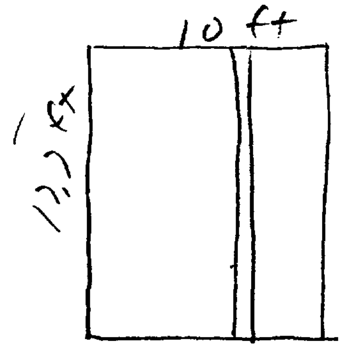
Total length of pipe = 12.7 + 3.5 + 17.7 = 33.9 fT

Area of pipe = (33.9)(3) = 102 ft²

Free Area = 248 − 102 = 146 ft²

gnv 1-18-95

Channel 5:



Channel Area = 177 ft^2

D_H = 100 ft

Total length of pipe = 17.7 ft

Pipe Area = (17.7)(3) = 53 ft^2

Free Area = 177 − 53 = 124 ft^2

Channel 6: Unobstructed

$$Area = (10)(17.7) = 177\ ft^2$$

$$D_H = \frac{(4)(177)}{10} = 71\ ft^2$$

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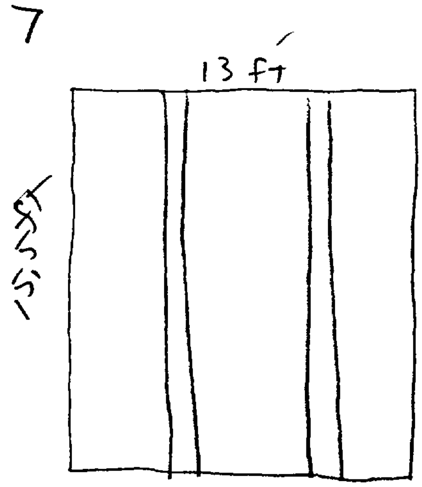
Channel 7



Channel Area = (13)(15.5)

Area = 202 ft²

D_H = 100 ft

Total length of pipe = (15.5)(2) = 31 ft

Pipe Area = (31)(3) = 93 ft²

Free Area = 202 − 93 = 109 ft²

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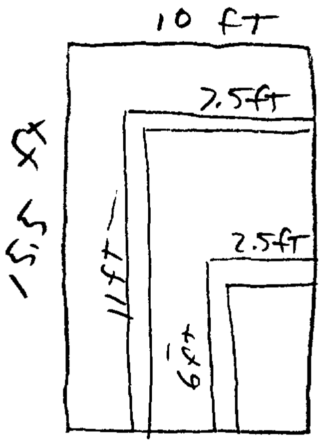
Channel 8:



Channel Area = 155 ft^2

D_H = 10.0 ft

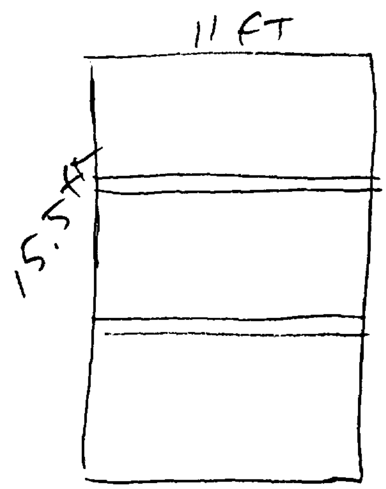
Length of pipe = 11 + 7.5 + 6 + 2.5 = 27 ft

Pipe Area = (27)(3) = 81 ft^2

Free Area = 155 - 81 = 74 ft^2

Form No. 9-2225

Channel 9



Channel Area = 170 ft^2

D_H = 100

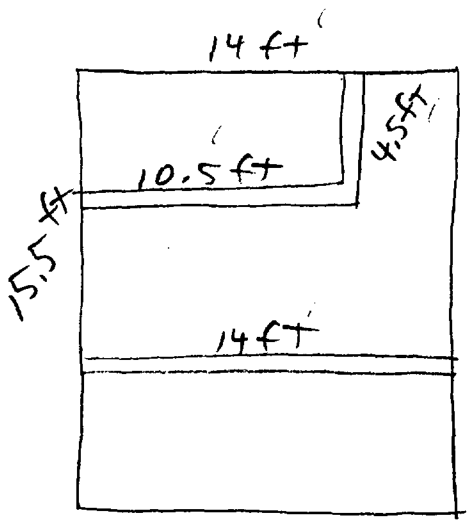
Length of pipe = 22 ft

Area of pipe = 66 ft^2

Free Area = 170 − 66 = 104 ft^2

gmw 1-18-95

Channel 10:



$Area = (14)(15.5) = 217 ft^2$

$D_H = 100$

Length of pipe = 14 + 10.5 + 4.5 = 29 ft

Pipe Area = (29)(3) = 87 ft^2

Free Area = 217 − 87 = 130 ft^2

Design Calculations – Nuclear

Southern Company Services

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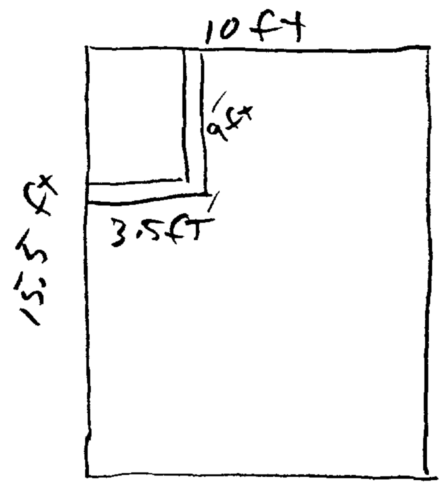
Channel 11:



Area = 155 ft^2

D_H = 100

Length of pipe = 9 + 3.5 = 12.5 ft

Pipe Area = (12.5)(3) = 38 ft^2

Free Area = 155 - 38 = 117 ft^2

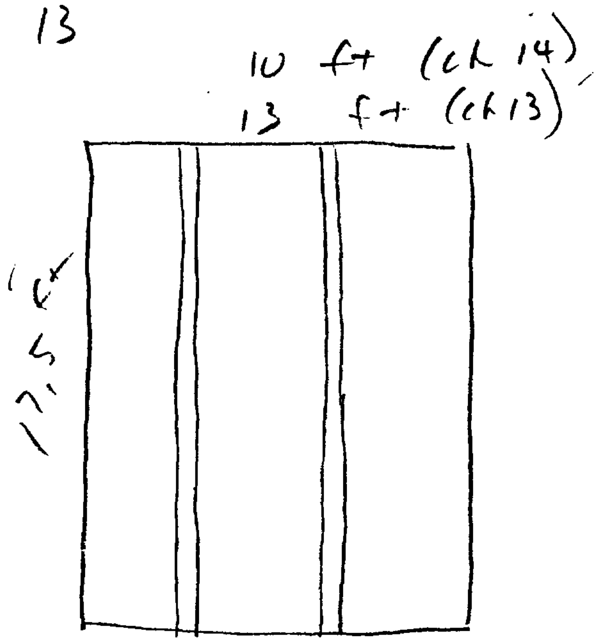
Channel 12: Unobstructed

Area = (10)(15.5) = 155 ft^2

D_H = 100

Form No. 9-2225

Channel 13



Area = (13)(17.5) = 228 ft^2

D_H = 100 (See Ch. 1)

Length of pipe = 17.5 + 17.5 = 35 ft

Pipe Area = (35)(3) = 105 ft^2

Free Area = 228 − 105 = 123 ft^2

Channel 14 Identical to 13 except 10 ft wide

Area = 175 ft^2 D_H = 100 (See Ch 1)

Free Area = 175 − 105 = 70 ft^2

Design Calculations – Nuclear

Southern Company Services

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Subject/Title	Turbine Bldg Leak Detection	Sheet ~~29~~ 32 of ~~125~~ 145

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Channel 15 (unobstructed)

Area = (17.5)(11) = 192 ft^2

D_H = 100 (see ch. 1)

Channel 16 (unobstructed)

Area = (17.5)(14) = 245 ft^2

D_H = 100 (see ch. 1)

Channel 17 (unobstructed)

Area = (10)(17.5) = 175 ft^2

D_H = 100

Channel 18 identical to 17

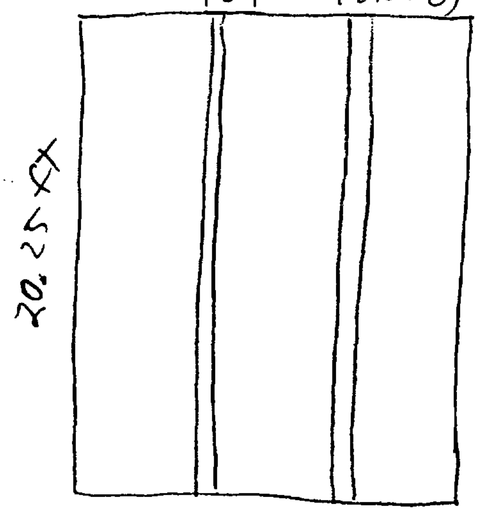
Area = 175

D_H = 100

Form No. 9-2225

Channel 19

13 ft (ch 19)
10 ft (ch 20)



Area = (13)(20.5) = 267 ft2

D_H = 100

Length of pipe = (20.25)(2) = 40.5 ft

Pipe area = (40.5)(3) = 121 ft^2

Free area = 267 − 121 = 146 ft^2

Channel 20: Same as 19, but 10 ft wide

Area = (10)(20.25) = 202 ft^2

D_H = 100

Free Area = 202 − 121 = 81 ft^2

Design Calculations – Nuclear

Southern Company Services

Project Hatch 2	Calculation Number SMNH 94-051
Subject/Title Turbine Bldg Leak Detection	Sheet ~~34~~ 34 of ~~146~~ 145

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Channel 21 (unobstructed)

Area = (20.25)(11) = 223 ft2

D_H = 100

Channel 22 (unobstructed)

Area = (20.25)(14) = 284 ft2

D_H = 100

Channel 23 (unobstructed)

Area = (20.25)(10) = 202 ft2

D_H = 100

Channel 24: Identical to 23

Area = 202

D_H = 100

Form No. 9-2225

Design Calculations – Nuclear

Southern Company Services

Project	Hatch 2	Calculation Number SMNH 94051
Subject/Title	Turbine Bldg Leak Detection	Sheet ~~38~~ 35 of ~~185~~ 145

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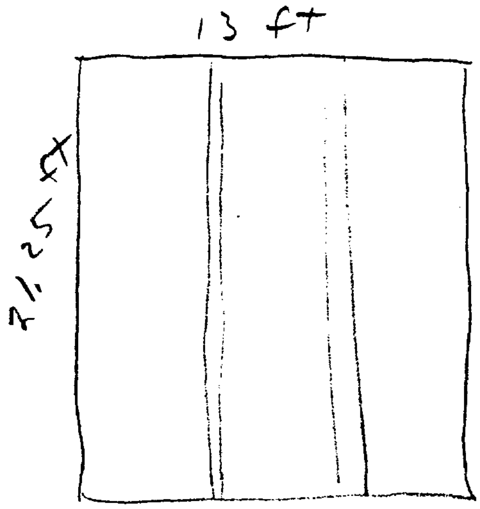
Channel 25



$A = (13)(21.25) = 276$

$D_H = 100$ (See Ch 1)

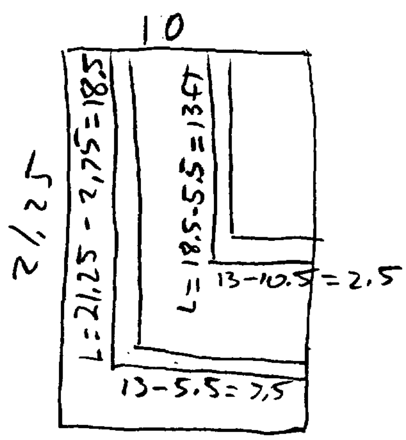
Length of pipe = (21.25)(2) = 42.5

Pipe area = (42.5)(3) = 128

Free Area = 276 − 128 = 148 ft^2

Form No. 9-2225

Channel 26:



Area = (10)(21.25) = 212 ft^2

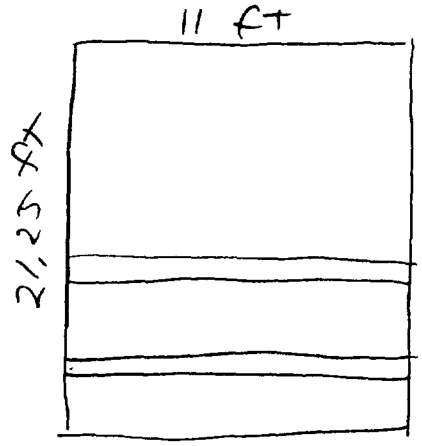
D_H = 100

Pipe Length = 18.5+7.5 + 13 + 2.5 = 41.5

Pipe Area = (41.5)(3) = 124

Free Area = 212 - 124 = 88 ft^2

Channel 27:



Area = (11)(21.25) = 234 ft²

D_H = 100

Length of pipe = (2)(11) = 22 ft

Pipe area = (22)(3) = 66 ft²

Free Area = 234 − 66 = 168 ft²

Channel 28: (Unobstructed)

Area = (14)(21.25) = 298 ft²

D_H = 100

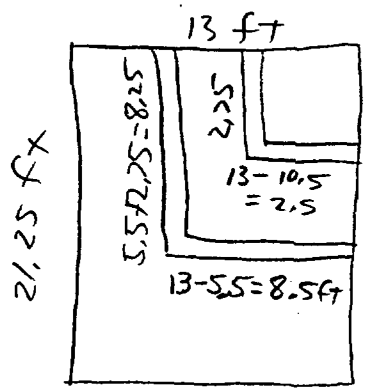
Channel 29: (Unobstructed)

Area = (21.25)(10) = 210

D_H = 100

Channel 30: Identical to channel 29

Channel 31:



Area = (13)(21.25) = 276 ft²

D_H = 100

Length of pipe = 8.25 + 8.5 + 2.75 + 2.5 = 22 ft

Pipe Area = (22)(3) = 66 ft²

Free Area = 276 − 66 = 210 ft²

Design Calculations – Nuclear | Southern Company Services

Project	Hatch 2	Calculation Number SMNH 94-051
Subject/Title	Turbine Bldg Leak Detection	Sheet ~~36~~ 39 of ~~120~~ 145

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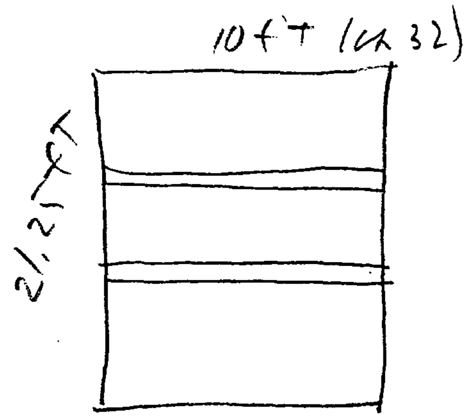
Channel 32:



Area = 212 ft²

D_H = 100

Length of pipe = 20 ft

Pipe Area = (20)(3) = 60 ft²

Free Area = 212 − 60 = 152 ft²

Channel 33: Identical to Channel 27

Area = 234 ft², D_H = 100

Free Area = 168 ft²

Channel 34: Unobstructed - identical to channel 28

Area = 298 ft² D_H = 100

Channel 35: Identical to 29

Area = 210 ft² D_H = 100

Channel 36: Identical to 35.

Form No. 9-2225

Computation of Heat Sources

Total Energy Release = 298150 BTU/hr (from ref. 12)
Total Energy Release = 82.819 BTU/sec
Total Length of Pipe = 561.3 feet

Cell Number	Pipe Length (feet)	Cell Heat Load (BTU/SEC)
109	25.0	3.689
110	20.0	2.951
111	22.2	3.276
112	33.9	5.002
113	17.7	2.612
115	31.0	4.574
116	27.0	3.984
117	22.0	3.246
118	29.0	4.279
119	12.5	1.844
121	35.0	5.164
122	35.0	5.164
127	40.5	5.976
128	40.5	5.976
133	42.5	6.271
134	41.5	6.123
135	22.0	3.246
139	22.0	3.246
140	20.0	2.951
141	22.0	3.246

Design Calculations – Nuclear

Southern Company Services

Project: Hatch 2	Calculation Number: SMNH 94-051
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Concrete Heat Conductor Areas:

External surface = 80°F (fixed all cases)

Level 1

Cells 1 - 27 ⇒ Null

Cell 28: Wall Area = (14 + 21.25)(18) = 634 ft²
Floor Area = 298 ft²

Total H.S. Area = 932 ft²

Cell 29: Wall Area = (10)(18) = 180 ft²
Floor Area = 210

Total = 390 ft²

Cell 30: Same as 29 A = 390 ft²

Cells 31-33: NULL

Cell 34: Same as 28 A = 932 ft²

Cell 35: Same as 29 A = 390 ft²

Cell 36: Same as 30 A = 390 ft²

Form No. 9-2225

Heat Conductors - Level 2:

Cells 37-39: Null

Cell 40: ~~Wall length = 17.7+14 = 31.7~~ H = 147-130 = 17
~~Wall Area = (31.7)(17) = 539 ft²~~
~~Floor Area = (17.7)(14) = 248~~ NULL
~~Total Area = 787 ft²~~

Cell 41: ~~Wall = (10)(17) = 170~~
~~Floor = (17.7)(10) = 177~~ NULL
~~Total = 347 ft²~~

Cell 42: Same as 41 ~~A = 347 ft²~~ NULL

Cells 43-45: NULL

Cell 46: Wall Area = (15.5)(17) + (14)(17) = 502
Floor Area = (15.5)(14) = 217 ft²
Total Area = 719

Cell 47: Floor Area = (10)(15.5) = 155
Wall Area = (10)(17) = 170 Total = 325 ft²

Cell 48: Same as 47 A = 325 ft²

Cells 49-51: NULL

Cell 52: Wall Area = (17.5)(17) = 298 ft²
Floor Area = (17.5)(14) = 245 ft²

Total = 543 ft²

Design Calculations – Nuclear

Southern Company Services

Project	Hatch 2	Calculation Number SMNH 94-051
Subject/Title	Turbine Bldg Leak Detection	Sheet ~~40~~ 43 of ~~120~~ 145

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Cell 53: Floor Only = (17.5)(10) = 175 ft2

Cell 54: Same as 53 A = 175 ft2

Cells 55-57: NULL

Cell 58: Wall Area = (20.25)(17) = 344 ft2
Floor Area = (20.25)(14) = 284
Total = 628 ft2

Cell 59: Floor only = (20.25)(10) = 203 ft2

Cell 60: Same as 59 A = 203 ft2

Cells 61-63: NULL

Cell 64: Wall only = (21.25) + (17) = 361 ft2

Cells 65-66: NO Walls / Floors

Cells 67-69: NULL

Cell 70: Wall only = (21.25)(17) = 361 ft2

Cells 71-72: No heat Sinks

Heat Conductors – Level 3:

Cell 73: Wall length = 13 + 17.8 = 30.8 ✓
Wall height = 4
Wall Area = (30.8)(4) = 123
Floor Area = (13)(17.8) = 231 ✓
Total Area = 354 ft²

Cell 74: Wall Area = (10)(4) = 40 ft²
Floor Area = (17.7)(10) = 177 ✓
Total Area = 217 ft²

Cell 75: Wall Area = (11)(4) = 44 ft²
Floor Area = (17.7)(11) = 195 ✓
Total = 239 ft²

Cell 76: Wall Area = (14)(4) = 56 ft²
Floor Area = (17.7)(14) = 248 ft² ✓
Total = 304 ft²

Cell 77: Wall Area = (10)(4) = 40 ft²
Floor Area = (17.7)(10) = 177 ✓
Total = 217 ft²

Cell 78: Same As 77 ✓ A = 217 ft²

Cell 79: Wall Area = (15.5)(4) = 62 ft²
Floor Area = (15.5)(13) = 202 ft² ✓
Total = 264 ft²

Cell 80: Floor Only = (15.5)(10) = 155 ft² ✓

Design Calculations – Nuclear

Southern Company Services

Project: Hatch 2	Calculation Number: SMNH 94051
Subject/Title: Turb Bldg Leak Det	Sheet ~~42~~ 45 of ~~126~~ 145

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Cell 81: Floor Only $A = 170 ft^2$

Cells 82–84: No walls or floors

Cell 85: wall Area = (17.5)(4) = 70 ft^2
floor Area = 228 ft^2
Total = 298 ft^2

Cell 86: Floor Area = 175 ft^2

Cell 87: Floor Area = 192 ft^2

Cells 88-90: No walls/floors.

Cell 91: Wall Area = (20.25)(4) = 81 ft^2
Floor Area = 267 ft^2
Total = 348 ft^2

Cell 92: floor area = 202 ft^2

Cell 93: floor area = 223 ft^2

Cells 94-96: No walls/floors

Cell 97: wall Area = (21.25)(4) = 85 ft^2
floor Area = 276 ft^2
Total = 361 ft^2

Cell 98: floor Area = 212 ft^2

Cell 99: floor Area = 234 ft^2

Cells 100-102: No walls/floors.

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Cell 103: wall length = 13 + 21.25 = 34.25 ✓
wall Area = (34.25)(4) = 137 ft2 ✓
floor Area = 276 ft2 ✓
Total = 413 ft2 ✓

Cell 104: wall Area = (10)(4) = 40 ft2 ✓
floor area = 212 ft2 ✓

Total = 252 ft2 ✓

Cell 105: wall Area = (11)(4) = 44 ft2 ✓
floor area = 234 ft^2 ✓

Total = 278 ft^2 ✓

Cells 106-108: No walls / floors. ✓

Design Calculations – Nuclear

Southern Company Services

Project	Hatch 2	Calculation Number SMNH 94051
Subject/Title	Turb Bldg Leak Det	Sheet ~~44~~ 47 of ~~120~~ 145

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Heat Conductors – Level 4: No floor or ceiling this level

Cell 109: Walls – Same as 73 = 123 ft²

Cell 110: Wall – Same as 74 = 40 ft²

Cell 111: Wall Same as 75 = 44 ft²

Cell 112: Wall Same as 76 = 56 ft²

Cell 113: Wall Same as 77 = 40 ft²

Cell 114: Wall Same as 78 = 40 ft²

Cell 115: Wall Same as 79 = 62 ft²

Cells 116 – 120: No walls

Cell 121: Wall Same as 85 = 70 ft²

Cells 122 – 126: No walls

Cell 127: wall same as 91 = 85 ft²

Cells 128 – 132: No walls

Cell 133: wall same as 97 = 85 ft²

Cells 134 – 138: No walls

Cell 139: Walls same as 103 = 137 ft²

Cell 140: Wall Same as 104 = 40 ft²

Design Calculations – Nuclear

Southern Company Services

Project	Hatch 2	Calculation Number	SMNH 94051
Subject/Title	Turb Bldg Leak Det	Sheet	~~45~~ 48 of ~~120~~ 145

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Cell 141: wall same as 105 = 44 ft^2

Cells 142-144: No walls

Heat Conductors Level 5: Ceiling over attic space

Cell 145: Same as 73 A = 354 ft^2

Cell 146: Same as 74 A = 217 ft^2

Cell 147: Same as 75 A = 239 ft^2

Cell 148: Same as 76 A = 304 ft^2

Cell 149: Same as 77 A = 217 ft^2

Cell 150: Same as 78 A = 217 ft^2

Cell 151: Same as 79 A = 264 ft^2

Cell 152: Same as 80 A = 155 ft^2

Cell 153: Same as 81 A = 170 ft^2

Cell 154: Ceiling = (15.5)(14) = 217 ft^2

Cell 155: Ceiling = (15.5)(10) = 155 ft^2

Cell 156: Ceiling = (15.5)(10) = 155 ft^2

Form No. 9-2225

Design Calculations – Nuclear

Southern Company Services

Project	Hatch 2	Calculation Number SMNH 94051
Subject/Title	Turb Bldg Leak Det	Sheet ~~46~~ 49 of ~~126~~ 145

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Cell 157: Same as 85 A = 298 ft^2

Cell 158: Same as 86 A = 175 ft^2

Cell 159: Same as 87 A = 192 ft^2

Cell 160: Ceiling = (17.5)(14) = 245 ft^2

Cell 161: Ceiling = (17.5)(10) = 175 ft^2

Cell 162: Ceiling = (17.5)(10) = 175 ft^2

Cell 163: Same as 91 A = 348 ft^2

Cell 164: Same as 92 A = 202 ft^2

Cell 165: Same as 93 A = 223 ft^2

Cell 166: Ceiling = (20.25)(14) = 284 ft^2

Cell 167: Ceiling = (20.25)(10) = 202 ft^2

Cell 168: Ceiling = (20.25)(10) = 202 ft^2

Cell 169: Same as 97 A = 361 ft^2

Cell 170: Same as 98 A = 212 ft^2

Cell 171: Same as 99 A = 234 ft^2

Cell 172: Ceiling = (21.25)(14) = 298 ft^2

Cell 173: Ceiling = (21.25)(10) = 212 ft^2

Cell 174: Ceiling = (21.25)(10) = 212 ft^2

Form No. 9-2225

Cell 175: Same as 103 $A = 413\ ft^2$

Cell 176: Same as 104 $A = 252\ ft^2$

Cell 177: Same as 105 $A = 278\ ft^2$

Cell 178: Same as 172 $A = 298\ ft^2$

Cell 179: Same as 173 $A = 212\ ft^2$

Cell 180: Same as 174 $A = 212\ ft^2$

Flow Boundary Conditions

Leakage Rates: (per Bechtel Calc 291, V01, 3, Bin. 20A)

$$5 \text{ gpm} \equiv 2400 \frac{lbm}{hr}$$

$$25 \text{ gpm} \equiv 12{,}000 \frac{lbm}{hr} = \frac{12{,}000}{3600} = 3.333 \frac{lbm}{sec}$$

All leakage to be saturated steam @ 1020 psia.

These data to be used to place leaks at various locations in model,

HVAC FLOWS (see p, 54 for Unit 1)

Summer Conditions: Inlet flows @ 110 °F.

Flows are as shown on the problem definition plan sketches.

Leakage Flows – Higher Flow Rates

$$50 \text{ gpm} \equiv \left(3.333 \frac{lbm}{sec}\right)(2) = 6.666 \frac{lbm}{sec}$$

$$100 \text{ gpm} \equiv \left(6.666 \frac{lbm}{sec}\right)(2) = 13.33 \frac{lbm}{sec}$$

$$1\% \text{ MS flow} = (0.01)\left(10.044 \times 10^6 \frac{lbm}{hr}\right)\left(\frac{1 \text{ hr}}{3600 \text{ sec}}\right)$$

$$= 27.9 \frac{lbm}{sec}$$

Pressure Boundary Conditions:

Per ASHRAE Fundamentals: @ 120°F, Moist Air

Humidity Ratio = 0.08156

$V_a = 14.613\ FT^3/LB_M$

$V_{as} = 1.906\ FT^3/lb_m$

$V_s = 16.519\ FT^3/lb_m$

$$Density = \frac{1}{16.519\ \frac{FT^3}{lb}} = 0.0605363\ \frac{lb}{ft^3}$$

Set Pressure = 14.7 at El. 112

@ El 130

$$\delta P = \left(\frac{0.0605363\ \frac{lb}{FT^3}}{144\ \frac{in^2}{ft^2}}\right)(18\ ft) = 0.007567\ psi$$

$$P_{130} = 14.7 - 0.007567 = 14.692433$$

@ El 147

$$\delta P = \left(\frac{0.0605363}{144}\right)(35) = 0.0147136$$

$$P_{147} = 14.7 - 0.0147136 = 14.685286$$

Design Calculations – Nuclear

Southern Company Services

Project	Hatch 2	Calculation Number	SMNH 94051
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@ El 151 $\delta P = \left(\frac{0.0605363}{144}\right)(39) = 0.0163952$

$P_{151} = 14.683605$

@ El 155 $\delta P = \left(\frac{0.0605363}{144}\right)(43) = 0.0180768$

$P_{155} = 14.681923$

@ EL 159 $\delta P = \left(\frac{0.0605363}{144}\right)(47) = 0.0197583$

$P_{159} = 14.680242$

AT 120°F P_{SAT} = 1.6927 psia (Per ASME steam Table)

Elevation	P_{TOT}	Stm Press Ratio
112	14.7	0.11515
130	14.692433	0.11521
147	14.685286	0.11526
151	14.683605	0.11528
155	14.681923	0.11529
159	14.680242	0.11530

Unit 1 HVAC Flows:

Use : $\rho_{AIR} = 0.0605 \frac{lbm}{ft^3}$ (ASHRAE) ✓

Flow = 2500 CFM (Ref 18) ✓

$2500 \frac{ft^3}{min} = \frac{(2500)(0.0605)}{60} = 2.52 \frac{lbm}{sec}$ ✓

From ref 12, $T_{HVAC} = 50°F$ ✓

$Area = \frac{26'' \times 16''}{144\ in^2/ft^2} = 2.89\ ft^2$ ✓

$D_H = 2$ ($L_F = 1$, $L_H = 1$ (Assumed)) ✓

Avg ELEV = 156.5 ✓

$H = 1.33$ ✓

Design Calculations – Nuclear

Southern Company Services

Project	Hatch 2	Calculation Number	SMNH 94051
Subject/Title	Turb Bldg Leak Det	Sheet ~~52~~ 55 of ~~126~~ 145	

gnm 1-18-95

FLOW BOUNDARY CONDITIONS

At $\rho = 0.0605363\ lbm/ft^3$

$$3000\ CFM = \frac{\left(3000\ \frac{ft^3}{min}\right)\left(0.0605363\ \frac{lbm}{ft^3}\right)}{60\ \frac{sec}{min}} = 3.0\ lbm/sec$$

$$2500\ CFM = 2.5\ \frac{lbm}{sec}$$

$$\text{Total HVAC IN} = (3)(3.0) + (2)(2.5) = 14.0\ \frac{lbm}{sec}$$

$$\text{HVAC OUT} = \text{HVAC IN} = 14.0\ \frac{lbm}{sec}$$

Channel 6 BC Flow Path

Flow Paths 11, 15, 19

Clear Width = 17.7 − 4.9 = 12.8 ft (per ref. 4)

Concrete Column block 4.9 ft

$A = (4)(12.8) = 51.2$

$P_W = (2)(12.8 + 4) = 33.6$

$D_H = \frac{4A}{P_W} = \frac{(4)(51.2)}{33.6} = 6.1$ ft

Assume 10 ft effective length representing flow path from problem boundary to condenser bay open space.

$L_F = L_H = 10$ ft

Set $k = 0.5$ to represent an orifice of low resistance.

Channel 11 BC Flow Paths

Flow Path 8:

Width = 15.5 − Column Blockage − Heater (ref. 17)

= 15.5 − 2.25 − 7.5 = 5.75

$A = (5.75)(17) = 97.8 \ ft^2$

$P_w = (2)(5.75 + 17) = 45.5$

$D_H = \frac{(4)(97.8)}{45.5} = 8.6 \ ft$

$L_f = L_h = 10 \qquad K = 0.5$ (See Channel 6)

Flow Paths 12, 16, 20:

$A = (5.75)(4) = 23 \ ft^2$

$P_w = (2)(5.75 + 4) = 19.5$

$D_H = \frac{(4)(23)}{19.5} = 4.7 \ ft$

$L_f = L_h = 10 \qquad K = 0.5$

Condenser Bay Temperatures (See Attachment A)

8-23-93

Instrument Number					Average
N101	161	169	165	166	165.3
N102	169	168	163	168	167.0
N103	158	169	168	169	166.0
N104	166	173	164	160	165.8
N105	163	170	170	172	168.8
N106	165	173	166	171	168.8
N107	168	169	172	173	170.5
N108	169	170	170	175	171.0
N109	172	171	168	157	167.0
N110	175	180	168	171	173.5
N111	178	178	171	166	173.3
N112	173	168	168	168	169.3
N113	169	170	165	162	166.5
N114	172	170	169	163	168.5
N115	171	170	164	162	166.8
N116	168	165	165	167	166.3
Average:	168.6	170.8	167.3	166.9	

Overall Average: 168.4 Std Deviation: 4.42

Maximum: 180 Minimum: 157

8-27-93

Instrument Number	A	B	C	D	Average
N101	169	169	167	170	168.8
N102	170	170	166	173	169.8
N103	150	171	169	170	165.0
N104	169	175	166	161	167.8
N105	169	172	170	172	170.8
N106	166	178	169	171	171.0
N107	168	171	170	171	170.0
N108	170	171	171	176	172.0
N109	170	177	154	161	165.5
N110	172	179	150	168	167.3
N111	177	171	170	168	171.5
N112	175	169	172	170	171.5
N113	171	175	171	163	170.0
N114	172	173	174	167	171.5
N115	174	173	172	167	171.5
N116	172	169	169	170	170.0
Average:	169.6	172.7	167.5	168.6	

Overall Average: 169.6 Std Deviation: 5.31

Maximum: 179 Minimum: 150

Condenser Bay Temperatures

8-30-93

Instrument Number	A	B	C	D	Average
N101	168	168	167	170	168.3
N102	165	170	167	173	168.8
N103	158	171	170	170	167.3
N104	169	176	167	162	168.5
N105	170	171	170	173	171.0
N106	167	177	171	172	171.8
N107	170	172	171	173	171.5
N108	172	172	173	178	173.8
N109	171	179	154	165	167.3
N110	173	178	163	172	171.5
N111	176	177	175	171	174.8
N112	177	171	172	171	172.8
N113	174	174	173	164	171.3
N114	175	175	175	168	173.3
N115	175	174	171	169	172.3
N116	174	171	169	171	171.3
Average:	170.9	173.5	169.3	170.1	

Overall Average: 170.9   Std Deviation: 4.51
Maximum: 179   Minimum: 154

7-18-94

Instrument Number	A	B	C	D	Average
N101	156	162	160	164	160.5
N102	158	163	161	166	162.0
N103	151	163	162	165	160.3
N104	158	167	159	155	159.8
N105	165	164	163	166	164.5
N106	159	166	160	164	162.3
N107	163	161	164	166	163.5
N108	164	163	163	167	164.3
N109	168	166	168	162	166.0
N110	168	173	166	169	169.0
N111	169	177	164	162	168.0
N112	177	163	160	161	165.3
N113	165	163	159	160	161.8
N114	169	165	157	158	162.3
N115	165	165	162	158	162.5
N116	163	162	162	164	162.8
Average:	163.6	165.2	161.9	162.9	

Overall Average: 163.4   Std Deviation: 4.47
Maximum: 177   Minimum: 151

Condenser Bay Temperatures

(See Attachment B)

12/01/94

Instrument Number	A	B	C	D	Average
N101	142	149	149	153	148.3
N102	143	150		150	147.7
N103	137	151	152	154	148.5
N104	146	149	149	143	146.8
N105	155	148	154	153	152.5
N106	149	156	150	154	152.3
N107	151	150	155	155	152.8
N108	153	153	157	156	154.8
N109	157	157	155	153	155.5
N110	157	161	153	157	157.0
N111	161	158	153	148	155.0
N112	160	152	145	150	151.8
N113	155	149	145	143	148.0
N114	151	153	147	147	149.5
N115	155	154	149	146	151.0
N116	154	150	149	151	151.0
Average:	151.6	152.5	150.8	150.8	

Overall Average: 151.4 Std Deviation: 4.72
Maximum: 161 Minimum: 137
Outside Temperature = 48

12/02/94

Instrument Number	A	B	C	D	Average
N101	143	149	148	154	148.5
N102	144	150		150	148.0
N103	136	151	153	154	148.5
N104	146	149	148	143	146.5
N105	155	148	154	154	152.8
N106	149	156	150	154	152.3
N107	152	150	155	155	153.0
N108	153	153	156	156	154.5
N109	157	156	155 156	154	155.5
N110	157	161	153	157	157.0
N111	161	158	154	148	155.3
N112	160	152	150	150	153.0
N113	155	149	149	144	149.3
N114	152	154	147	147	150.0
N115	155	153	149	146	150.8
N116	154	150	149	152	151.3
Average:	151.8	152.4	151.3	151.1	

Overall Average: 151.7 Std Deviation: 4.57
Maximum: 161 Minimum: 136
Outside Temperature = 45

The following is a tabulation of the temperatures in the computational cells corresponding to the location of temperature instrumentation at 1200 sec of problem time (immediately prior to start of the leak). The average temperature computed from these cells is comparable to the projected plant average for 20F outside temperature.

Model Temperature Average

Cell Number	Cell Temps (F)
145	144
146	144
147	144
148	143
149	143
151	144
152	145
153	145
154	140
155	141
157	146
163	146
169	139
175	138
158	147
164	146
170	139
176	138
171	138
172	138
177	138
178	137
Average:	142.0
Std Dev:	3.28

Plant Data Temperature Average

Date	Outside Temp (F)	Calc Avg Temp (F)
08/23/93	95	168.4
08/27/93	95	169.6
08/30/93	95	170.9
07/18/94	95	163.4
Summer Average:	95	168.1
12/01/94	48	151.4
12/02/94	45	151.7
Autumn Average	46.5	151.6

Projection/Comparison Plant Winter Conditions vs Model

Projected Winter Avg:	20	142.5
Model Winter Avg:		142.0
Margin:		0.6

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
08:55:02 13-JAN-95
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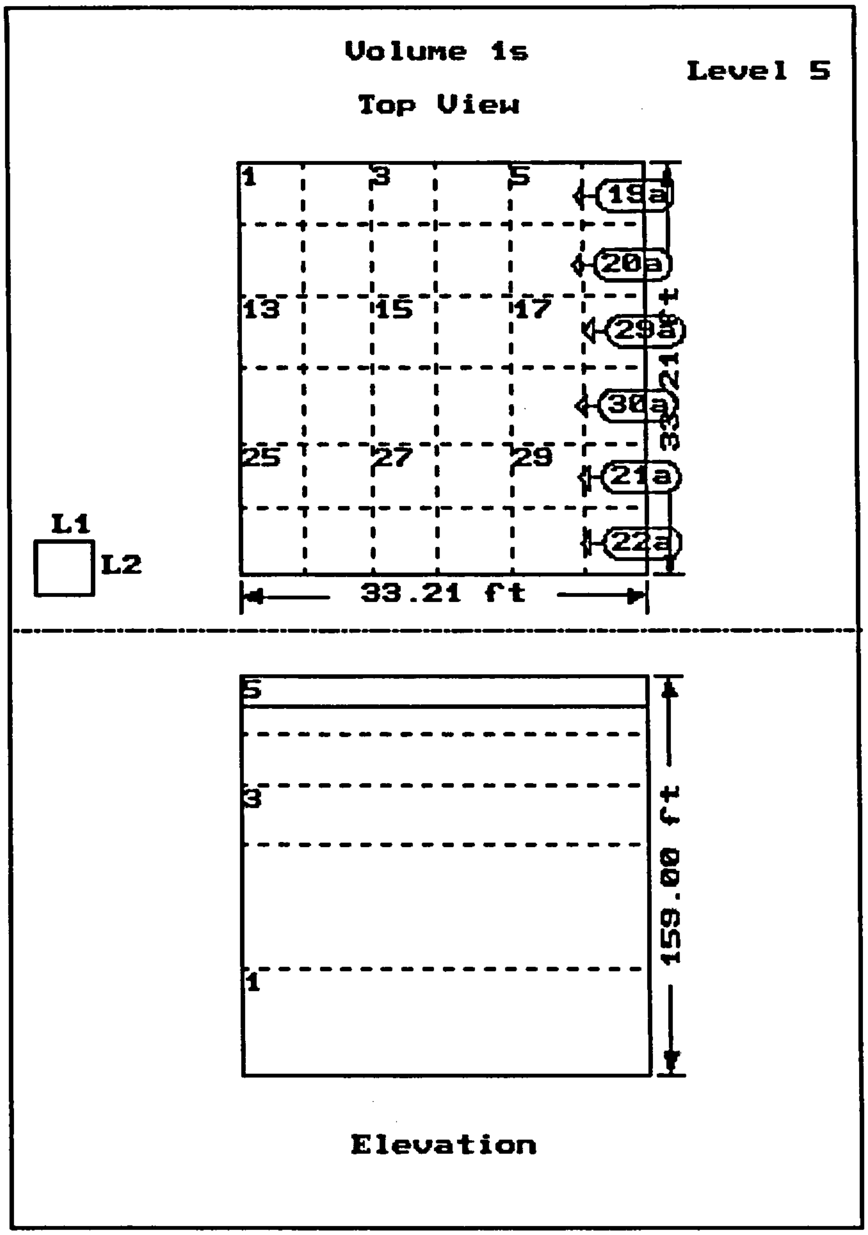

SMNH94051
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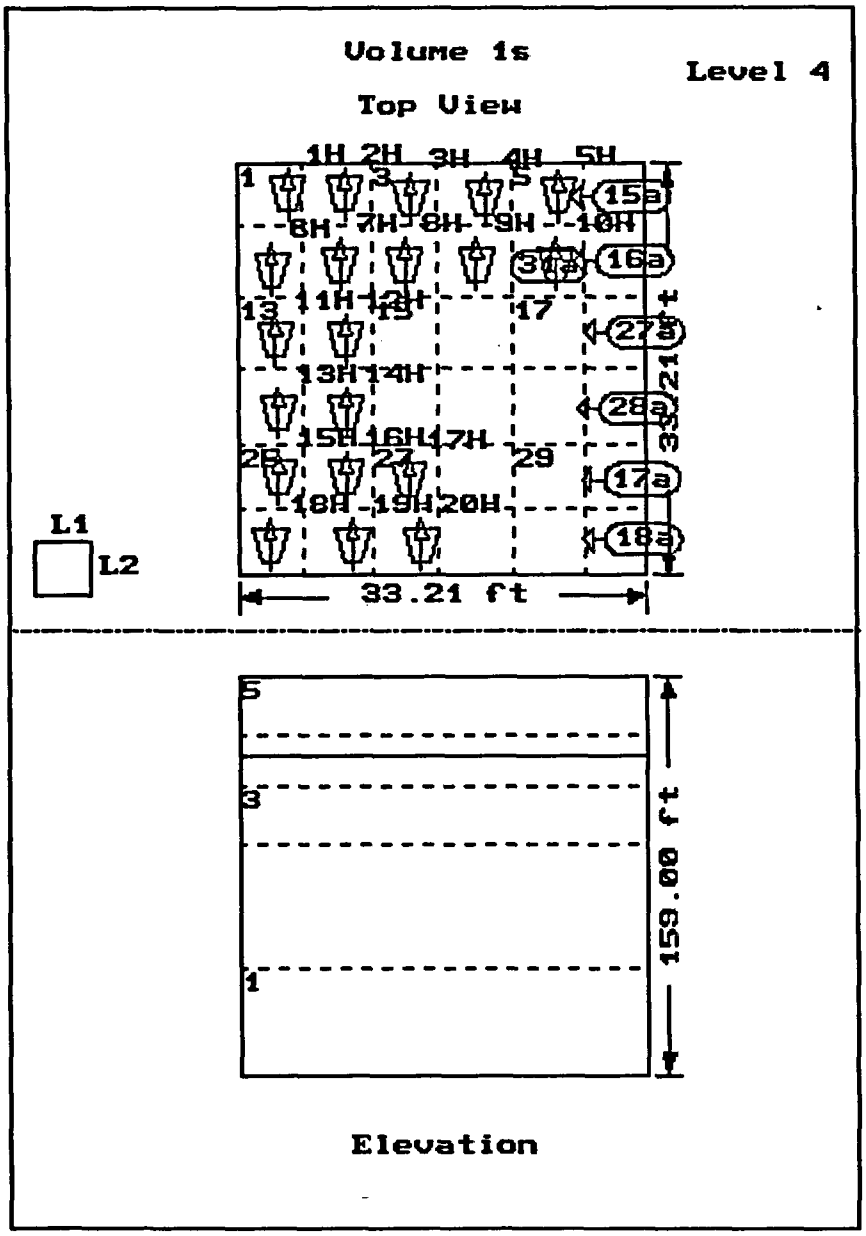
DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
08:55:11 13-JAN-95
GOTHIC Version 4.0 - August 1993



DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
08:55:21 13-JAN-95
GOTHIC Version 4.0 - August 1993

SMNH 94051
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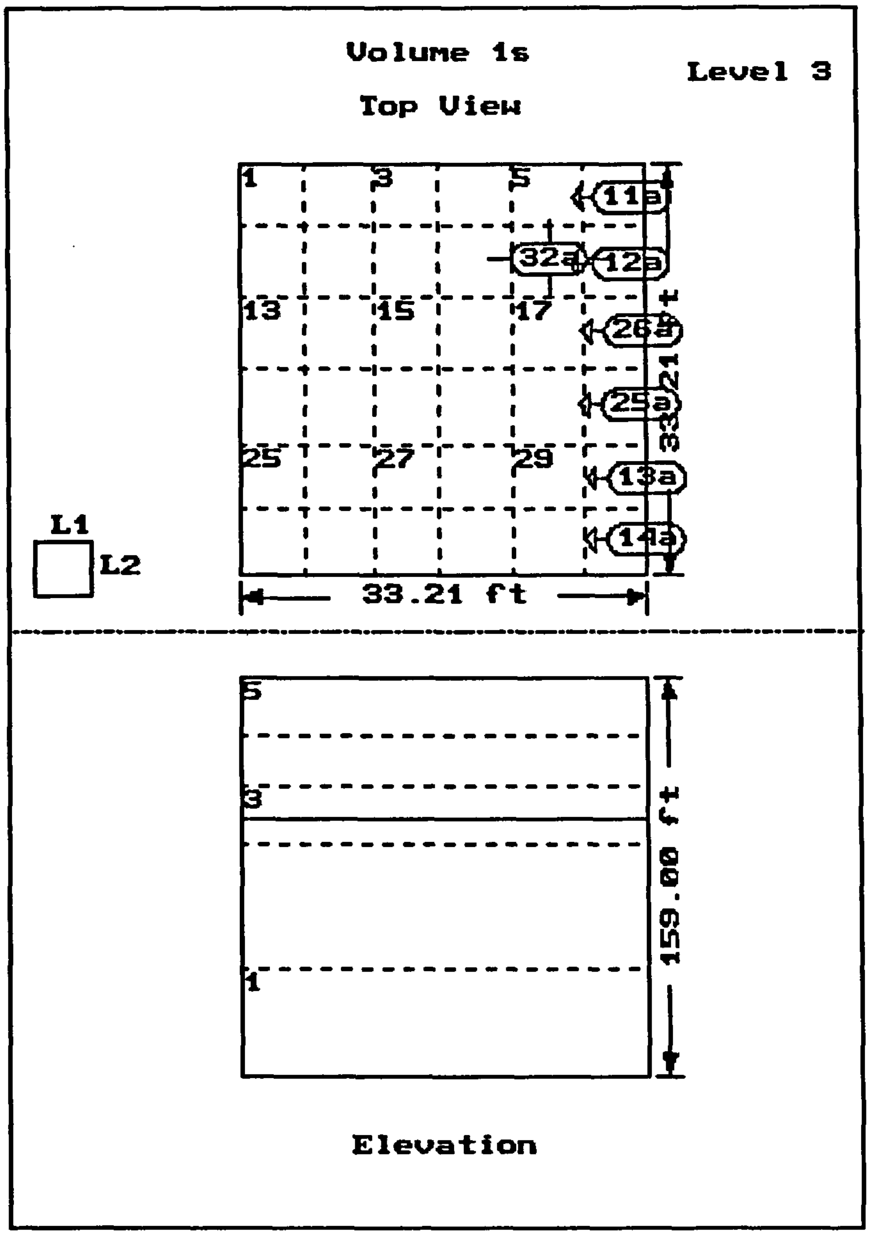

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07:11:34 12-JAN-95
GOTHIC Version 4.0 - August 1993

SMNH 94051
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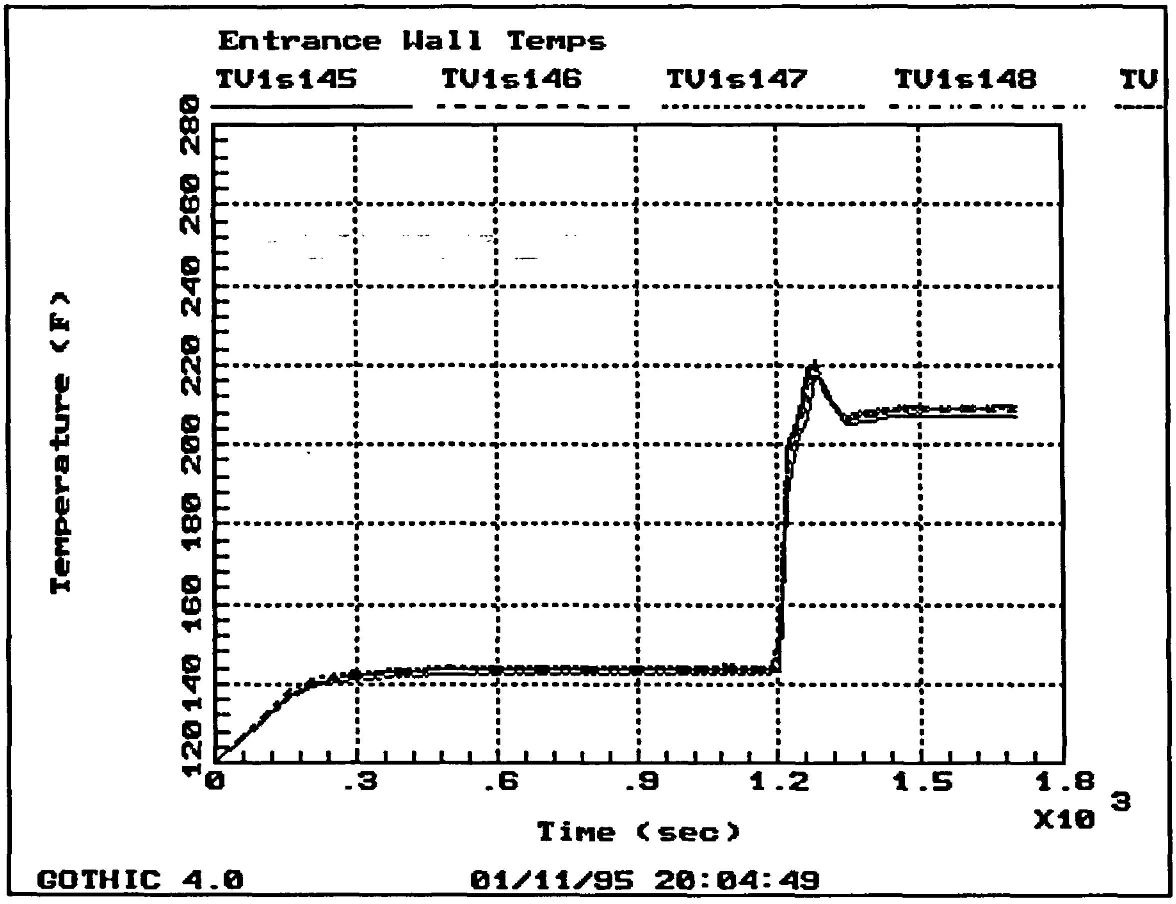

SMNH 94051
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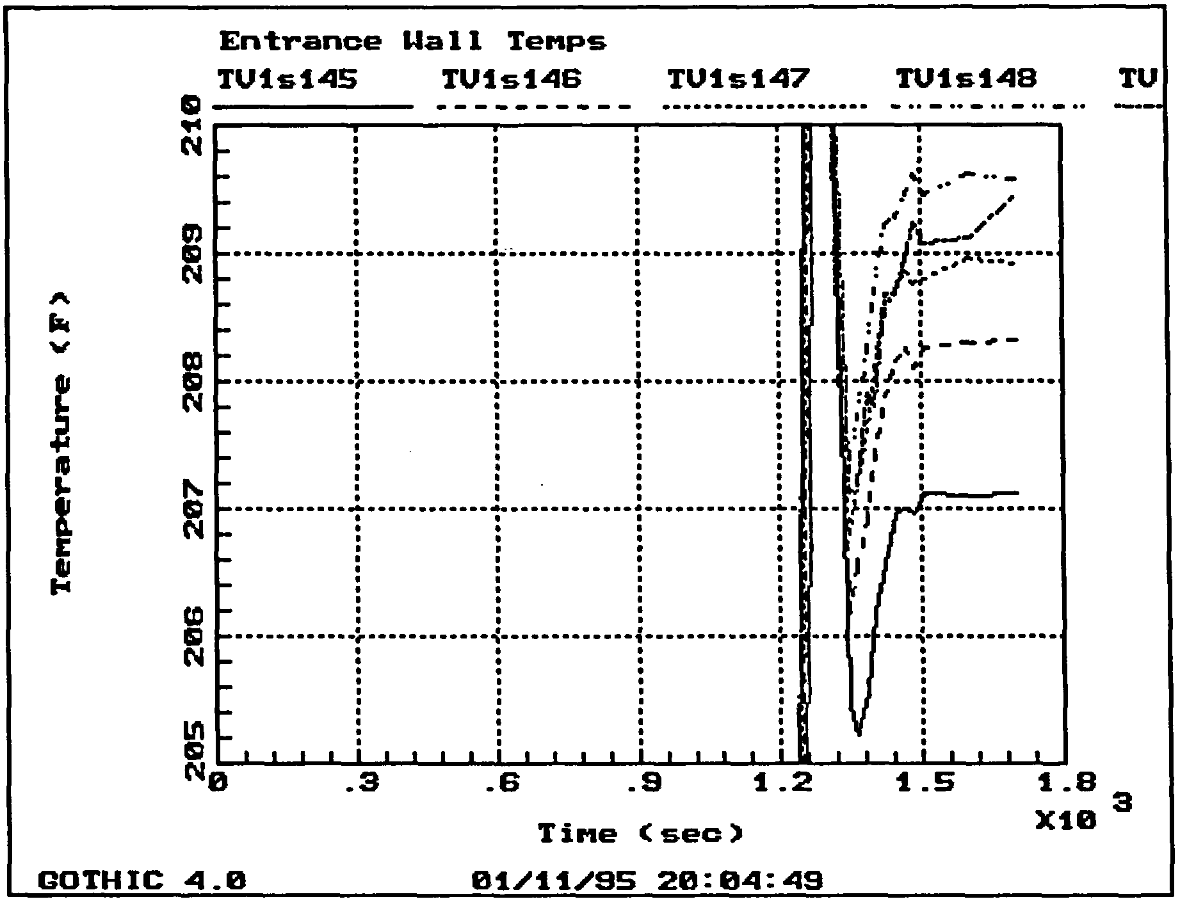
DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
08:51:07 13-JAN-95
GOTHIC Version 4.0 - August 1993



DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
07:13:28 12-JAN-95
GOTHIC Version 4.0 - August 1993

SMNH 94051
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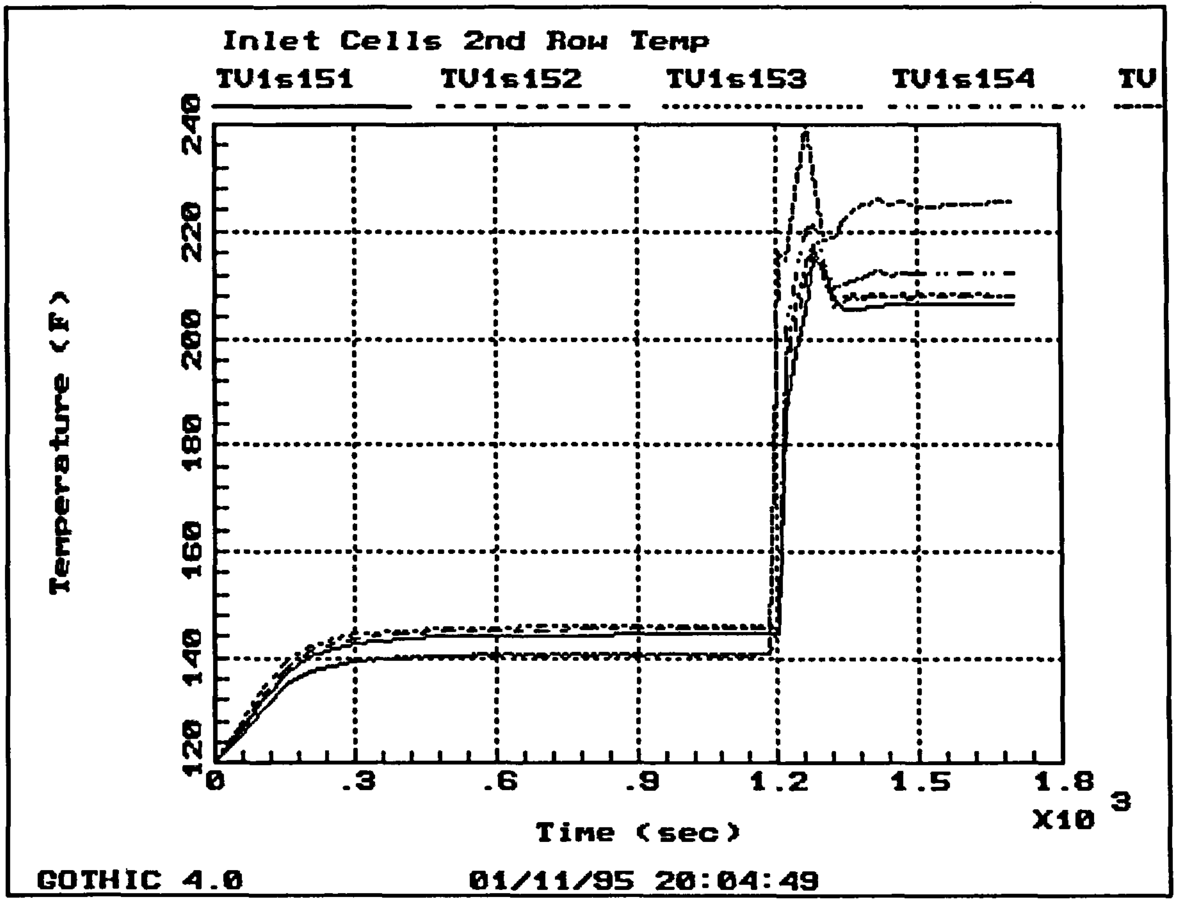
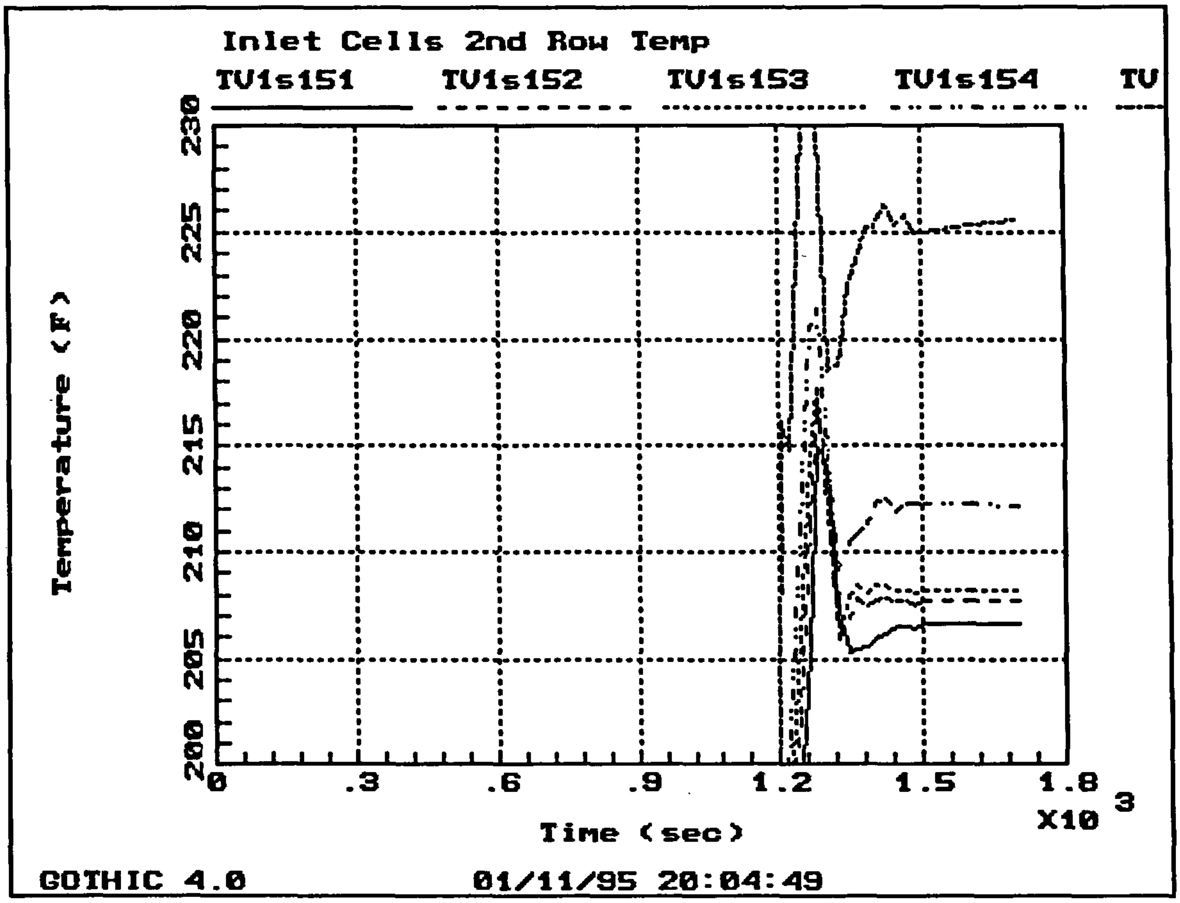


SMNH94057
68/145

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
07:14:14 12-JAN-95
GOTHIC Version 4.0 - August 1993



DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
07:14:44 12-JAN-95
GOTHIC Version 4.0 - August 1993

SMNH 94051
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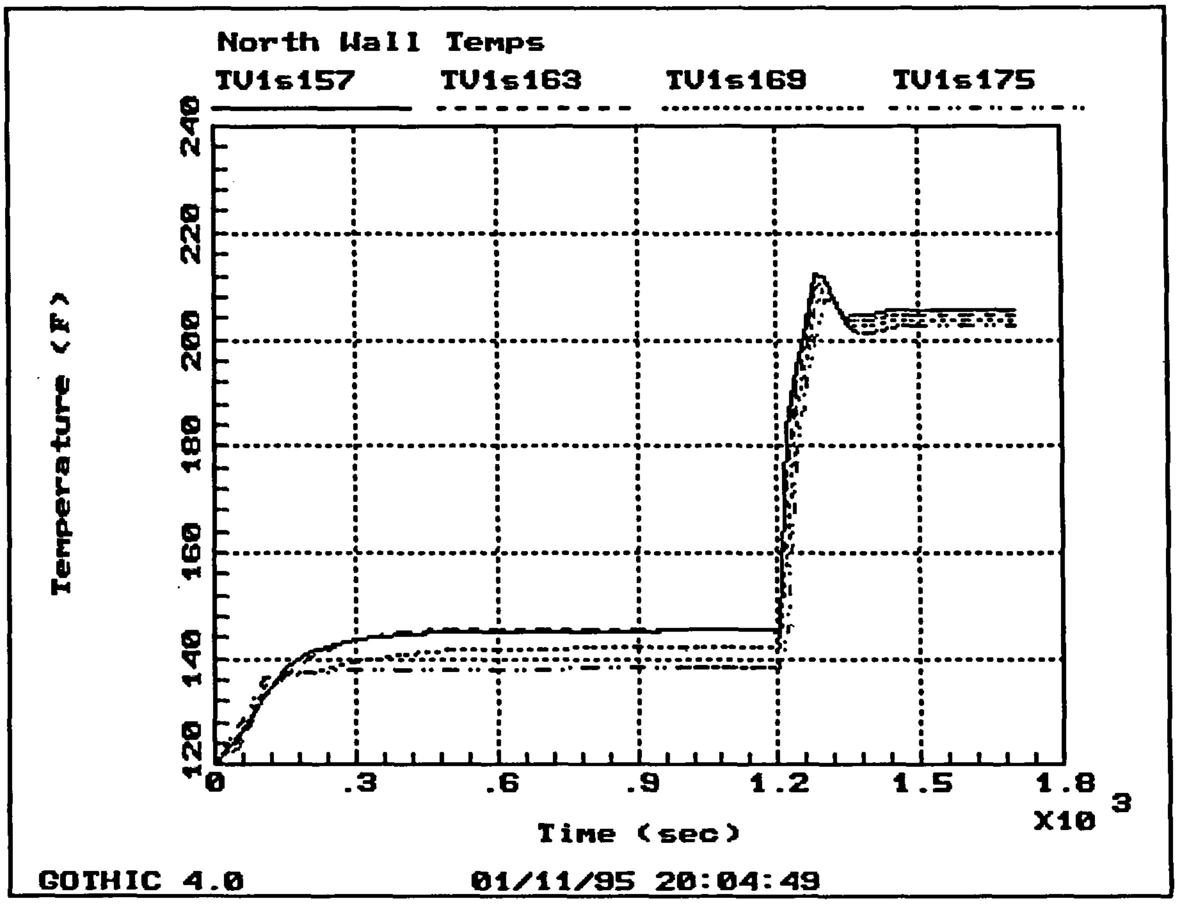
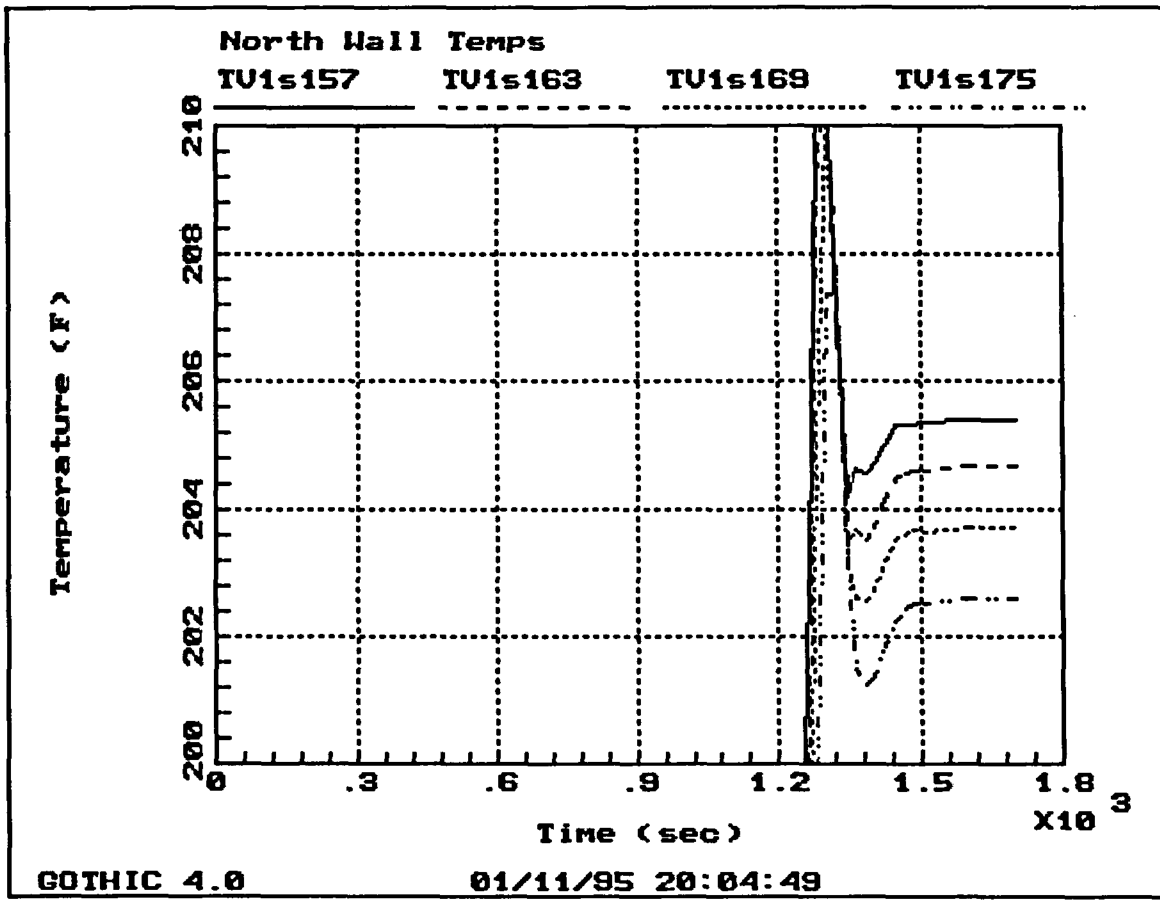


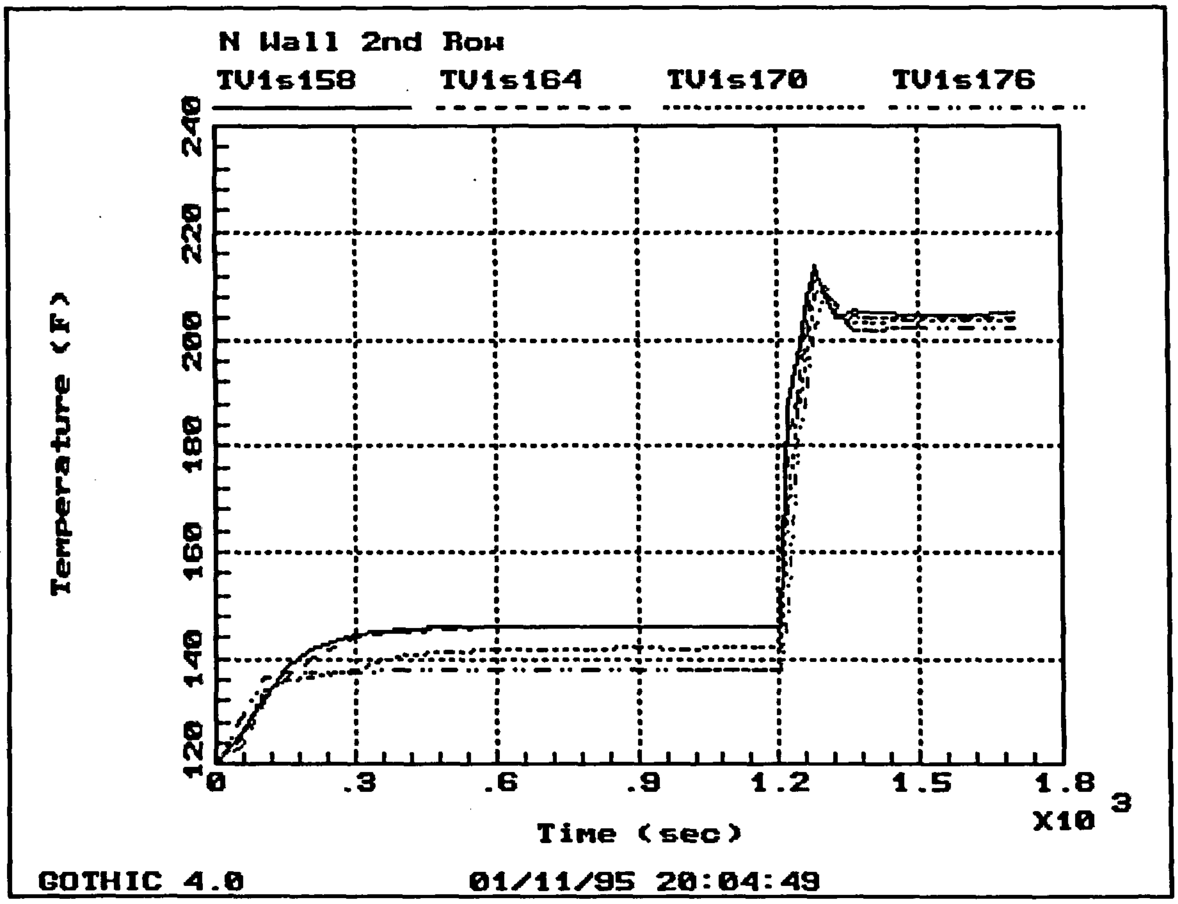
DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
07:15:20 12-JAN-95
GOTHIC Version 4.0 - August 1993

SMNH 94051
70/145



SMNH 94051
71/145

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
07:15:53 12-JAN-95
GOTHIC Version 4.0 - August 1993



DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
08:53:33 13-JAN-95
GOTHIC Version 4.0 - August 1993

SMN#94051
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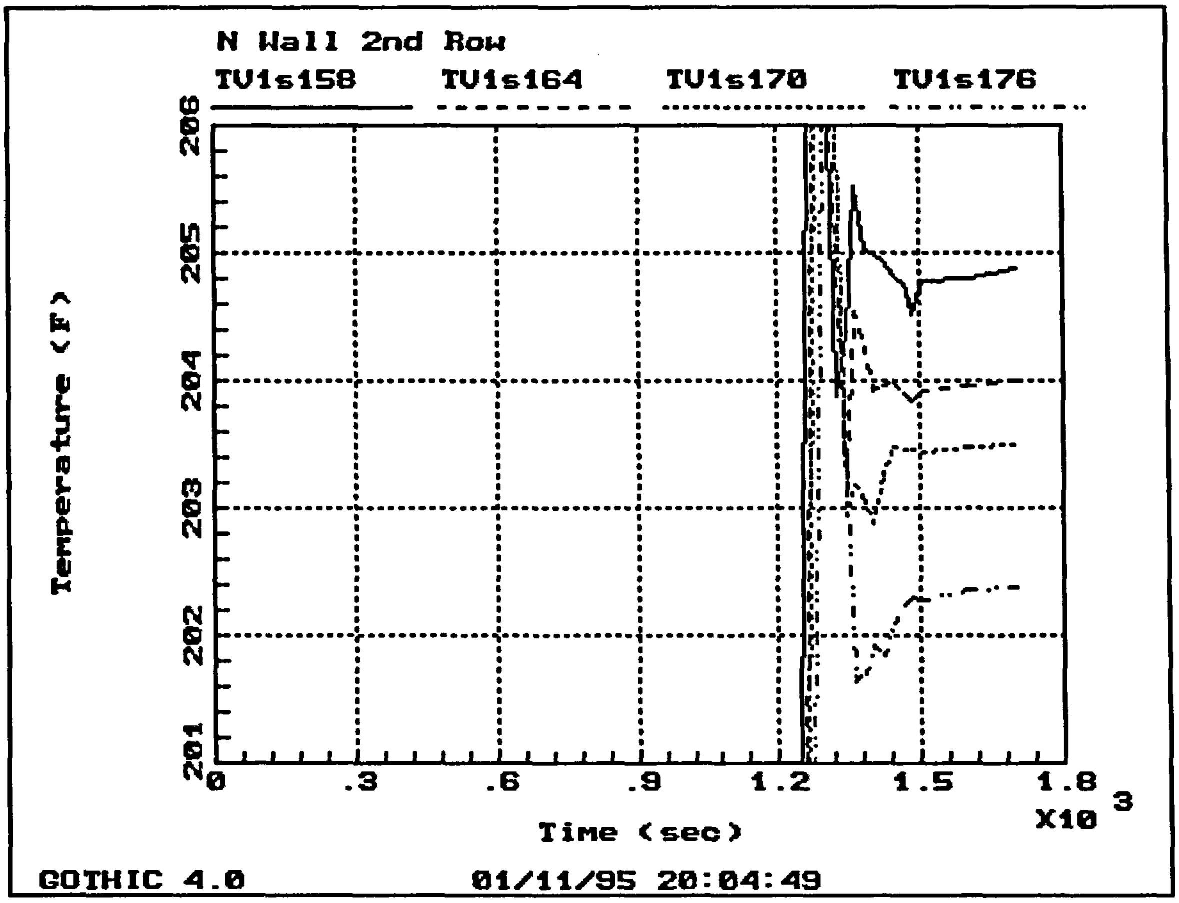

SMNH 94057
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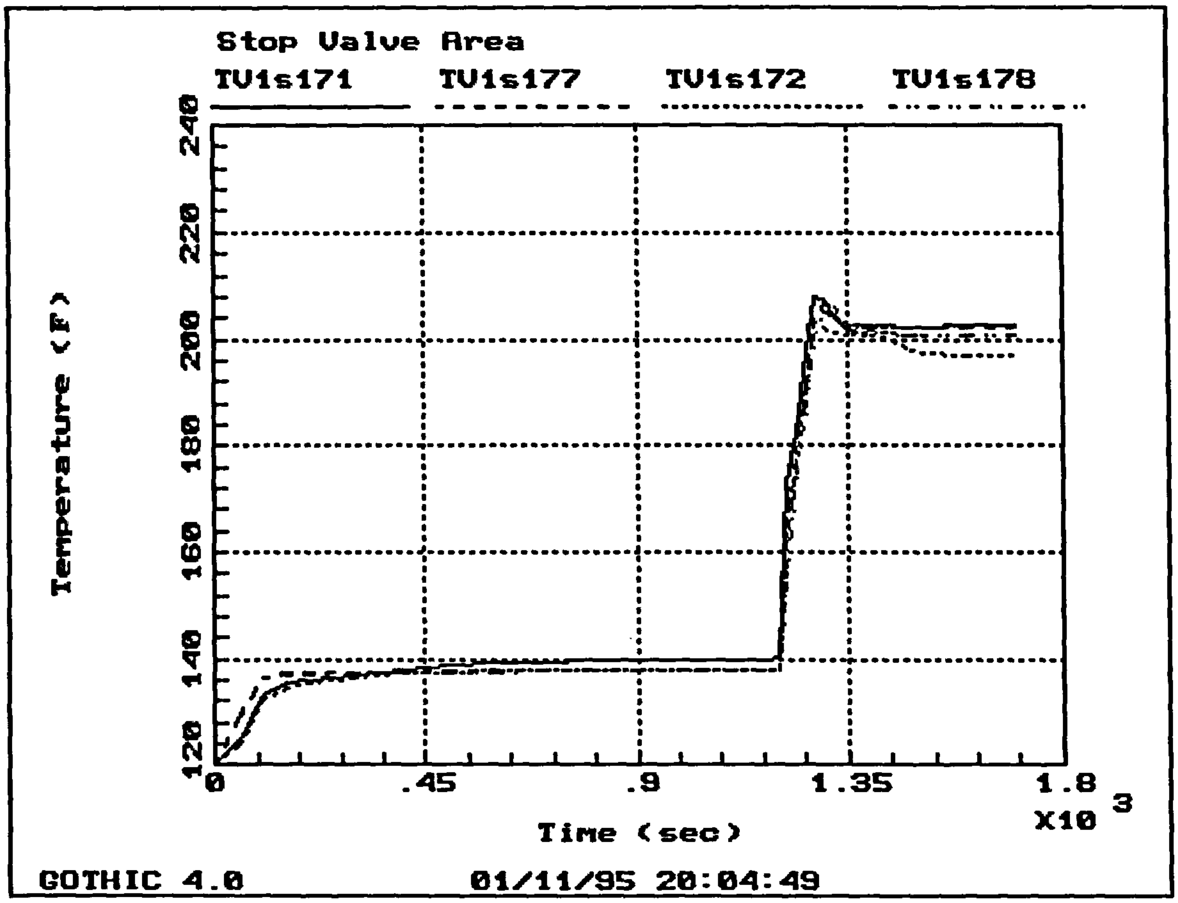
DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
07:17:06 12-JAN-95
GOTHIC Version 4.0 - August 1993



SMN H-94051
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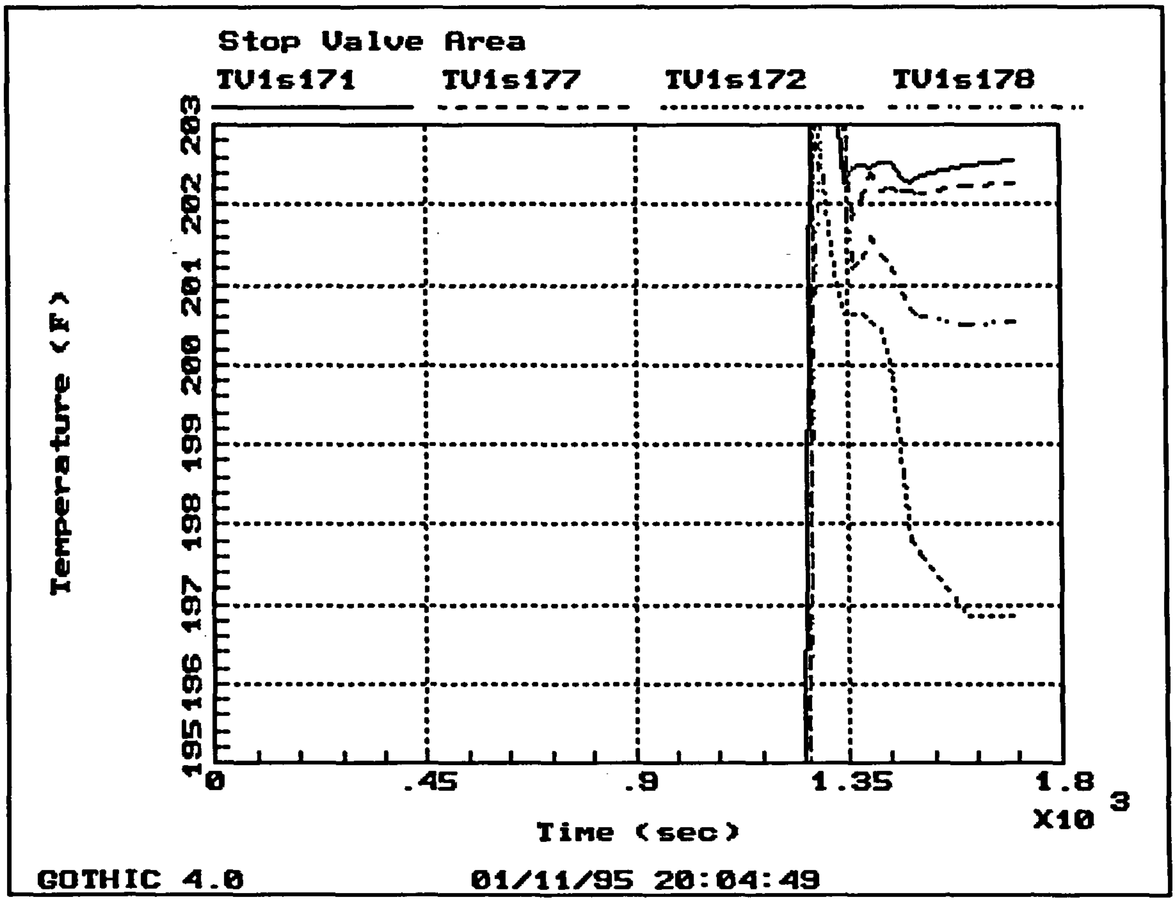
DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
07:18:15 12-JAN-95
GOTHIC Version 4.0 - August 1993



SMNH 94051
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DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
07:18:47 12-JAN-95
GOTHIC Version 4.0 - August 1993

Flow Paths - Table 1

F.P. #	Description	Vol A	Elev (ft)	Ht (ft)	Vol B	Elev (ft)	Ht (ft)
1	HVAC Out	1s70	140.	6.	1F	140.	6.
2	HVAC 3000-2	1s53	140.	2.	2F	140.	2.
3	HVAC 3000-3	1s59	140.	2.	3F	140.	2.
4	HVAC 2500-1	1s65	140.	2.	4F	140.	2.
5	HVAC 2500-2	1s71	140.	2.	5F	140.	2.
6	el 112-1	1s30	112.1	17.	6P	112.1	17.
7	el 112-2	1s36	112.1	17.	7P	112.1	17.
8	el 130-1	1s48	130.1	16.	8P	130.1	16.
9	el 130-2	1s66	130.1	16.	9P	130.1	16.
10	el 130-3	1s72	130.1	16.	10P	130.1	16.
11	el 147-1	1s78	147.0	3.9	11P	147.0	3.9
12	el 147-2	1s84	147.0	3.9	12P	147.0	3.9
13	el 147-3	1s102	147.0	3.9	13P	147.0	3.9
14	el 147-4	1s108	147.0	3.9	14P	147.0	3.9
15	el 151-1	1s114	151.0	3.9	15P	151.0	3.9
16	el 151-2	1s120	151.0	3.9	16P	151.0	3.9
17	el 151-3	1s138	151.0	3.9	17P	151.0	3.9
18	el 151-4	1s144	151.0	3.9	18P	151.0	3.9
19	el 155-1	1s150	155.0	3.9	19P	155.0	3.9
20	el 155-2	1s156	155.0	3.9	20P	155.0	3.9
21	el 155-3	1s174	155.0	3.9	21P	155.0	3.9
22	el 155-4	1s180	155.0	3.9	22P	155.0	3.9
23	el 130-5	1s60	130.1	16.	24P	130.1	16.
24	el 130-4	1s54	130.1	16.	23P	130.1	16.
25	el 147-5	1s96	147.	3.9	25P	147.	3.9
26	el 147-6	1s90	147.	3.9	26P	147.	3.9
27	el 151-5	1s126	151.	3.9	27P	151.	3.9
28	el 151-6	1s132	151.	3.9	28P	151.	3.9
29	el 155-5	1s162	155.	3.9	29P	155.	3.9
30	el 155-6	1s168	155.	3.9	30P	155.	3.9
31	Leakage Flow	1s119	151.	3.9	31F	151.	3.9
32	Leakage Flow	1s83	147.	3.9	32F	147.	3.9

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DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Flow Paths - Table 2

Flow Path #	Flow Area (ft2)	Hyd. Diam. (ft)	Inertia Length (ft)	Friction Length (ft)	Critical Flow Model	De-Entrmt Frac.	Mom Trn Opt
1	20.	5.	20.	20.	NO		-
2	20.	5.	20.	20.	NO		-
3	20.	5.	20.	20.	NO		-
4	20.	5.	20.	20.	NO		-
5	20.	5.	20.	20.	NO		-
6	382.	50.	50.	10.	NO		-
7	382.	50.	50.	10.	NO		-
8	98.	8.6	10.	10.	NO		-
9	362.	50.	50.	10.	NO		-
10	362.	50.	50.	10.	NO		-
11	51.2	6.1	10.	10.	NO		-
12	23.	4.7	10.	10.	NO		-
13	85.	20.	50.	10.	NO		-
14	85.	20.	50.	10.	NO		-
15	51.2	6.1	10.	10.	NO		-
16	23.	4.7	10.	10.	NO		-
17	85.	20.	50.	10.	NO		-
18	85.	20.	50.	10.	NO		-
19	51.2	6.1	10.	10.	NO		-
20	23.	4.7	10.	10.	NO		-
21	85.	20.	50.	10.	NO		-
22	85.	20.	50.	10.	NO		-
23	362.	50.	50.	10.	NO		-
24	298.	50.	50.	10.	NO		-
25	85.	20.	50.	10.	NO		-
26	78.	20.	50.	10.	NO		-
27	78.	20.	50.	10.	NO		-
28	85.	20.	50.	10.	NO		-
29	78.	20.	50.	10.	NO		-
30	85.	20.	50.	10.	NO		-
31	150.	10.	1.	1.	NO		-
32	150.	10.	1.	1.	NO		-

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DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
07:19:00 12-JAN-95
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Flow Paths - Table 3			
Flow Path #	Fwd. Loss Coeff.	Rev. Loss Coeff.	Comp. Opt.
1	0.05	0.05	OFF
2	0.05	0.05	OFF
3	0.05	0.05	OFF
4	0.05	0.05	OFF
5	0.05	0.05	OFF
6	0.05	0.05	OFF
7	0.05	0.05	OFF
8	0.5	0.5	OFF
9	0.05	0.05	OFF
10	0.05	0.05	OFF
11	0.5	0.5	OFF
12	0.5	0.5	OFF
13	0.05	0.05	OFF
14	0.05	0.05	OFF
15	0.5	0.5	OFF
16	0.5	0.5	OFF
17	0.05	0.05	OFF
18	0.05	0.05	OFF
19	0.5	0.5	OFF
20	0.5	0.5	OFF
21	0.05	0.05	OFF
22	0.05	0.05	OFF
23	0.05	0.05	OFF
24	0.05	0.05	OFF
25	0.05	0.05	OFF
26	0.05	0.05	OFF
27	0.05	0.05	OFF
28	0.05	0.05	OFF
29	0.05	0.05	OFF
30	0.05	0.05	OFF
31	0.05	0.05	OFF
32	0.05	0.05	OFF

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DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
08:32:05 12-JAN-95
GOTHIC Version 4.0 - August 1993

Control Volumes						
Vol #	Description	Vol (ft3)	Elev (ft)	Ht (ft)	Hyd. D. (ft)	Pl Area (ft2)
1s	Condenser Bay	175323.	112.	159.	100.	1436.

3D Volumes - Volume 1s
Nominal Values - Vertical

Chan. #	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor	Vari. Table
1	230.	230.	100.	0.	0.	YES
2	177.	177.	100.	0.	0.	YES
3	195.	195.	100.	0.	0.	YES
4	248.	248.	100.	0.	0.	YES
5	177.	177.	100.	0.	0.	YES
6	177.	177.	100.	0.	0.	YES
7	202.	202.	100.	0.	0.	YES
8	155.	155.	100.	0.	0.	YES
9	170.	170.	100.	0.	0.	YES
10	217.	217.	100.	0.	0.	YES
11	155.	155.	100.	0.	0.	YES
12	155.	155.	100.	0.	0.	YES
13	228.	228.	100.	0.	0.	YES
14	175.	175.	100.	0.	0.	YES
15	192.	192.	100.	0.	0.	YES
16	245.	245.	100.	0.	0.	YES
17	175.	175.	100.	0.	0.	YES
18	175.	175.	100.	0.	0.	YES
19	267.	267.	100.	0.	0.	YES
20	202.	202.	100.	0.	0.	YES
21	223.	223.	100.	0.	0.	YES
22	284.	284.	100.	0.	0.	YES
23	202.	202.	100.	0.	0.	YES
24	202.	202.	100.	0.	0.	YES
25	276.	276.	100.	0.	0.	YES
26	212.	212.	100.	0.	0.	YES
27	234.	234.	100.	0.	0.	YES
28	298.	298.	100.	0.	0.	NO
29	210.	210.	100.	0.	0.	NO
30	210.	210.	100.	0.	0.	NO
31	276.	276.	100.	0.	0.	YES
32	212.	212.	100.	0.	0.	YES
33	234.	234.	100.	0.	0.	YES
34	298.	298.	100.	0.	0.	NO
35	210.	210.	100.	0.	0.	NO
36	210.	210.	100.	0.	0.	NO

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3D Volumes - Volume 1s
Nominal Values - Horizontal

Chan. #	Dir.	Width (ft)	Loss Coeff.	Dent. Factor	Gap Mult.	Wall Factor	Vari. Table
1	L1	13.	0.	0.	1.	0.	NO
1	L2	17.7	0.	0.	1.	0.	NO
2	L1	10.	0.	0.	1.	0.	NO
2	L2	17.7	0.	0.	1.	0.	NO
3	L1	11.	0.	0.	1.	0.	NO
3	L2	17.7	0.	0.	1.	0.	NO
4	L1	14.	0.	0.	1.	0.	NO
4	L2	17.7	0.	0.	1.	0.	NO
5	L1	10.	0.	0.	1.	0.	NO
5	L2	17.7	0.	0.	1.	0.	NO
6	L1	10.	0.	0.	1.	0.	NO
6	L2	17.7	0.	0.	1.	0.	NO
7	L1	13.	0.	0.	1.	0.	NO
7	L2	15.5	0.	0.	1.	0.	NO
8	L1	10.	0.	0.	1.	0.	NO
8	L2	15.5	0.	0.	1.	0.	NO
9	L1	11.	0.	0.	1.	0.	NO
9	L2	15.5	0.	0.	1.	0.	NO
10	L1	14.	0.	0.	1.	0.	NO
10	L2	15.5	0.	0.	1.	0.	NO
11	L1	10.	0.	0.	1.	0.	NO
11	L2	15.5	0.	0.	1.	0.	NO
12	L1	10.	0.	0.	1.	0.	NO
12	L2	15.5	0.	0.	1.	0.	NO
13	L1	13.	0.	0.	1.	0.	NO
13	L2	17.5	0.	0.	1.	0.	NO
14	L1	10.	0.	0.	1.	0.	NO
14	L2	17.5	0.	0.	1.	0.	NO
15	L1	11.	0.	0.	1.	0.	NO
15	L2	17.5	0.	0.	1.	0.	NO
16	L1	14.	0.	0.	1.	0.	NO
16	L2	17.5	0.	0.	1.	0.	NO
17	L1	10.	0.	0.	1.	0.	NO
17	L2	17.5	0.	0.	1.	0.	NO
18	L1	10.	0.	0.	1.	0.	NO
18	L2	17.5	0.	0.	1.	0.	NO
19	L1	13.	0.	0.	1.	0.	NO
19	L2	20.25	0.	0.	1.	0.	NO
20	L1	10.	0.	0.	1.	0.	NO
20	L2	20.25	0.	0.	1.	0.	NO
21	L1	11.	0.	0.	1.	0.	NO
21	L2	20.25	0.	0.	1.	0.	NO
22	L1	14.	0.	0.	1.	0.	NO
22	L2	20.25	0.	0.	1.	0.	NO

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3D Volumes - Volume 1s Nominal Values - Horizontal							
Chan. #	Dir.	Width (ft)	Loss Coeff.	Dent. Factor	Gap Mult.	Wall Factor	Vari. Table
23	L1	10.	0.	0.	1.	0.	NO
23	L2	20.25	0.	0.	1.	0.	NO
24	L1	10.	0.	0.	1.	0.	NO
24	L2	20.25	0.	0.	1.	0.	NO
25	L1	13.	0.	0.	1.	0.	NO
25	L2	21.25	0.	0.	1.	0.	NO
26	L1	10.	0.	0.	1.	0.	NO
26	L2	21.25	0.	0.	1.	0.	NO
27	L1	11.	0.	0.	1.	0.	NO
27	L2	21.25	0.	0.	1.	0.	NO
28	L1	14.	0.	0.	1.	0.	NO
28	L2	21.25	0.	0.	1.	0.	NO
29	L1	10.	0.	0.	1.	0.	NO
29	L2	21.25	0.	0.	1.	0.	NO
30	L1	10.	0.	0.	1.	0.	NO
30	L2	21.25	0.	0.	1.	0.	NO
31	L1	13.	0.	0.	1.	0.	NO
31	L2	21.25	0.	0.	1.	0.	NO
32	L1	10.	0.	0.	1.	0.	NO
32	L2	21.25	0.	0.	1.	0.	NO
33	L1	11.	0.	0.	1.	0.	NO
33	L2	21.25	0.	0.	1.	0.	NO
34	L1	14.	0.	0.	1.	0.	NO
34	L2	21.25	0.	0.	1.	0.	NO
35	L1	10.	0.	0.	1.	0.	NO
35	L2	21.25	0.	0.	1.	0.	NO
36	L1	10.	0.	0.	1.	0.	NO
36	L2	21.25	0.	0.	1.	0.	NO

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3D Volumes - Volume 1s
Vertical Noding

Level	Bottom El. (ft)	Height (ft)
1	112.	18.
2	130.	17.
3	147.	4.
4	151.	4.
5	155.	4.

3D Volumes - Volume 1s
Vertical Variation - Channel 1

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.		100.	0.	0.
3	230.	230.	100.	0.	0.
4	155.	155.	100.	0.	0.
5	230.	230.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 2

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	177.	177.	100.	0.	0.
4	117.	117.	100.	0.	0.
5	177.	177.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 3

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	195.	195.	100.	0.	0.
4	128.	128.	100.	0.	0.
5	195.	195.	100.	0.	0.

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3D Volumes - Volume 1s
Vertical Variation - Channel 4

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	248.	248.	100.	0.	0.
4	146.	146.	100.	0.	0.
5	248.	248.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 5

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	177.	177.	100.	0.	0.
4	124.	124.	100.	0.	0.
5	177.	177.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 6

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	177.	177.	100.	0.	0.
4	177.	177.	100.	0.	0.
5	177.	177.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 7

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	202.	202.	100.	0.	0.
4	109.	109.	100.	0.	0.
5	202.	202.	100.	0.	0.

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3D Volumes - Volume 1s Vertical Variation - Channel 8					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	155.	155.	100.	0.	0.
4	74.	74.	100.	0.	0.
5	155.	155.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 9					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	170.	170.	100.	0.	0.
4	104.	104.	100.	0.	0.
5	170.	170.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 10					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	217.	217.	100.	0.	0.
3	217.	217.	100.	0.	0.
4	130.	130.	100.	0.	0.
5	217.	217.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 11					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	155.	155.	100.	0.	0.
3	155.	155.	100.	0.	0.
4	117.	117.	100.	0.	0.
5	155.	155.	100.	0.	0.

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3D Volumes - Volume 1s Vertical Variation - Channel 12					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	155.	155.	100.	0.	0.
3	155.	155.	100.	0.	0.
4	155.	155.	100.	0.	0.
5	155.	155.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 13					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	228.	228.	100.	0.	0.
4	123.	123.	100.	0.	0.
5	228.	228.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 14					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	175.	175.	100.	0.	0.
4	70.	70.	100.	0.	0.
5	175.	175.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 15					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	192.	192.	100.	0.	0.
4	192.	192.	100.	0.	0.
5	192.	192.	100.	0.	0.

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3D Volumes - Volume 1s Vertical Variation - Channel 16					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	245.	245.	100.	0.	0.
3	245.	245.	100.	0.	0.
4	245.	245.	100.	0.	0.
5	245.	245.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 17					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	175.	175.	100.	0.	0.
3	175.	175.	100.	0.	0.
4	175.	175.	100.	0.	0.
5	175.	175.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 18					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	175.	175.	100.	0.	0.
3	175.	175.	100.	0.	0.
4	175.	175.	100.	0.	0.
5	175.	175.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 19					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	267.	267.	100.	0.	0.
4	146.	146.	100.	0.	0.
5	267.	267.	100.	0.	0.

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3D Volumes - Volume 1s
Vertical Variation - Channel 20

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	202.	202.	100.	0.	0.
4	81.	18.	100.	0.	0.
5	202.	202.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 21

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	223.	223.	100.	0.	0.
4	223.	223.	100.	0.	0.
5	223.	223.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 22

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	284.	284.	100.	0.	0.
3	284.	284.	100.	0.	0.
4	284.	284.	100.	0.	0.
5	284.	284.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 23

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	202.	202.	100.	0.	0.
3	202.	202.	100.	0.	0.
4	202.	202.	100.	0.	0.
5	202.	202.	100.	0.	0.

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3D Volumes - Volume 1s Vertical Variation - Channel 24					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	202.	202.	100.	0.	0.
3	202.	202.	100.	0.	0.
4	202.	202.	100.	0.	0.
5	202.	202.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 25					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	276.	276.	100.	0.	0.
4	148.	148.	100.	0.	0.
5	276.	276.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 26					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	212.	212.	100.	0.	0.
4	88.	88.	100.	0.	0.
5	212.	212.	100.	0.	0.

3D Volumes - Volume 1s Vertical Variation - Channel 27					
Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	234.	234.	100.	0.	0.
4	168.	168.	100.	0.	0.
5	234.	234.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 31

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	276.	276.	100.	0.	0.
4	210.	210.	100.	0.	0.
5	276.	276.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 32

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	212.	212.	100.	0.	0.
4	152.	152.	100.	0.	0.
5	212.	212.	100.	0.	0.

3D Volumes - Volume 1s
Vertical Variation - Channel 33

Level	Area (ft2)	Ver. Flow Ar. (ft2)	Hyd. D. (ft)	Loss Coeff.	De-ent. Factor
1	0.	0.	100.	0.	0.
2	0.	0.	100.	0.	0.
3	234.	234.	100.	0.	0.
4	168.	168.	100.	0.	0.
5	234.	234.	100.	0.	0.

Turbulence Parameters

Vol #	Visc. Shear	Turb. Shear	Liquid Mix.L. (ft)	Vapor Mix.L (ft)	Liquid Pr No.	Vapor Pr No.
1s	NO	NO			1.	1.

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Fluid Boundary Conditions - Table 1

BC#	Description	Press. (psia)	FF	Temp. (F)	FF	Flow (lbm/s)	FF	ON Trip	OFF Trip
1F	HVAC out	14.6924		110		-14.0			
2F	HVAC 3000-2	14.6924		110		3			
3F	HVAC 3000-3	14.6924		110		3			
4F	HVAC 2500-1	14.6924		110		2.5			
5F	HVAC 2500-2	14.6924		110		2.5			
6P	el 112-1	14.7		139					
7P	el 112-2	14.7		139					
8P	el 130-1	14.6924		139					
9P	el 130-2	14.6924		139					
10P	el 130-3	14.6924		139					
11P	el 147-1	14.6852		139					
12P	el 147-2	14.6852		139					
13P	el 147-3	14.6852		139					
14P	el 147-4	14.6852		139					
15P	el 151-1	14.6836		139					
16P	el 151-2	14.6836		139					
17P	el 151-3	14.6836		139					
18P	el 151-4	14.6836		139					
19P	el 155-1	14.6819		139					
20P	el 155-2	14.6819		139					
21P	el 155-3	14.6819		139					
22P	el 155-4	14.6819		139					
23P	el 130-4	14.6924		139					
24P	el 130-5	14.6924		139					
25P	el 147-5	14.6852		139					
26P	el 147-6	14.6852		139					
27P	el 151-5	14.6836		139					
28P	el 151-6	14.6836		139					
29P	el 155-5	14.6819		139					
30P	el 155-6	14.6819		139					
31F	Steam Leakage	14.7	0	E1191.4	0	13.9	1	1	
32F	Steam Leakage	14.7	0	E1191.4	0	13.9	1	1	

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Fluid Boundary Conditions - Table 2

BC#	Liq. V Frac.	FF	Stm. P.R.	FF	Drop D (in)	FF	Cpld BC#	Flow Frac.	FF	Heat (Btu/s)	FF
1F	0.		0.1152								
2F	0.		0.1152								
3F	0.		0.1152								
4F	0.		0.1152								
5F	0.		0.1152								
6P	0.		0.1151								
7P	0.		0.1151								
8P	0.		0.1152								
9P	0.		0.1152								
10P	0.		0.1152								
11P	0.		0.1152								
12P	0.		0.1152								
13P	0.		0.1152								
14P	0.		0.1152								
15P	0.		0.1152								
16P	0.		0.1152								
17P	0.		0.1152								
18P	0.		0.1152								
19P	0.		0.1152								
20P	0.		0.1152								
21P	0.		0.1152								
22P	0.		0.1152								
23P	0.		0.1152								
24P	0.		0.1152								
25P	0.		0.1152								
26P	0.		0.1152								
27P	0.		0.1152								
28P	0.		0.1152								
29P	0.		0.1152								
30P	0.		0.1152								
31F	0.		1.		0.01						
32F	0.		1.		0.01						

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Fluid Boundary Conditions - Table 3
Gas Pressure Ratios

BC#	Air	FF	Ar	FF	He	FF	H2	FF
1F	1.							
2F	1.							
3F	1.							
4F	1.							
5F	1.							
6P	1.							
7P	1.							
8P	1.							
9P	1.							
10P	1.							
11P	1.							
12P	1.							
13P	1.							
14P	1.							
15P	1.							
16P	1.							
17P	1.							
18P	1.							
19P	1.							
20P	1.							
21P	1.							
22P	1.							
23P	1.							
24P	1.							
25P	1.							
26P	1.							
27P	1.							
28P	1.							
29P	1.							
30P	1.							
31F	0.							
32F	0.							

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Fluid Boundary Conditions - Table 4
Gas Pressure Ratios

BC#	Kr	FF	N2	FF	O2	FF	Xe	FF
1F								
2F								
3F								
4F								
5F								
6P								
7P								
8P								
9P								
10P								
11P								
12P								
13P								
14P								
15P								
16P								
17P								
18P								
19P								
20P								
21P								
22P								
23P								
24P								
25P								
26P								
27P								
28P								
29P								
30P								
31F								
32F								

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Flow Paths - Table 1

F.P. #	Description	Vol A	Elev (ft)	Ht (ft)	Vol B	Elev (ft)	Ht (ft)
1	HVAC Out	1s70	140.	6.	1F	140.	6.
2	HVAC 3000-2	1s53	140.	2.	2F	140.	2.
3	HVAC 3000-3	1s59	140.	2.	3F	140.	2.
4	HVAC 2500-1	1s65	140.	2.	4F	140.	2.
5	HVAC 2500-2	1s71	140.	2.	5F	140.	2.
6	el 112-1	1s30	112.1	17.	6P	112.1	17.
7	el 112-2	1s36	112.1	17.	7P	112.1	17.
8	el 130-1	1s48	130.1	16.	8P	130.1	16.
9	el 130-2	1s66	130.1	16.	9P	130.1	16.
10	el 130-3	1s72	130.1	16.	10P	130.1	16.
11	el 147-1	1s78	147.0	3.9	11P	147.0	3.9
12	el 147-2	1s84	147.0	3.9	12P	147.0	3.9
13	el 147-3	1s102	147.0	3.9	13P	147.0	3.9
14	el 147-4	1s108	147.0	3.9	14P	147.0	3.9
15	el 151-1	1s114	151.0	3.9	15P	151.0	3.9
16	el 151-2	1s120	151.0	3.9	16P	151.0	3.9
17	el 151-3	1s138	151.0	3.9	17P	151.0	3.9
18	el 151-4	1s144	151.0	3.9	18P	151.0	3.9
19	el 155-1	1s150	155.0	3.9	19P	155.0	3.9
20	el 155-2	1s156	155.0	3.9	20P	155.0	3.9
21	el 155-3	1s174	155.0	3.9	21P	155.0	3.9
22	el 155-4	1s180	155.0	3.9	22P	155.0	3.9
23	el 130-5	1s60	130.1	16.	24P	130.1	16.
24	el 130-4	1s54	130.1	16.	23P	130.1	16.
25	el 147-5	1s96	147.	3.9	25P	147.	3.9
26	el 147-6	1s90	147.	3.9	26P	147.	3.9
27	el 151-5	1s126	151.	3.9	27P	151.	3.9
28	el 151-6	1s132	151.	3.9	28P	151.	3.9
29	el 155-5	1s162	155.	3.9	29P	155.	3.9
30	el 155-6	1s168	155.	3.9	30P	155.	3.9
31	Leakage Flow	1s119	151.	3.9	31F	151.	3.9
32	Leakage Flow	1s83	147.	3.9	32F	147.	3.9

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Flow Paths - Table 2							
Flow Path #	Flow Area (ft2)	Hyd. Diam. (ft)	Inertia Length (ft)	Friction Length (ft)	Critical Flow Model	De-Entrmt Frac.	Mom Trn Opt
1	20.	5.	20.	20.	NO		-
2	20.	5.	20.	20.	NO		-
3	20.	5.	20.	20.	NO		-
4	20.	5.	20.	20.	NO		-
5	20.	5.	20.	20.	NO		-
6	382.	50.	50.	10.	NO		-
7	382.	50.	50.	10.	NO		-
8	98.	8.6	10.	10.	NO		-
9	362.	50.	50.	10.	NO		-
10	362.	50.	50.	10.	NO		-
11	51.2	6.1	10.	10.	NO		-
12	23.	4.7	10.	10.	NO		-
13	85.	20.	50.	10.	NO		-
14	85.	20.	50.	10.	NO		-
15	51.2	6.1	10.	10.	NO		-
16	23.	4.7	10.	10.	NO		-
17	85.	20.	50.	10.	NO		-
18	85.	20.	50.	10.	NO		-
19	51.2	6.1	10.	10.	NO		-
20	23.	4.7	10.	10.	NO		-
21	85.	20.	50.	10.	NO		-
22	85.	20.	50.	10.	NO		-
23	362.	50.	50.	10.	NO		-
24	298.	50.	50.	10.	NO		-
25	85.	20.	50.	10.	NO		-
26	78.	20.	50.	10.	NO		-
27	78.	20.	50.	10.	NO		-
28	85.	20.	50.	10.	NO		-
29	78.	20.	50.	10.	NO		-
30	85.	20.	50.	10.	NO		-
31	150.	10.	1.	1.	NO		-
32	150.	10.	1.	1.	NO		-

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Flow Paths - Table 3

Flow Path #	Fwd. Loss Coeff.	Rev. Loss Coeff.	Comp. Opt.
1	0.05	0.05	OFF
2	0.05	0.05	OFF
3	0.05	0.05	OFF
4	0.05	0.05	OFF
5	0.05	0.05	OFF
6	0.05	0.05	OFF
7	0.05	0.05	OFF
8	0.5	0.5	OFF
9	0.05	0.05	OFF
10	0.05	0.05	OFF
11	0.5	0.5	OFF
12	0.5	0.5	OFF
13	0.05	0.05	OFF
14	0.05	0.05	OFF
15	0.5	0.5	OFF
16	0.5	0.5	OFF
17	0.05	0.05	OFF
18	0.05	0.05	OFF
19	0.5	0.5	OFF
20	0.5	0.5	OFF
21	0.05	0.05	OFF
22	0.05	0.05	OFF
23	0.05	0.05	OFF
24	0.05	0.05	OFF
25	0.05	0.05	OFF
26	0.05	0.05	OFF
27	0.05	0.05	OFF
28	0.05	0.05	OFF
29	0.05	0.05	OFF
30	0.05	0.05	OFF
31	0.05	0.05	OFF
32	0.05	0.05	OFF

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Thermal Conductors									
Cond #	Description	Vol A	HT Co	Vol B	HT Co	Cond Type	S. A. (ft2)	Init. T.(F)	Or
1	cell 28 conc	1s28	1	1s28	2	1	932.	120.	I
2	cell 29 conc	1s29	1	1s29	2	1	390.	120.	I
3	cell 30 conc	1s30	1	1s30	2	1	390.	120.	I
4	cell 34 conc	1s34	1	1s34	2	1	932.	120.	I
5	cell 35 conc	1s35	1	1s35	2	1	390.	120.	I
6	cell 36 conc	1s36	1	1s36	2	1	390.	120.	I
7	cell 46 conc	1s46	1	1s46	2	1	719.	120.	I
8	cell 47 conc	1s47	1	1s47	2	1	325.	120.	I
9	cell 48 conc	1s48	1	1s48	2	1	325.	120.	I
10	cell 52 conc	1s52	1	1s52	2	1	543.	120.	I
11	cell 53 conc	1s53	1	1s53	2	1	175.	120.	I
12	cell 54 conc	1s54	1	1s54	2	1	175.	120.	I
13	cell 58 conc	1s58	1	1s58	2	1	628.	120.	I
14	cell 59 conc	1s59	1	1s59	2	1	203.	120.	I
15	cell 60 conc	1s60	1	1s60	2	1	203.	120.	I
16	cell 64 conc	1s64	1	1s64	2	1	361.	120.	I
17	cell 70 conc	1s70	1	1s70	2	1	361.	120.	I
18	cell 73 conc	1s73	1	1s73	2	1	354.	140.	I
19	cell 74 conc	1s74	1	1s74	2	1	217.	140.	I
20	cell 75 conc	1s75	1	1s75	2	1	239.	140.	I
21	cell 76 conc	1s76	1	1s76	2	1	304.	140.	I
22	cell 77 conc	1s77	1	1s77	2	1	217.	140.	I
23	cell 78 conc	1s78	1	1s78	2	1	217.	140.	I
24	cell 79 conc	1s79	1	1s79	2	1	264.	140.	I
25	cell 80 conc	1s80	1	1s80	2	1	155.	140.	I
26	cell 81 conc	1s81	1	1s81	2	1	170.	140.	I
27	cell 85 conc	1s85	1	1s85	2	1	298.	140.	I
28	cell 86 conc	1s86	1	1s86	2	1	175.	140.	I
29	cell 87 conc	1s87	1	1s87	2	1	192.	140.	I
30	cell 91 conc	1s91	1	1s91	2	1	348.	140.	I
31	cell 92 conc	1s92	1	1s92	2	1	202.	140.	I
32	cell 93 conc	1s93	1	1s93	2	1	223.	140.	I
33	cell 97 conc	1s97	1	1s97	2	1	361.	140.	I
34	cell 98 conc	1s98	1	1s98	2	1	212.	140.	I
35	cell 99 conc	1s99	1	1s99	2	1	234.	140.	I
36	cell 103 conc	1s103	1	1s103	2	1	413.	140.	I
37	cell 104 conc	1s104	1	1s104	2	1	252.	140.	I
38	cell 105 conc	1s105	1	1s105	2	1	278.	140.	I
39	cell 109 conc	1s109	1	1s109	2	1	123.	150.	I
40	cell 110 conc	1s110	1	1s110	2	1	40.	150.	I
41	cell 111 conc	1s111	1	1s111	2	1	44.	150.	I
42	cell 112 conc	1s112	1	1s112	2	1	56.	150.	I
43	cell 113 conc	1s113	1	1s113	2	1	40.	150.	I
44	cell 114 conc	1s114	1	1s114	2	1	40.	150.	I
45	cell 115 conc	1s115	1	1s115	2	1	62.	150.	I

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Thermal Conductors									
Cond #	Description	Vol A	HT Co	Vol B	HT Co	Cond Type	S. A. (ft2)	Init. T.(F)	Or
46	cell 121 conc	1s121	1	1s121	2	1	70.	150.	I
47	cell 127 conc	1s127	1	1s127	2	1	85.	150.	I
48	cell 133 conc	1s133	1	1s133	2	1	85.	150.	I
49	cell 139 conc	1s139	1	1s139	2	1	137.	150.	I
50	cell 140 conc	1s140	1	1s140	2	1	40.	150.	I
51	cell 141 conc	1s141	1	1s141	2	1	44.	150.	I
52	cell 145 conc	1s145	1	1s145	2	1	354.	150.	I
53	cell 146 conc	1s146	1	1s146	2	1	217.	150.	I
54	cell 147 conc	1s147	1	1s147	2	1	239.	150.	I
55	cell 148 conc	1s148	1	1s148	2	1	304.	150.	I
56	cell 149 conc	1s149	1	1s149	2	1	217.	150.	I
57	cell 150 conc	1s150	1	1s150	2	1	217.	150.	I
58	cell 151 conc	1s151	1	1s151	2	1	264.	150.	I
59	cell 152 conc	1s152	1	1s152	2	1	155.	150.	I
60	cell 153 conc	1s153	1	1s153	2	1	170.	150.	I
61	cell 154 conc	1s154	1	1s154	2	1	217.	150.	I
62	cell 155 conc	1s155	1	1s155	2	1	155.	150.	I
63	cell 156 conc	1s156	1	1s156	2	1	155.	150.	I
64	cell 157 conc	1s157	1	1s157	2	1	298.	150.	I
65	cell 158 conc	1s158	1	1s158	2	1	175.	150.	I
66	cell 159 conc	1s159	1	1s159	2	1	192.	150.	I
67	cell 160 conc	1s160	1	1s160	2	1	245.	150.	I
68	cell 161 conc	1s161	1	1s161	2	1	175.	150.	I
69	cell 162 conc	1s162	1	1s162	2	1	175.	150.	I
70	cell 163 conc	1s163	1	1s163	2	1	348.	150.	I
71	cell 164 conc	1s164	1	1s164	2	1	202.	150.	I
72	cell 165 conc	1s165	1	1s165	2	1	223.	150.	I
73	cell 166 conc	1s166	1	1s166	2	1	284.	150.	I
74	cell 167 conc	1s167	1	1s167	2	1	202.	150.	I
75	cell 168 conc	1s168	1	1s168	2	1	202.	150.	I
76	cell 169 conc	1s169	1	1s169	2	1	361.	150.	I
77	cell 170 conc	1s170	1	1s170	2	1	212.	150.	I
78	cell 171 conc	1s171	1	1s171	2	1	234.	150.	I
79	cell 172 conc	1s172	1	1s172	2	1	298.	150.	I
80	cell 173 conc	1s173	1	1s173	2	1	212.	150.	I
81	cell 174 conc	1s174	1	1s174	2	1	212.	150.	I
82	cell 175 conc	1s175	1	1s175	2	1	413.	150.	I
83	cell 176 conc	1s176	1	1s176	2	1	252.	150.	I
84	cell 177 conc	1s177	1	1s177	2	1	278.	150.	I
85	cell 178 conc	1s178	1	1s178	2	1	298.	150.	I
86	cell 179 conc	1s179	1	1s179	2	1	212.	150.	I
87	cell 180 conc	1s180	1	1s180	2	1	212.	150.	I

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Heat Transfer Coefficient Types								
Type #	Option	Heat Release (Btu)	Peak Time (s)	Const Value	Curv #	Cond Opt.	Scnd. HTC	Phase HT Opt.
1	Direct/Co	0.	0.	0.	0	UCHID		VAP
2	Temp. Spe	0.	0.	120.	0			VAP

Thermal Conductor Types							
Type #	Description	Geom	Thick. (in)	O.D. (in)	Regions	Heat (Btu/ft3-s)	Heat FF
1	Concrete slab	WALL	60.	0.	16	0.	

Thermal Conductor Type 1 Concrete slab					
Region	Mat. #	Bdry. (in)	Thick (in)	Sub-regs.	Heat Factor
1	1	0.	0.1	5	0.
2	1	0.1	0.2	5	0.
3	1	0.3	0.4	2	0.
4	1	0.7	0.8	1	0.
5	1	1.5	1.5	1	0.
6	1	3.	3.	1	0.
7	1	6.	6.	1	0.
8	1	12.	12.	1	0.
9	1	24.	12.	1	0.
10	1	36.	12.	1	0.
11	1	48.	6.	1	0.
12	1	54.	3.	1	0.
13	1	57.	1.5	1	0.
14	1	58.5	0.8	1	0.
15	1	59.3	0.5	1	0.
16	1	59.8	0.2	1	0.

Materials	
Type #	Description
1	concrete

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Material Type 1 concrete			
Temp. (F)	Density (lbm/ft3)	Cond. (Btu/hr-ft-F)	Sp. Heat (Btu/lbm-F)
0.	140.	1.	0.2
1000.	140.	1.	0.2

Cooler/Heater

Heater Cooler #	Description	Vol. #	On Trip #	Off Trip #	Flow Rate (CFM)	Flow Rate FF	Heat Rate (Btu/s)	Heat Rate FF	Phs Opt	Ct I
1H	cell 109	1s109					3.689		VTI	1s
2H	cell 110	1s110					2.951		VTI	1s
3H	cell 111	1s111					3.276		VTI	1s
4H	cell 112	1s112					5.002		VTI	1s
5H	cell 113	1s113			0.		2.612		VTI	1s
6H	cell 115	1s115					4.574		VTI	1s
7H	cell 116	1s116					3.984		VTI	1s
8H	cell 117	1s117					3.246		VTI	1s
9H	cell 118	1s118					4.279		VTI	1s
10H	cell 119	1s119					1.844		VTI	1s
11H	cell 121	1s121					5.164		VTI	1s
12H	cell 122	1s122					5.164		VTI	1s
13H	cell 127	1s127					5.976		VTI	1s
14H	cell 128	1s128					5.976		VTI	1s
15H	cell 133	1s133					6.271		VTI	1s
16H	cell 134	1s134					6.123		VTI	1s
17H	cell 135	1s135					3.246		VTI	1s
18H	cell 139	1s139					3.246		VTI	1s
19H	cell 140	1s140					2.951		VTI	1s
20H	cell 141	1s141					3.246		VTI	1s

Component Trips

Trip #	Sense Var.	Sensor 1 Loc.	Sensor 2 Loc.	Var. Limit	Set Point	Delay Time	Rset Trip	Cond Trip	Cond Type
1	TIME			UPPER	1200.	0.			AND

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Functions				
FF#	Description	Ind. Var.	Dep. Var.	Points
0	Constant	-	-	0
1	BC on Trip	Ind. Var.	Dep. Var.	4

Function 1 BC on Trip Ind. Var.: Dep. Var.:			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	0.	0.1	1.
1800.1	1.	100000.	1.

Volume Initial Conditions						
Vol #	Pressure (psia)	Temp. (F)	Relative Humidity (%)	Liquid Volume Fractio	Ice Volume Fract.	Ice Surf. A. (ft2)
def	14.7	80.	60.	0.	0.	0.
1s28	14.7	120.	100.	0.	0.	0.
1s29	14.7	120.	100.	0.	0.	0.
1s30	14.7	120.	100.	0.	0.	0.
1s34	14.7	120.	100.	0.	0.	0.
1s35	14.7	120.	100.	0.	0.	0.
1s36	14.7	120.	100.	0.	0.	0.
1s46	14.6924	120.	100.	0.	0.	0.
1s47	14.6924	120.	100.	0.	0.	0.
1s48	14.6924	120.	100.	0.	0.	0.
1s52	14.6924	120.	100.	0.	0.	0.
1s53	14.6924	120.	100.	0.	0.	0.
1s54	14.6924	120.	100.	0.	0.	0.
1s58	14.6924	120.	100.	0.	0.	0.
1s59	14.6924	120.	100.	0.	0.	0.
1s60	14.6924	120.	100.	0.	0.	0.
1s64	14.6924	120.	100.	0.	0.	0.
1s65	14.6924	120.	100.	0.	0.	0.
1s66	14.6924	120.	100.	0.	0.	0.
1s70	14.6924	120.	100.	0.	0.	0.
1s71	14.6924	120.	100.	0.	0.	0.
1s72	14.6924	120.	100.	0.	0.	0.
1s73	14.6836	120.	100.	0.	0.	0.
1s74	14.6836	120.	100.	0.	0.	0.
1s75	14.6836	120.	100.	0.	0.	0.
1s76	14.6836	120.	100.	0.	0.	0.
1s77	14.6853	120.	100.	0.	0.	0.
1s78	14.6853	120.	100.	0.	0.	0.
1s79	14.6853	120.	100.	0.	0.	0.
1s80	14.6853	120.	100.	0.	0.	0.
1s81	14.6853	120.	100.	0.	0.	0.
1s82	14.6853	120.	100.	0.	0.	0.
1s83	14.6853	120.	100.	0.	0.	0.
1s84	14.6853	120.	100.	0.	0.	0.
1s85	14.6853	120.	100.	0.	0.	0.
1s86	14.6853	120.	100.	0.	0.	0.
1s87	14.6853	120.	100.	0.	0.	0.
1s88	14.6853	120.	100.	0.	0.	0.
1s89	14.6853	120.	100.	0.	0.	0.
1s90	14.6853	120.	100.	0.	0.	0.
1s91	14.6853	120.	100.	0.	0.	0.
1s92	14.6853	120.	100.	0.	0.	0.
1s93	14.6853	120.	100.	0.	0.	0.
1s94	14.6853	120.	100.	0.	0.	0.

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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SMNH9405J

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Volume Initial Conditions						
Vol #	Pressure (psia)	Temp. (F)	Relative Humidity (%)	Liquid Volume Fractio	Ice Volume Fract.	Ice Surf. A. (ft2)
1s95	14.6853	120.	100.	0.	0.	0.
1s96	14.6853	120.	100.	0.	0.	0.
1s97	14.6853	120.	100.	0.	0.	0.
1s98	14.6853	120.	100.	0.	0.	0.
1s99	14.6853	120.	100.	0.	0.	0.
1s100	14.6853	120.	100.	0.	0.	0.
1s101	14.6853	120.	100.	0.	0.	0.
1s102	14.6853	120.	100.	0.	0.	0.
1s103	14.6853	120.	100.	0.	0.	0.
1s104	14.6853	120.	100.	0.	0.	0.
1s105	14.6853	120.	100.	0.	0.	0.
1s106	14.6853	120.	100.	0.	0.	0.
1s107	14.6853	120.	100.	0.	0.	0.
1s108	14.6853	120.	100.	0.	0.	0.
1s109	14.6836	120.	100.	0.	0.	0.
1s110	14.6836	120.	100.	0.	0.	0.
1s111	14.6836	120.	100.	0.	0.	0.
1s112	14.6836	120.	100.	0.	0.	0.
1s113	14.6836	120.	100.	0.	0.	0.
1s114	14.6836	120.	100.	0.	0.	0.
1s115	14.6836	120.	100.	0.	0.	0.
1s116	14.6836	120.	100.	0.	0.	0.
1s117	14.6836	120.	100.	0.	0.	0.
1s118	14.6836	120.	100.	0.	0.	0.
1s119	14.6836	120.	100.	0.	0.	0.
1s120	14.6836	120.	100.	0.	0.	0.
1s121	14.6836	120.	100.	0.	0.	0.
1s122	14.6836	120.	100.	0.	0.	0.
1s123	14.6836	120.	100.	0.	0.	0.
1s124	14.6836	120.	100.	0.	0.	0.
1s125	14.6836	120.	100.	0.	0.	0.
1s126	14.6836	120.	100.	0.	0.	0.
1s127	14.6836	120.	100.	0.	0.	0.
1s128	14.6836	120.	100.	0.	0.	0.
1s129	14.6836	120.	100.	0.	0.	0.
1s130	14.6836	120.	100.	0.	0.	0.
1s131	14.6836	120.	100.	0.	0.	0.
1s132	14.6836	120.	100.	0.	0.	0.
1s133	14.6836	120.	100.	0.	0.	0.
1s134	14.6836	120.	100.	0.	0.	0.
1s135	14.6836	120.	100.	0.	0.	0.
1s136	14.6836	120.	100.	0.	0.	0.
1s137	14.6836	120.	100.	0.	0.	0.
1s138	14.6836	120.	100.	0.	0.	0.

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Volume Initial Conditions						
Vol #	Pressure (psia)	Temp. (F)	Relative Humidity (%)	Liquid Volume Fractio	Ice Volume Fract.	Ice Surf. A. (ft2)
1s139	14.6836	120.	100.	0.	0.	0.
1s140	14.6836	120.	100.	0.	0.	0.
1s141	14.6836	120.	100.	0.	0.	0.
1s142	14.6836	120.	100.	0.	0.	0.
1s143	14.6836	120.	100.	0.	0.	0.
1s144	14.6836	120.	100.	0.	0.	0.
1s145	14.6819	120.	100.	0.	0.	0.
1s146	14.6819	120.	100.	0.	0.	0.
1s147	14.6819	120.	100.	0.	0.	0.
1s148	14.6819	120.	100.	0.	0.	0.
1s149	14.6819	120.	100.	0.	0.	0.
1s150	14.6819	120.	100.	0.	0.	0.
1s151	14.6819	120.	100.	0.	0.	0.
1s152	14.6819	120.	100.	0.	0.	0.
1s153	14.6819	120.	100.	0.	0.	0.
1s154	14.6819	120.	100.	0.	0.	0.
1s155	14.6819	120.	100.	0.	0.	0.
1s156	14.6819	120.	100.	0.	0.	0.
1s157	14.6819	120.	100.	0.	0.	0.
1s158	14.6819	120.	100.	0.	0.	0.
1s159	14.6819	120.	100.	0.	0.	0.
1s160	14.6819	120.	100.	0.	0.	0.
1s161	14.6819	120.	100.	0.	0.	0.
1s162	14.6819	120.	100.	0.	0.	0.
1s163	14.6819	120.	100.	0.	0.	0.
1s164	14.6819	120.	100.	0.	0.	0.
1s165	14.6819	120.	100.	0.	0.	0.
1s166	14.6819	120.	100.	0.	0.	0.
1s167	14.6819	120.	100.	0.	0.	0.
1s168	14.6819	120.	100.	0.	0.	0.
1s169	14.6819	120.	100.	0.	0.	0.
1s170	14.6819	120.	100.	0.	0.	0.
1s171	14.6819	120.	100.	0.	0.	0.
1s172	14.6819	120.	100.	0.	0.	0.
1s173	14.6819	120.	100.	0.	0.	0.
1s174	14.6819	120.	100.	0.	0.	0.
1s175	14.6819	120.	100.	0.	0.	0.
1s176	14.6819	120.	100.	0.	0.	0.
1s177	14.6819	120.	100.	0.	0.	0.
1s178	14.6819	120.	100.	0.	0.	0.
1s179	14.6819	120.	100.	0.	0.	0.
1s180	14.6819	120.	100.	0.	0.	0.

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Initial Gas Pressure Ratios								
Vol #	Air	Ar	He	H	Kr	N	O	Xe
def	1.	0.	0.	0.	0.	0.	0.	0.
1s28	1.	0.	0.	0.	0.	0.	0.	0.
1s29	1.	0.	0.	0.	0.	0.	0.	0.
1s30	1.	0.	0.	0.	0.	0.	0.	0.
1s34	1.	0.	0.	0.	0.	0.	0.	0.
1s35	1.	0.	0.	0.	0.	0.	0.	0.
1s36	1.	0.	0.	0.	0.	0.	0.	0.
1s46	1.	0.	0.	0.	0.	0.	0.	0.
1s47	1.	0.	0.	0.	0.	0.	0.	0.
1s48	1.	0.	0.	0.	0.	0.	0.	0.
1s52	1.	0.	0.	0.	0.	0.	0.	0.
1s53	1.	0.	0.	0.	0.	0.	0.	0.
1s54	1.	0.	0.	0.	0.	0.	0.	0.
1s58	1.	0.	0.	0.	0.	0.	0.	0.
1s59	1.	0.	0.	0.	0.	0.	0.	0.
1s60	1.	0.	0.	0.	0.	0.	0.	0.
1s64	1.	0.	0.	0.	0.	0.	0.	0.
1s65	1.	0.	0.	0.	0.	0.	0.	0.
1s66	1.	0.	0.	0.	0.	0.	0.	0.
1s70	1.	0.	0.	0.	0.	0.	0.	0.
1s71	1.	0.	0.	0.	0.	0.	0.	0.
1s72	1.	0.	0.	0.	0.	0.	0.	0.
1s73	1.	0.	0.	0.	0.	0.	0.	0.
1s74	1.	0.	0.	0.	0.	0.	0.	0.
1s75	1.	0.	0.	0.	0.	0.	0.	0.
1s76	1.	0.	0.	0.	0.	0.	0.	0.
1s77	1.	0.	0.	0.	0.	0.	0.	0.
1s78	1.	0.	0.	0.	0.	0.	0.	0.
1s79	1.	0.	0.	0.	0.	0.	0.	0.
1s80	1.	0.	0.	0.	0.	0.	0.	0.
1s81	1.	0.	0.	0.	0.	0.	0.	0.
1s82	1.	0.	0.	0.	0.	0.	0.	0.
1s83	1.	0.	0.	0.	0.	0.	0.	0.
1s84	1.	0.	0.	0.	0.	0.	0.	0.
1s85	1.	0.	0.	0.	0.	0.	0.	0.
1s86	1.	0.	0.	0.	0.	0.	0.	0.
1s87	1.	0.	0.	0.	0.	0.	0.	0.
1s88	1.	0.	0.	0.	0.	0.	0.	0.
1s89	1.	0.	0.	0.	0.	0.	0.	0.
1s90	1.	0.	0.	0.	0.	0.	0.	0.
1s91	1.	0.	0.	0.	0.	0.	0.	0.
1s92	1.	0.	0.	0.	0.	0.	0.	0.
1s93	1.	0.	0.	0.	0.	0.	0.	0.
1s94	1.	0.	0.	0.	0.	0.	0.	0.
1s95	1.	0.	0.	0.	0.	0.	0.	0.

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Initial Gas Pressure Ratios

Vol #	Air	Ar	He	H	Kr	N	O	Xe
1s96	1.	0.	0.	0.	0.	0.	0.	0.
1s97	1.	0.	0.	0.	0.	0.	0.	0.
1s98	1.	0.	0.	0.	0.	0.	0.	0.
1s99	1.	0.	0.	0.	0.	0.	0.	0.
1s100	1.	0.	0.	0.	0.	0.	0.	0.
1s101	1.	0.	0.	0.	0.	0.	0.	0.
1s102	1.	0.	0.	0.	0.	0.	0.	0.
1s103	1.	0.	0.	0.	0.	0.	0.	0.
1s104	1.	0.	0.	0.	0.	0.	0.	0.
1s105	1.	0.	0.	0.	0.	0.	0.	0.
1s106	1.	0.	0.	0.	0.	0.	0.	0.
1s107	1.	0.	0.	0.	0.	0.	0.	0.
1s108	1.	0.	0.	0.	0.	0.	0.	0.
1s109	1.	0.	0.	0.	0.	0.	0.	0.
1s110	1.	0.	0.	0.	0.	0.	0.	0.
1s111	1.	0.	0.	0.	0.	0.	0.	0.
1s112	1.	0.	0.	0.	0.	0.	0.	0.
1s113	1.	0.	0.	0.	0.	0.	0.	0.
1s114	1.	0.	0.	0.	0.	0.	0.	0.
1s115	1.	0.	0.	0.	0.	0.	0.	0.
1s116	1.	0.	0.	0.	0.	0.	0.	0.
1s117	1.	0.	0.	0.	0.	0.	0.	0.
1s118	1.	0.	0.	0.	0.	0.	0.	0.
1s119	1.	0.	0.	0.	0.	0.	0.	0.
1s120	1.	0.	0.	0.	0.	0.	0.	0.
1s121	1.	0.	0.	0.	0.	0.	0.	0.
1s122	1.	0.	0.	0.	0.	0.	0.	0.
1s123	1.	0.	0.	0.	0.	0.	0.	0.
1s124	1.	0.	0.	0.	0.	0.	0.	0.
1s125	1.	0.	0.	0.	0.	0.	0.	0.
1s126	1.	0.	0.	0.	0.	0.	0.	0.
1s127	1.	0.	0.	0.	0.	0.	0.	0.
1s128	1.	0.	0.	0.	0.	0.	0.	0.
1s129	1.	0.	0.	0.	0.	0.	0.	0.
1s130	1.	0.	0.	0.	0.	0.	0.	0.
1s131	1.	0.	0.	0.	0.	0.	0.	0.
1s132	1.	0.	0.	0.	0.	0.	0.	0.
1s133	1.	0.	0.	0.	0.	0.	0.	0.
1s134	1.	0.	0.	0.	0.	0.	0.	0.
1s135	1.	0.	0.	0.	0.	0.	0.	0.
1s136	1.	0.	0.	0.	0.	0.	0.	0.
1s137	1.	0.	0.	0.	0.	0.	0.	0.
1s138	1.	0.	0.	0.	0.	0.	0.	0.
1s139	1.	0.	0.	0.	0.	0.	0.	0.
1s140	1.	0.	0.	0.	0.	0.	0.	0.

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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Initial Gas Pressure Ratios								
Vol #	Air	Ar	He	H	Kr	N	O	Xe
1s141	1.	0.	0.	0.	0.	0.	0.	0.
1s142	1.	0.	0.	0.	0.	0.	0.	0.
1s143	1.	0.	0.	0.	0.	0.	0.	0.
1s144	1.	0.	0.	0.	0.	0.	0.	0.
1s145	1.	0.	0.	0.	0.	0.	0.	0.
1s146	1.	0.	0.	0.	0.	0.	0.	0.
1s147	1.	0.	0.	0.	0.	0.	0.	0.
1s148	1.	0.	0.	0.	0.	0.	0.	0.
1s149	1.	0.	0.	0.	0.	0.	0.	0.
1s150	1.	0.	0.	0.	0.	0.	0.	0.
1s151	1.	0.	0.	0.	0.	0.	0.	0.
1s152	1.	0.	0.	0.	0.	0.	0.	0.
1s153	1.	0.	0.	0.	0.	0.	0.	0.
1s154	1.	0.	0.	0.	0.	0.	0.	0.
1s155	1.	0.	0.	0.	0.	0.	0.	0.
1s156	1.	0.	0.	0.	0.	0.	0.	0.
1s157	1.	0.	0.	0.	0.	0.	0.	0.
1s158	1.	0.	0.	0.	0.	0.	0.	0.
1s159	1.	0.	0.	0.	0.	0.	0.	0.
1s160	1.	0.	0.	0.	0.	0.	0.	0.
1s161	1.	0.	0.	0.	0.	0.	0.	0.
1s162	1.	0.	0.	0.	0.	0.	0.	0.
1s163	1.	0.	0.	0.	0.	0.	0.	0.
1s164	1.	0.	0.	0.	0.	0.	0.	0.
1s165	1.	0.	0.	0.	0.	0.	0.	0.
1s166	1.	0.	0.	0.	0.	0.	0.	0.
1s167	1.	0.	0.	0.	0.	0.	0.	0.
1s168	1.	0.	0.	0.	0.	0.	0.	0.
1s169	1.	0.	0.	0.	0.	0.	0.	0.
1s170	1.	0.	0.	0.	0.	0.	0.	0.
1s171	1.	0.	0.	0.	0.	0.	0.	0.
1s172	1.	0.	0.	0.	0.	0.	0.	0.
1s173	1.	0.	0.	0.	0.	0.	0.	0.
1s174	1.	0.	0.	0.	0.	0.	0.	0.
1s175	1.	0.	0.	0.	0.	0.	0.	0.
1s176	1.	0.	0.	0.	0.	0.	0.	0.
1s177	1.	0.	0.	0.	0.	0.	0.	0.
1s178	1.	0.	0.	0.	0.	0.	0.	0.
1s179	1.	0.	0.	0.	0.	0.	0.	0.
1s180	1.	0.	0.	0.	0.	0.	0.	0.

DB19_BCS: 1% MS 119 - 139F - Sm BC Flow Paths
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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	0.01	1e+06	0.05	0.05	0.05	60.	0.
2	0.001	10.	100.	200.	300.	50.	6000.	0.
3	0.001	10.	10.	1000.	300.	100.	18000	0.
4	0.001	10.	1.	1500.	100.	20.	54000	0.
5	0.001	10.	1.	1800.	300.	100.	54000	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	Entrance Wall T		TV1s145	TV1s146	TV1s147	TV1s148	TV1s149
2	Inlet Cells 2nd		TV1s151	TV1s152	TV1s153	TV1s154	TV1s155
3	North Wall Temp		TV1s157	TV1s163	TV1s169	TV1s175	
4	N Wall 2nd Row		TV1s158	TV1s164	TV1s170	TV1s176	
5	Stop Valve Area		TV1s171	TV1s177	TV1s172	TV1s178	
6			TV1s83	TV1s89	TV1s88	TV1s82	
7			PR1s83	PR1s47	PR1s77	PR1s113	PR1s149
8	Leakage Flow		FV31				
9			TV1s84	TV1s83	TV1s82	TV1s119	TV1s118
10			TV1s149	TV1s155	TV1s113	TV1s119	TV1s77
11			PR1s149	PR1s155	PR1s113	PR1s119	PR1s77
12			FV25	FV12	FV17	FV20	
13			vV1s119	vV1s113	vV1s154	vV1s148	

DB13_BCS: 1% MS 113 - 139F - Sm BC Flow Paths
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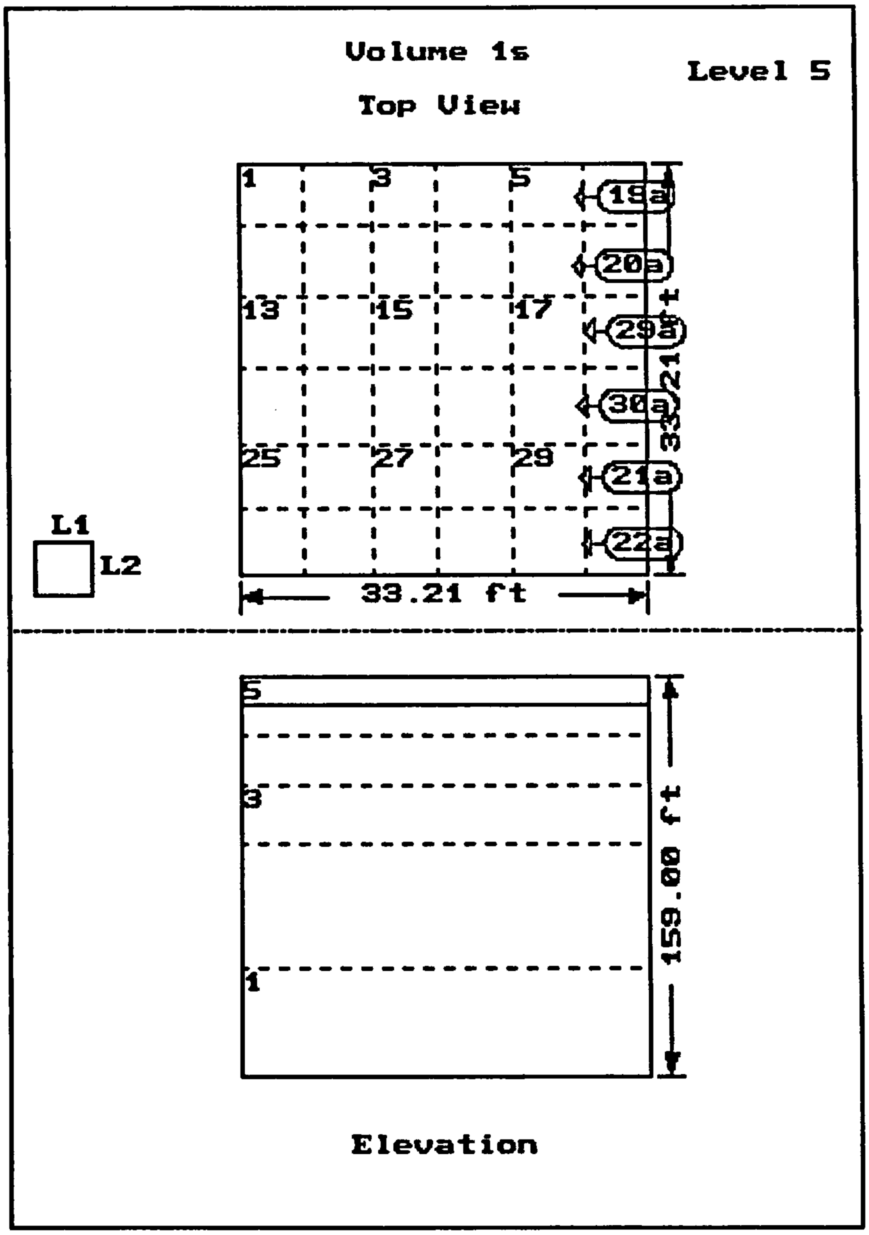

DB13_BCS: 1% MS 113 - 139F - Sm BC Flow Paths
10:11:58 13-JAN-95
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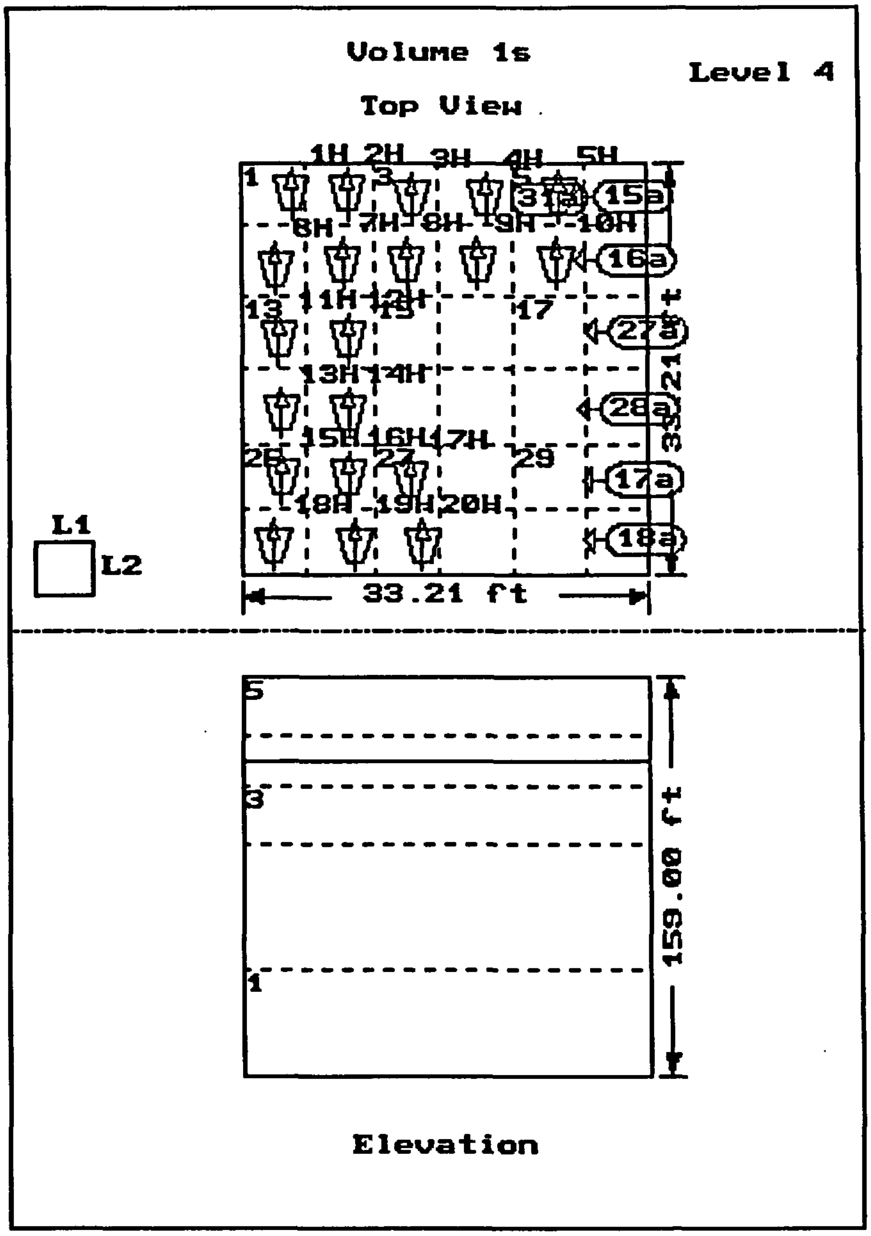

DB13_BCS: 1% MS 113 - 139F - Sm BC Flow Paths
10:12:08 13-JAN-95
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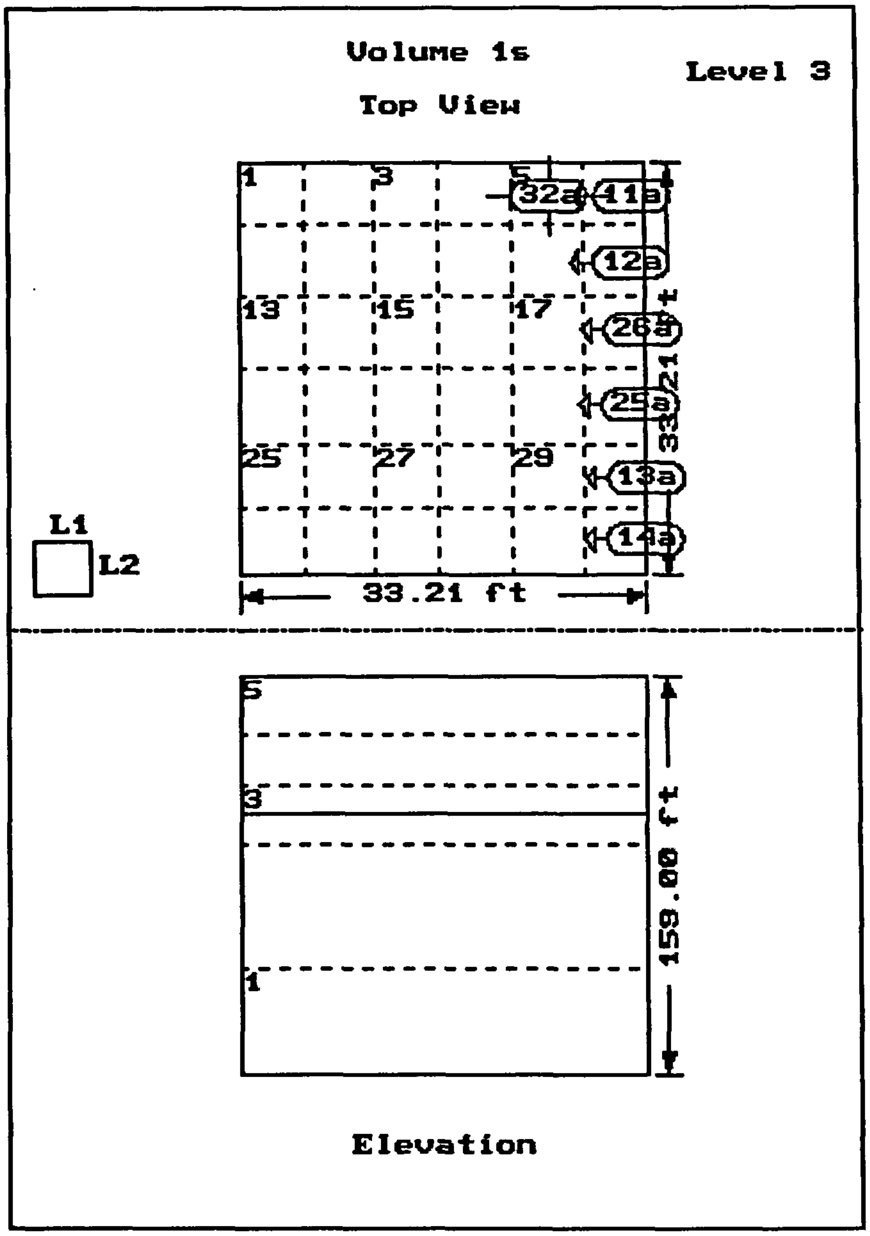

DB13_BCS: 1% MS 113 - 139F - Sm BC Flow Paths
10:12:30 13-JAN-95
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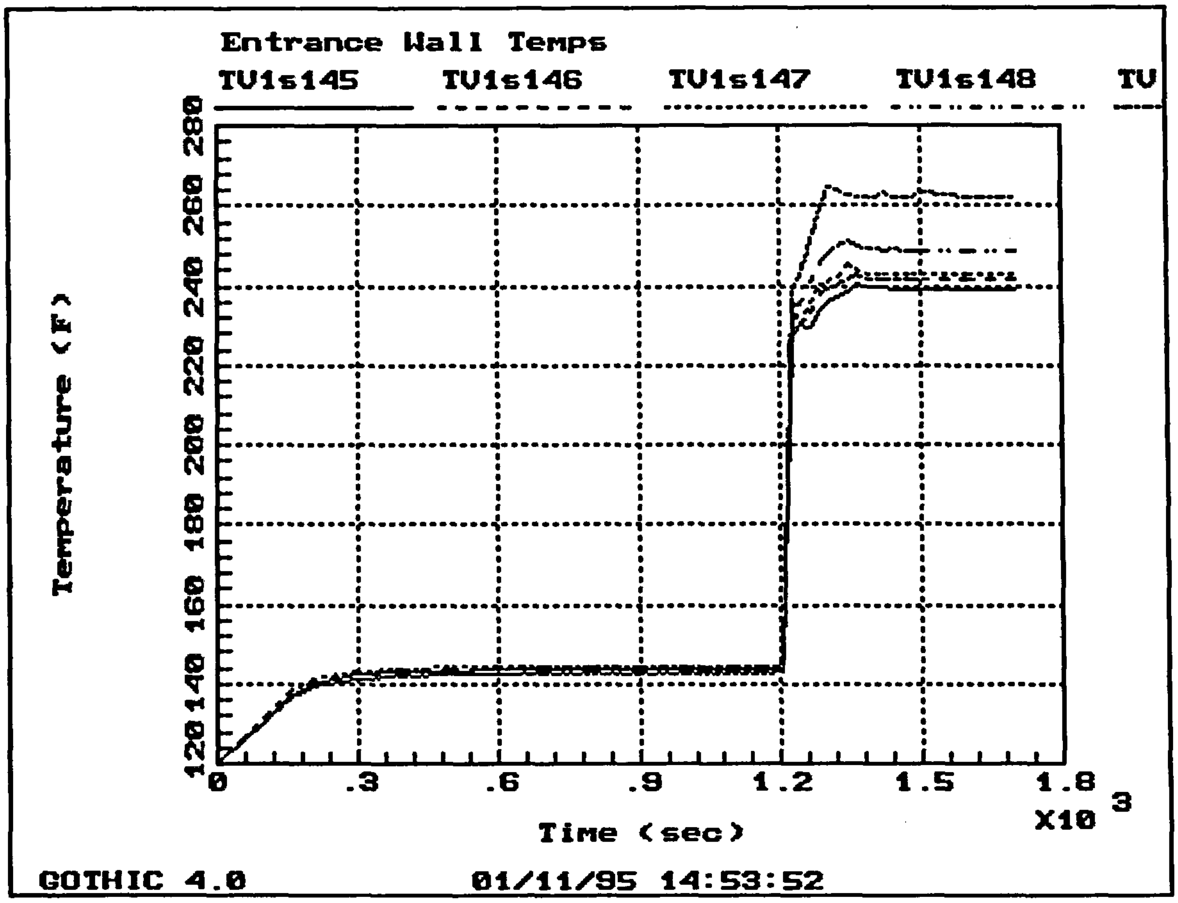

SMNH94051

DB13_BCS: 1% MS 113 - 139F - Sm BC Flow Paths
10:12:40 13-JAN-95
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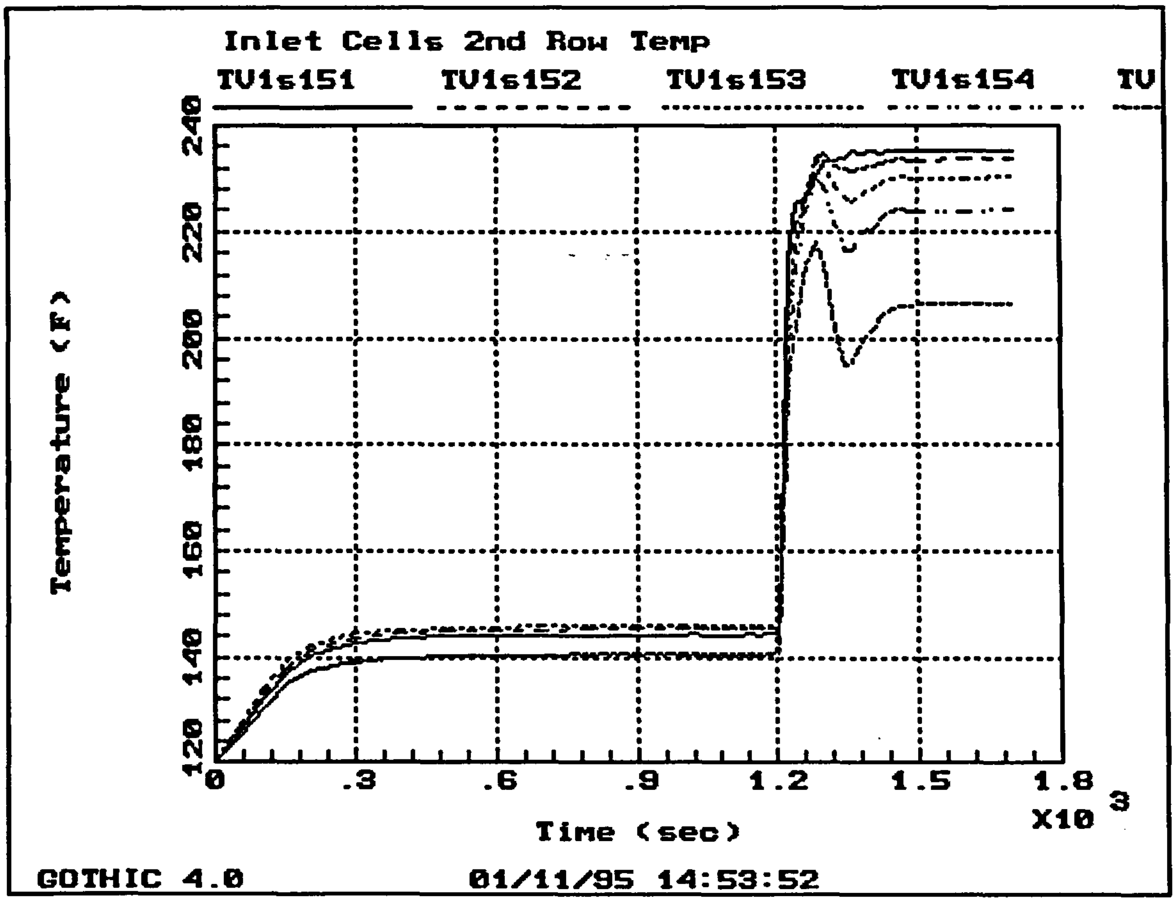

DB13_BCS: 1% MS 113 - 139F - Sm BC Flow Paths
10:12:46 13-JAN-95
GOTHIC Version 4.0 - August 1993

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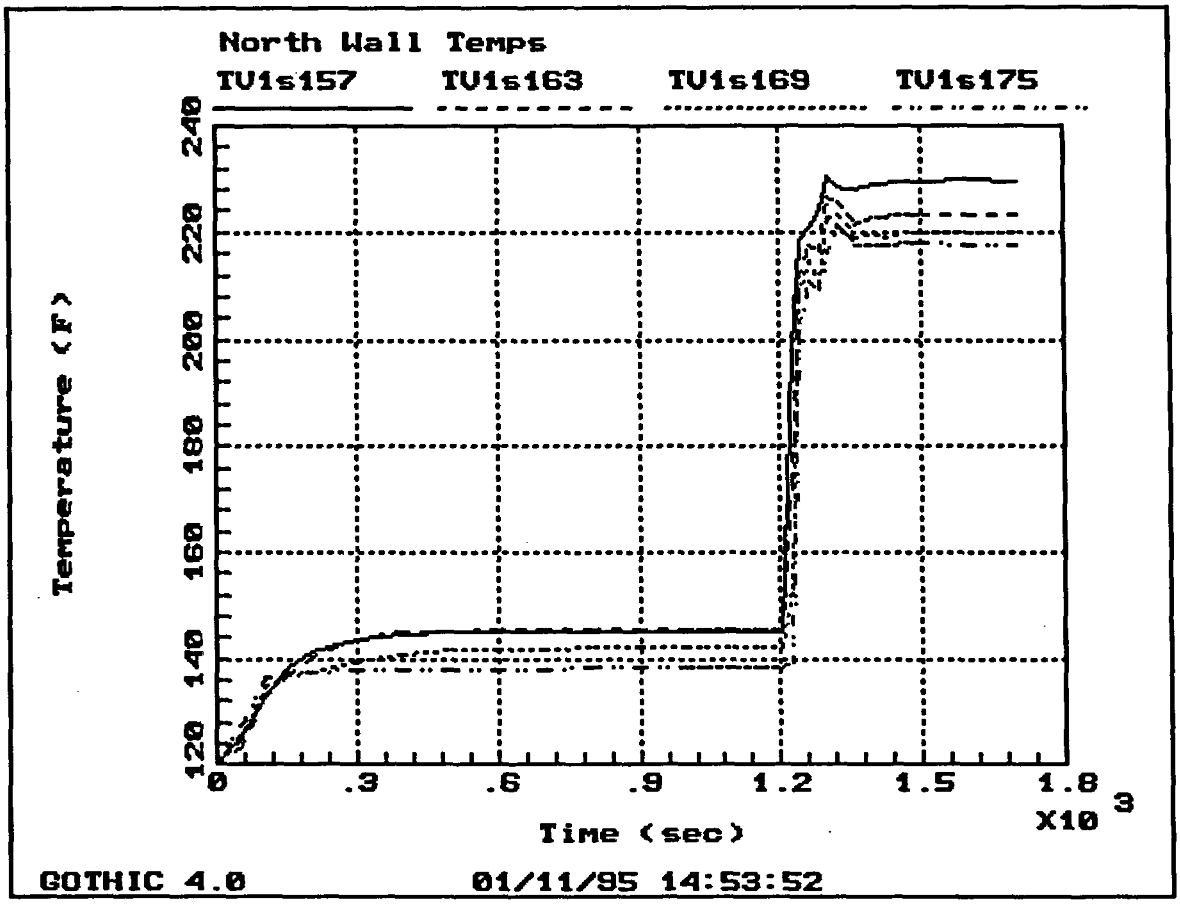

DB13_BCS: 1% MS 113 - 139F - Sm BC Flow Paths
10:12:55 13-JAN-95
GOTHIC Version 4.0 - August 1993

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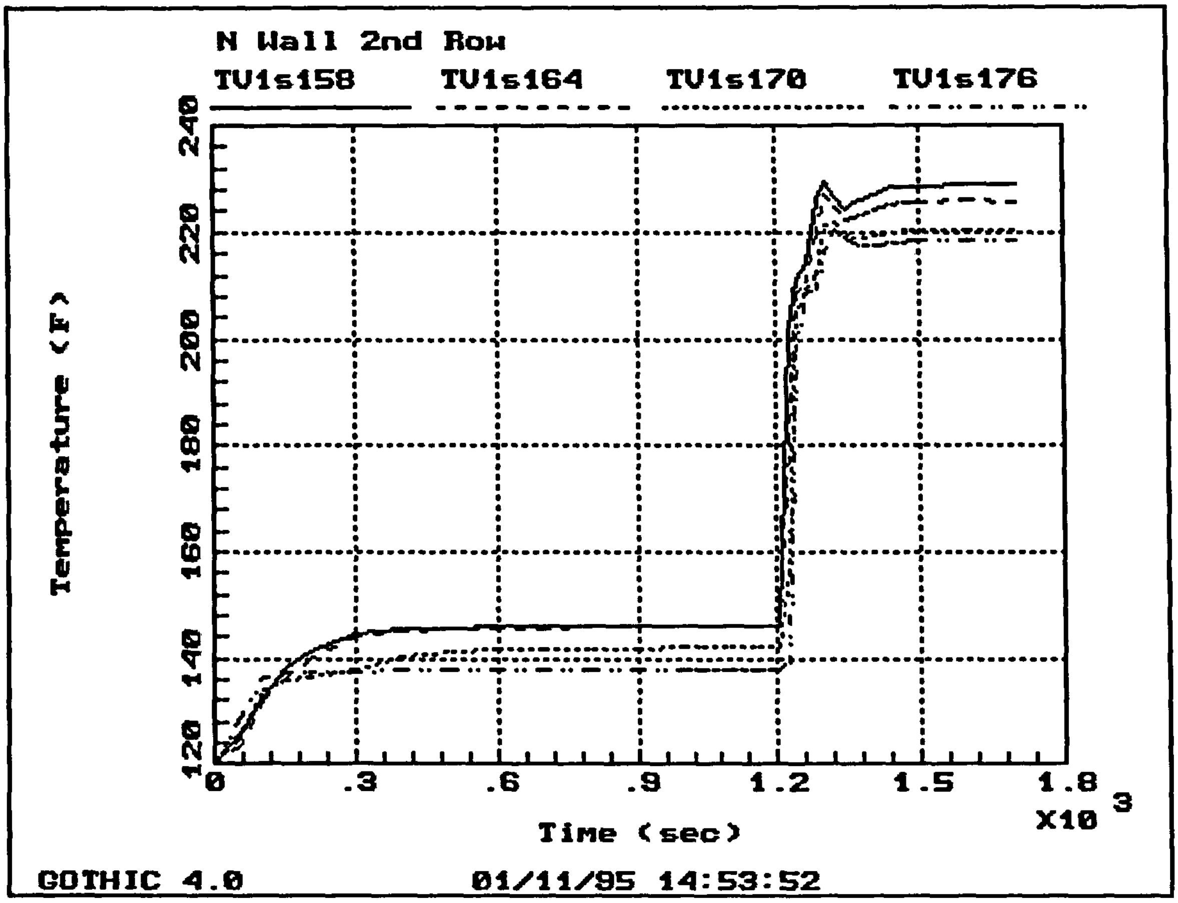

DB13_BCS: 1% MS 113 - 139F - Sm BC Flow Paths
10:13:02 13-JAN-95
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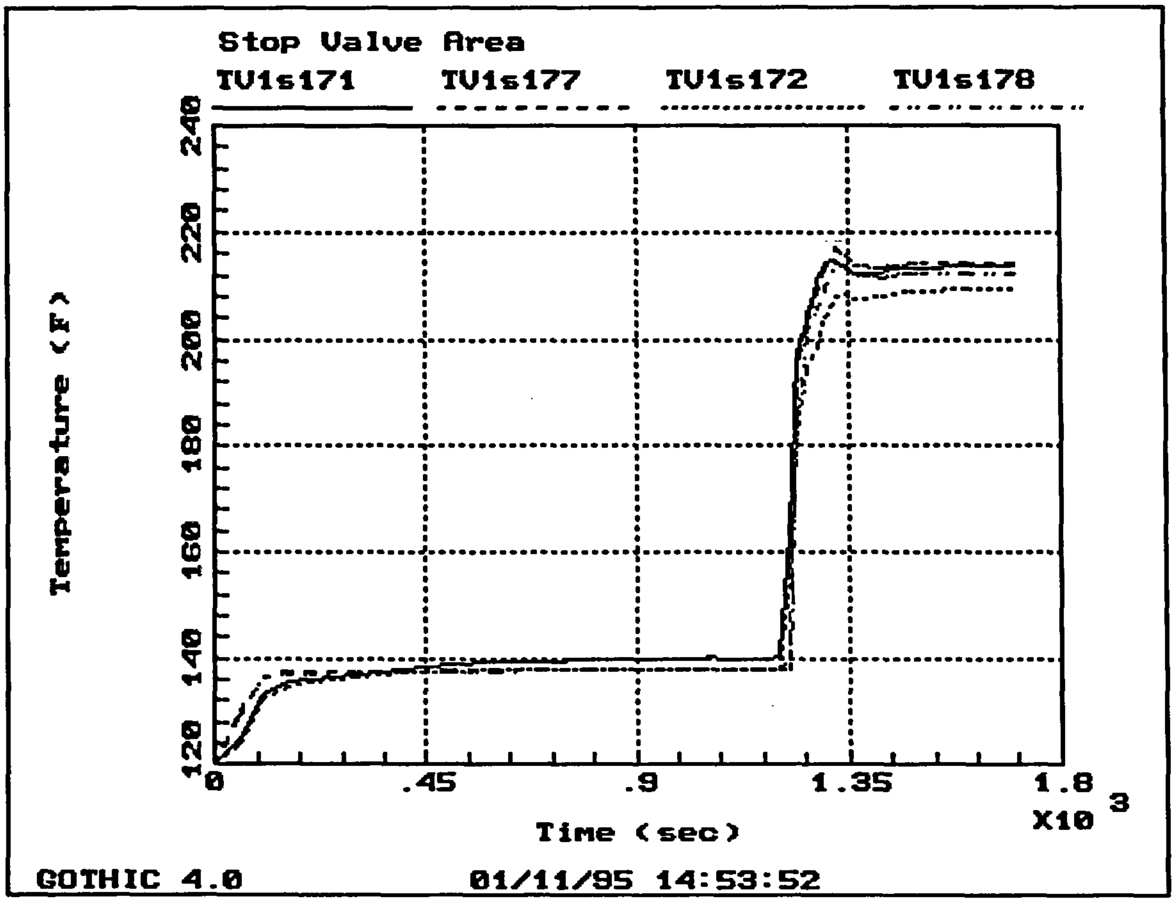

DBAS122: 1% MS Leak cell 122 - 139F BC
08:11:06 14-DEC-94
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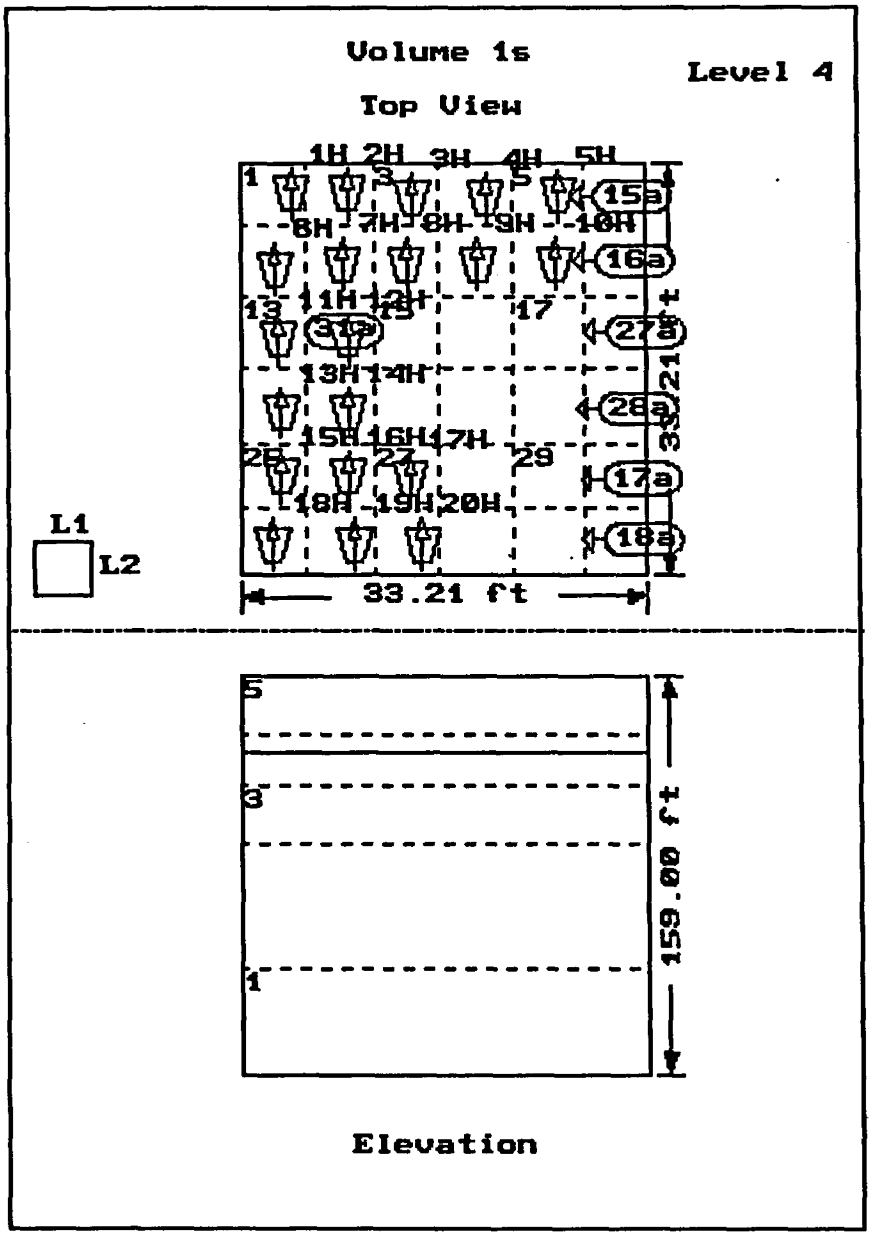

DBAS122: 1% MS Leak cell 122 - 139F BC
08:11:15 14-DEC-94
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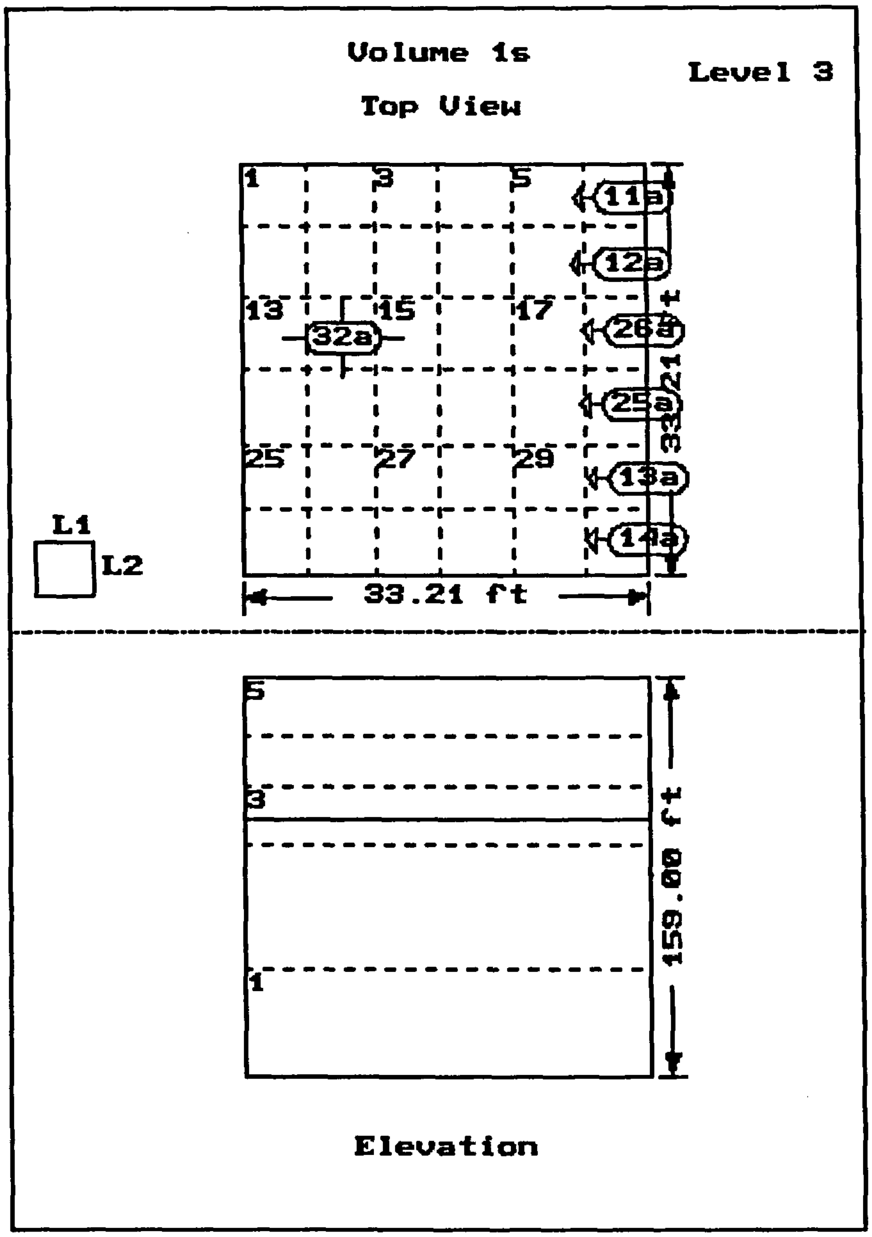

DBAS122: 1% MS Leak cell 122 - 139F BC
07:55:04 14-DEC-94
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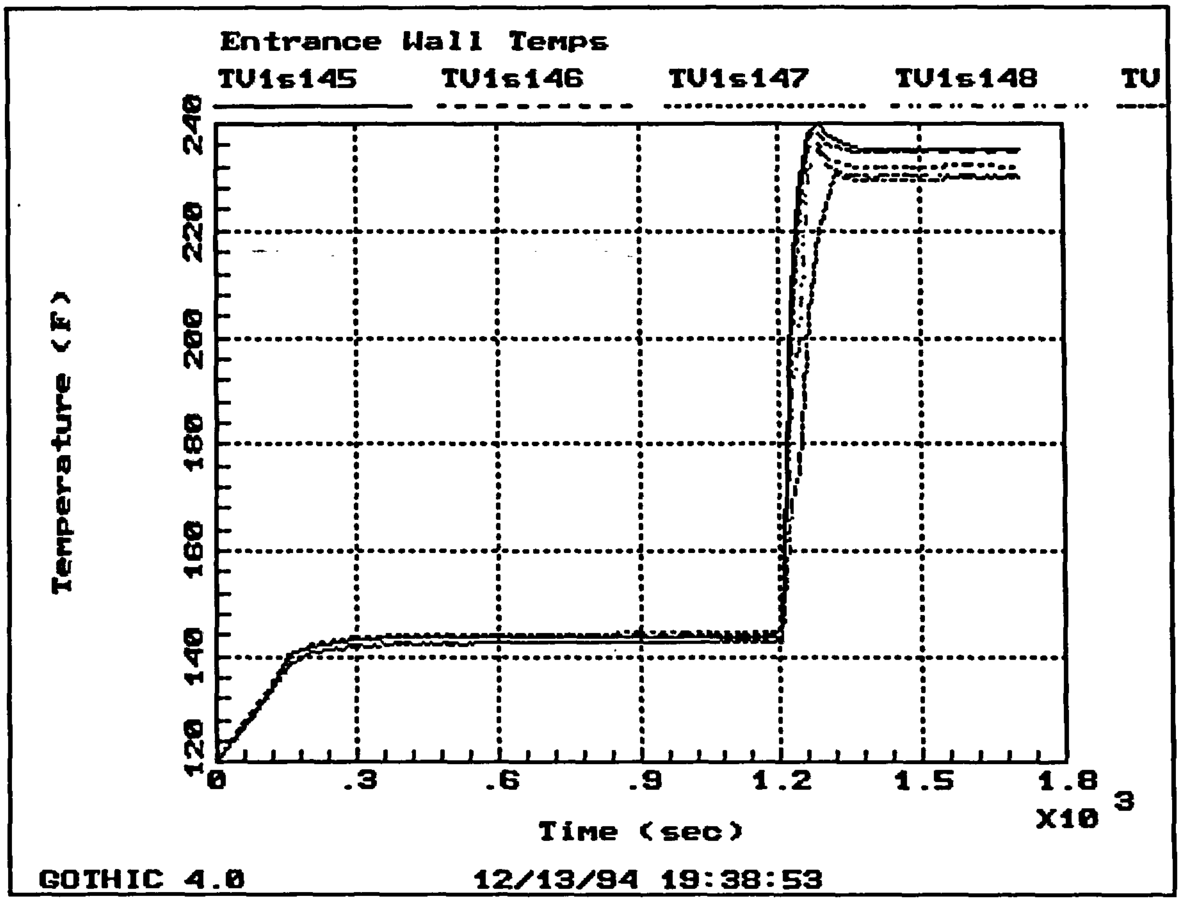

DBAS122: 1% MS Leak cell 122 - 139F BC
07:55:40 14-DEC-94
GOTHIC Version 4.0 - August 1993

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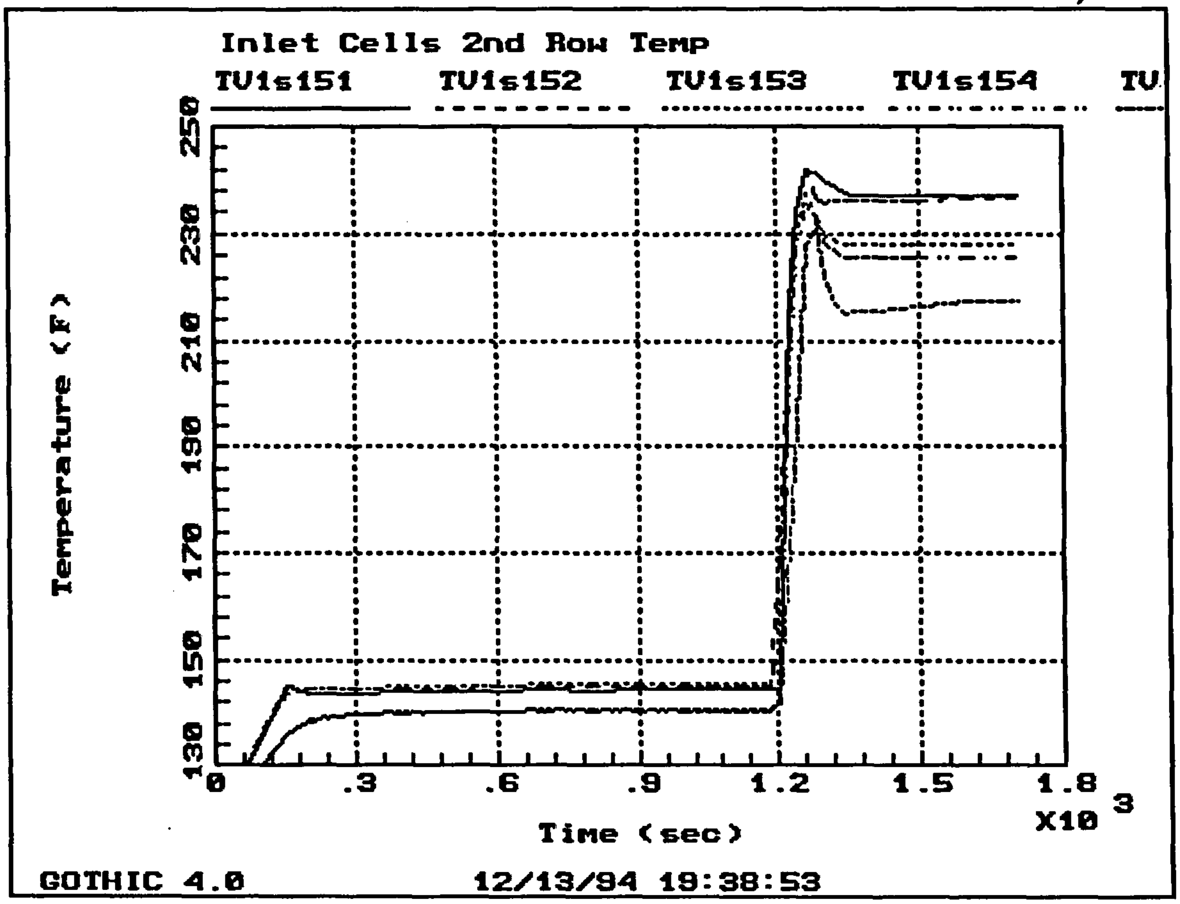
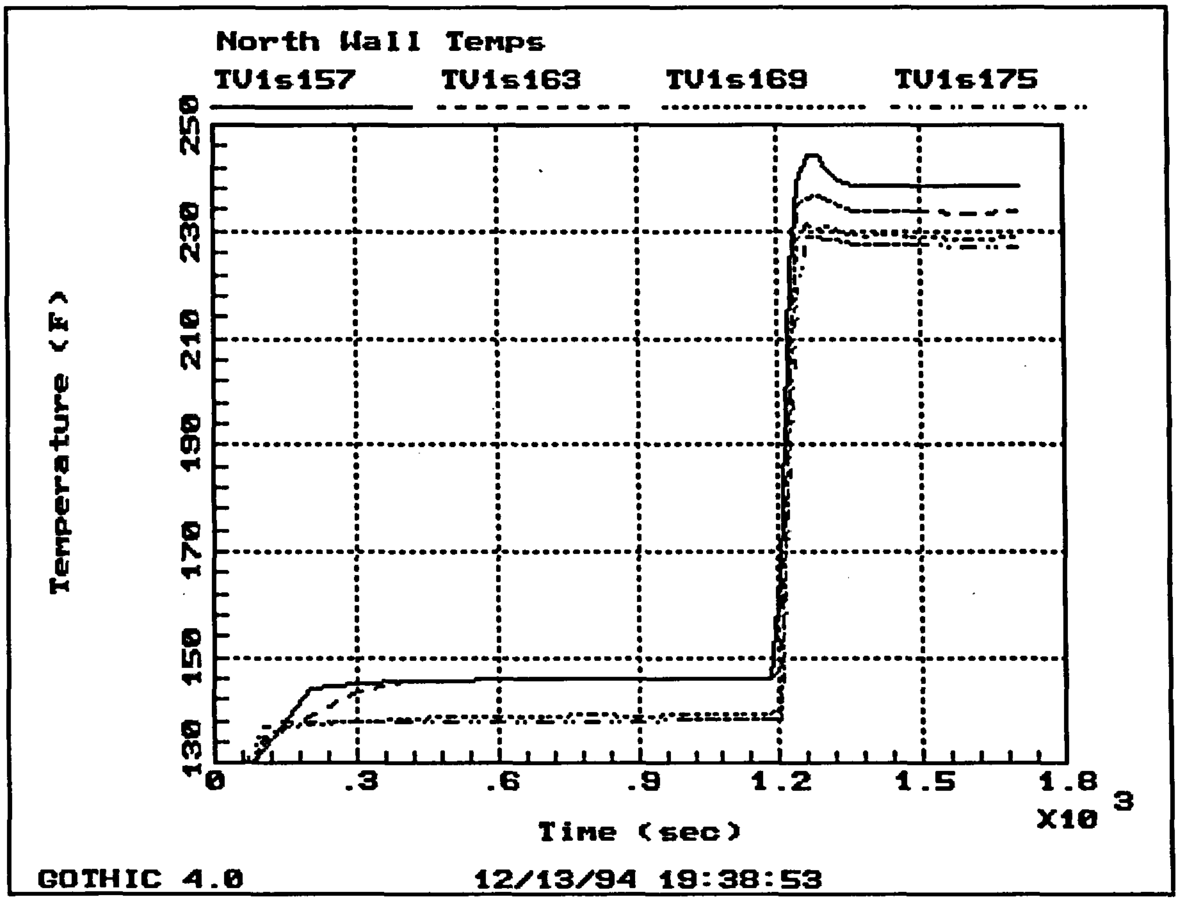


DBAS122: 1% MS Leak cell 122 - 139F BC
07:56:46 14-DEC-94
GOTHIC Version 4.0 - August 1993



DBAS122: 1% MS Leak cell 122 - 139F BC
07:57:59 14-DEC-94
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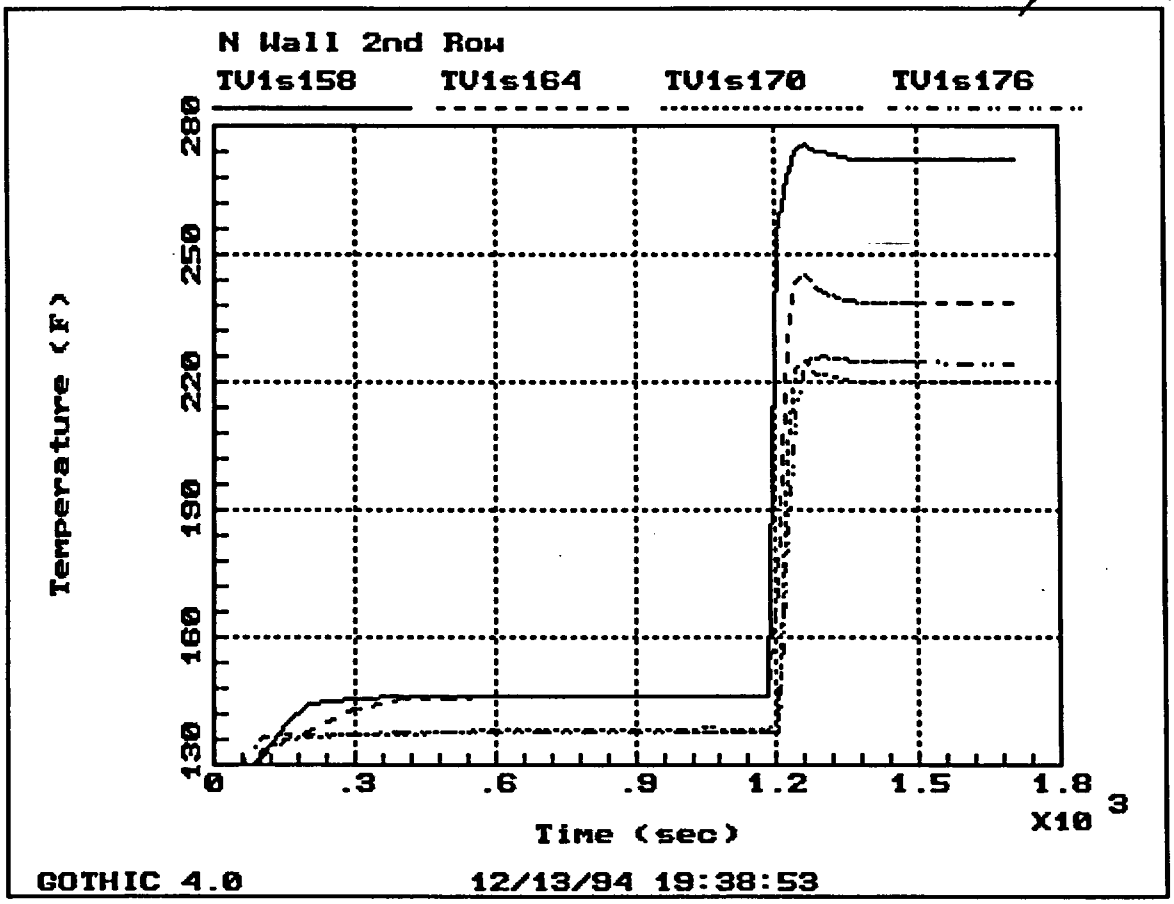

DBAS122: 1% MS Leak cell 122 - 139F BC
07:59:33 14-DEC-94
GOTHIC Version 4.0 - August 1993

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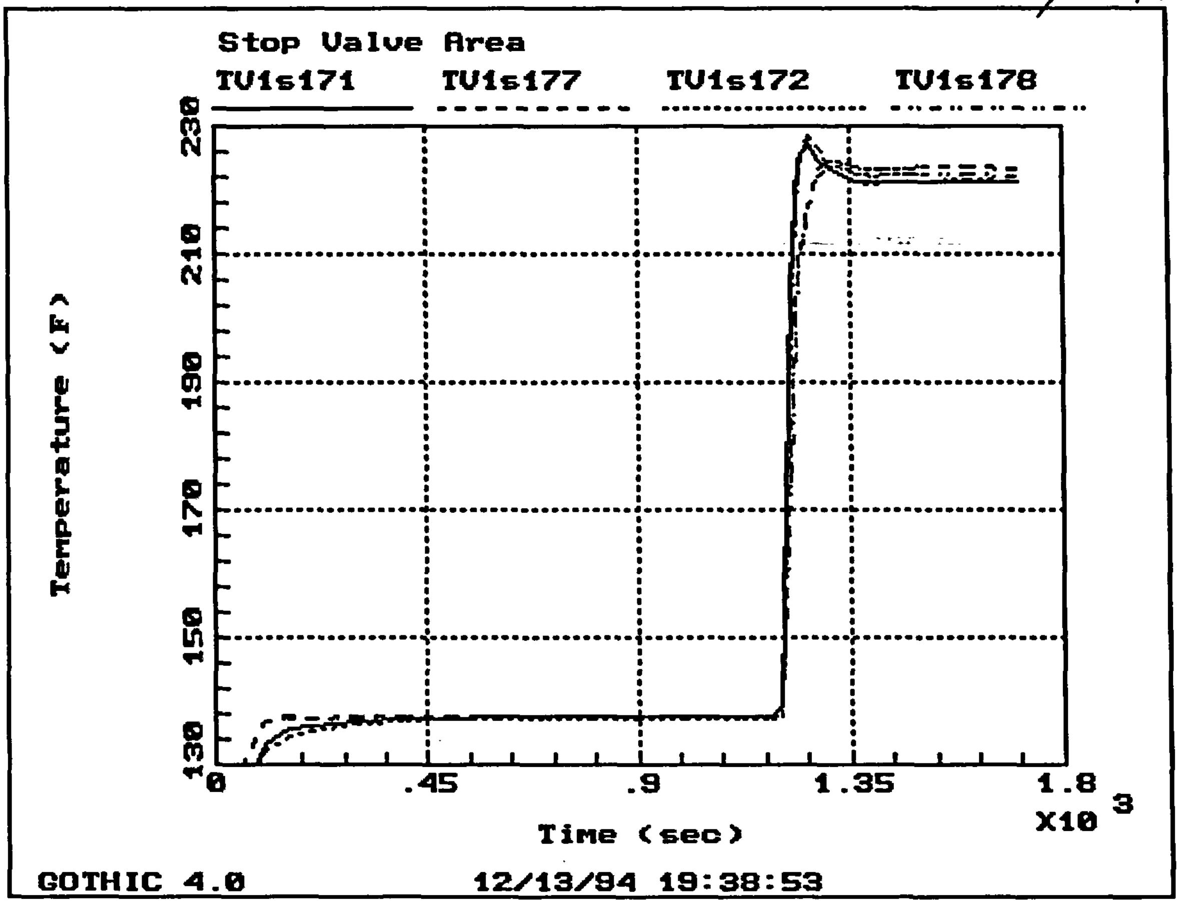

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
08:18:49 13-JAN-95
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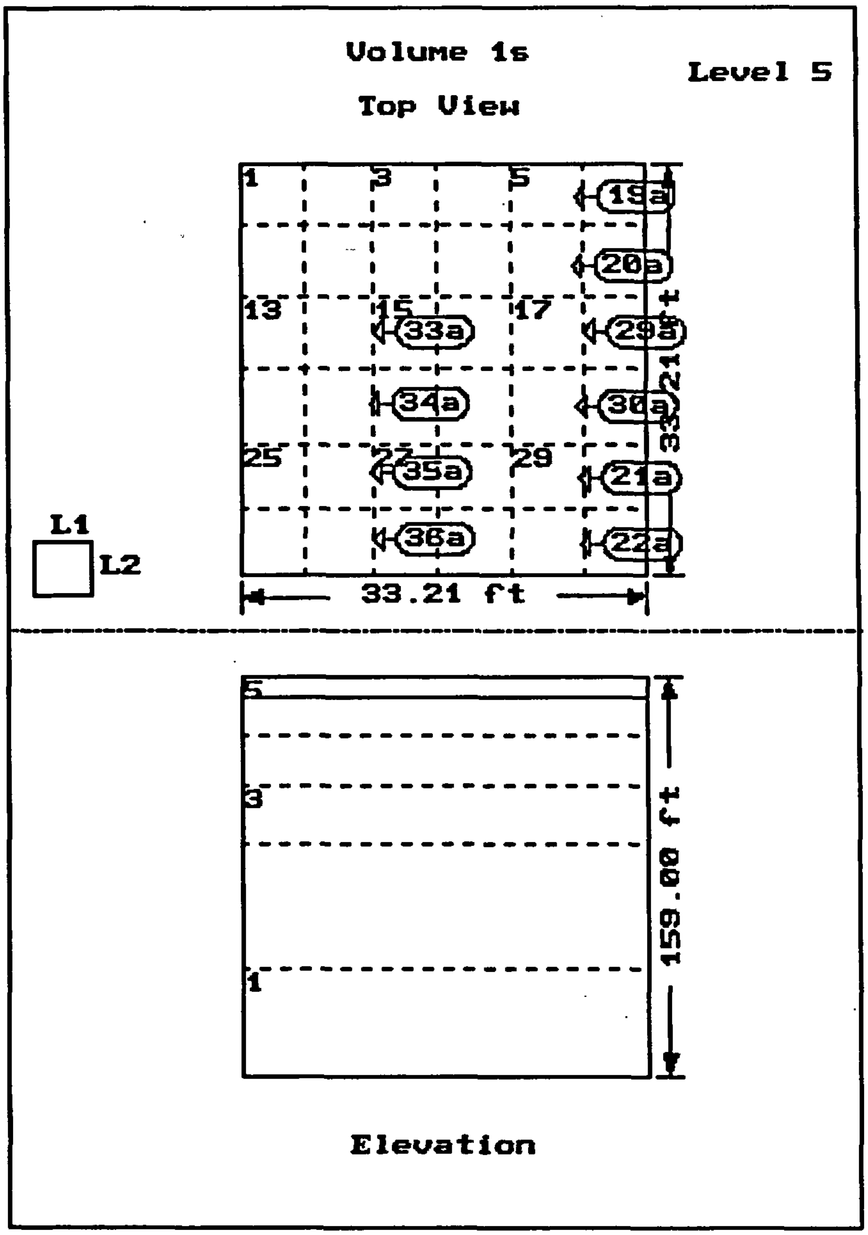

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
08:18:58 13-JAN-95
GOTHIC Version 4.0 - August 1993

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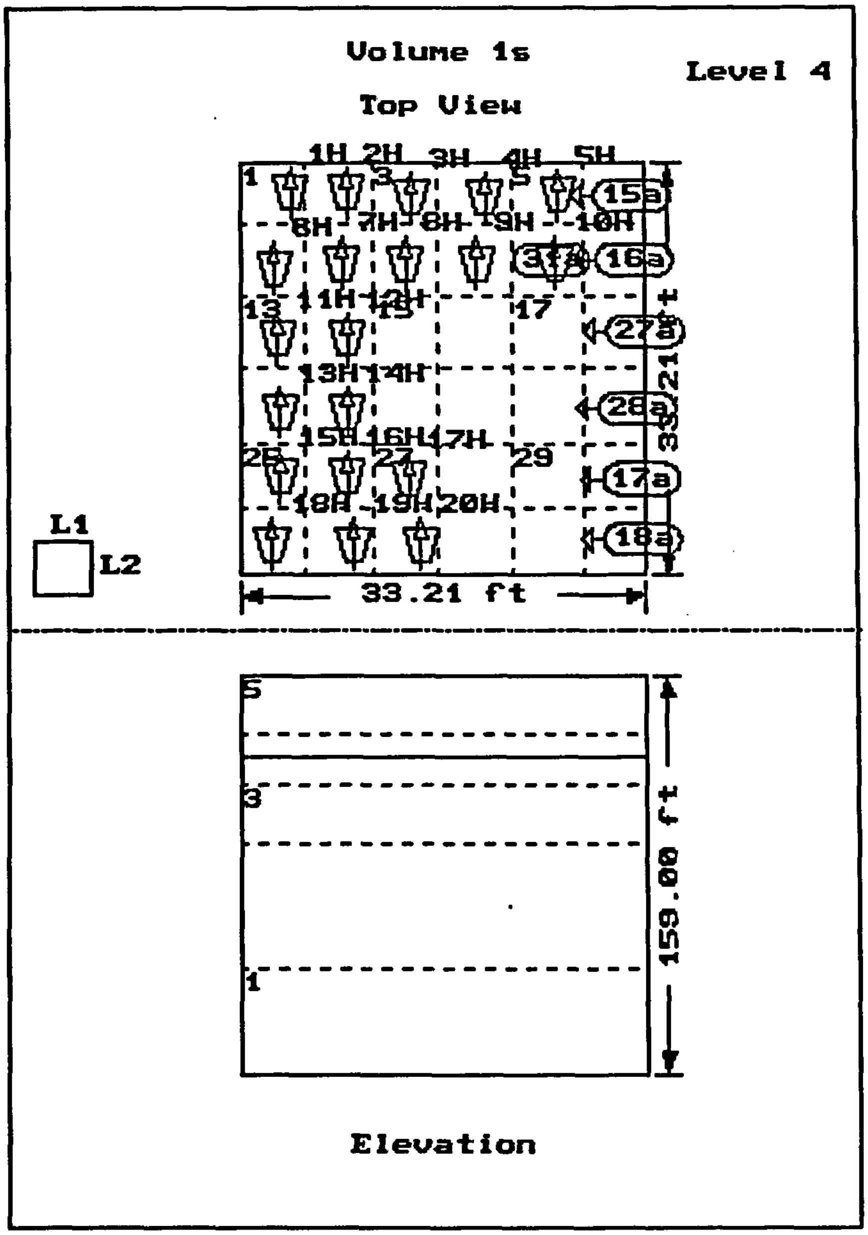

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
08:19:08 13-JAN-95
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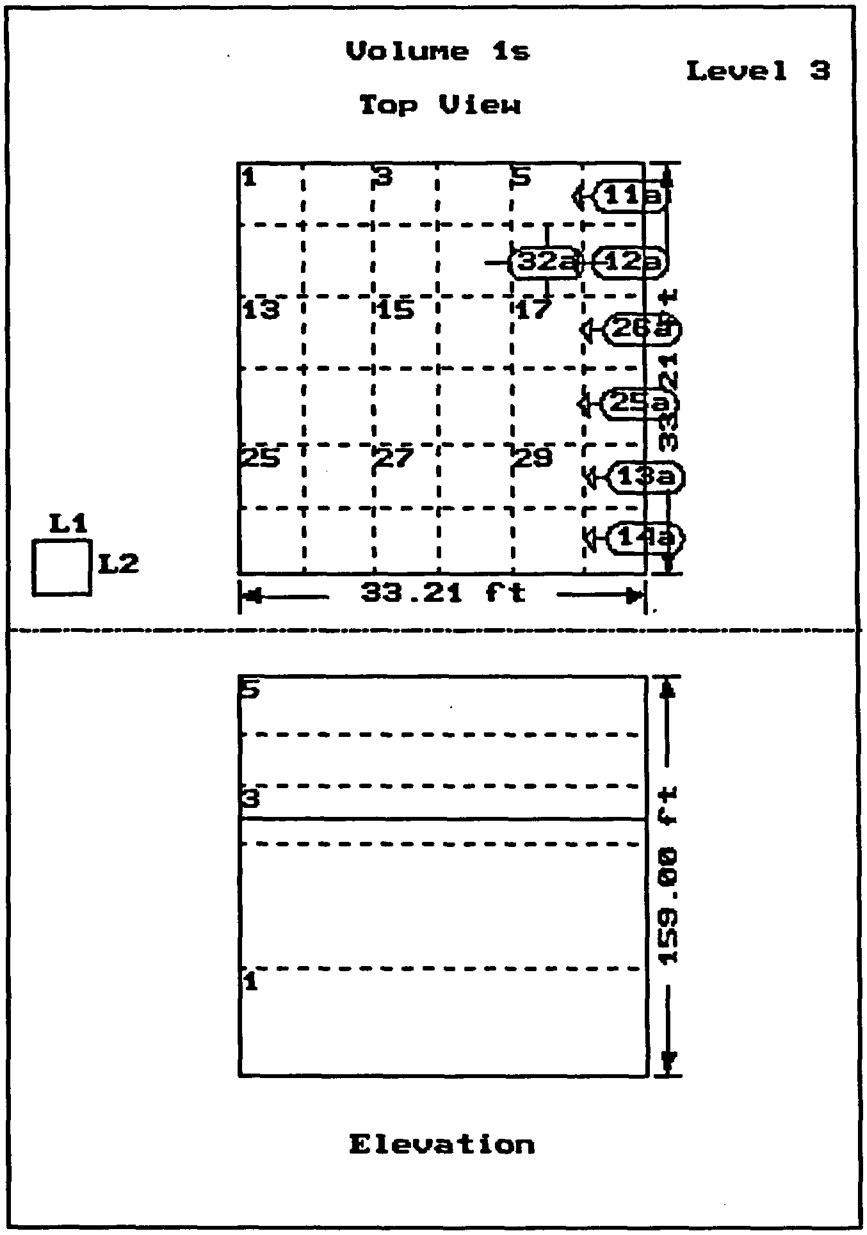

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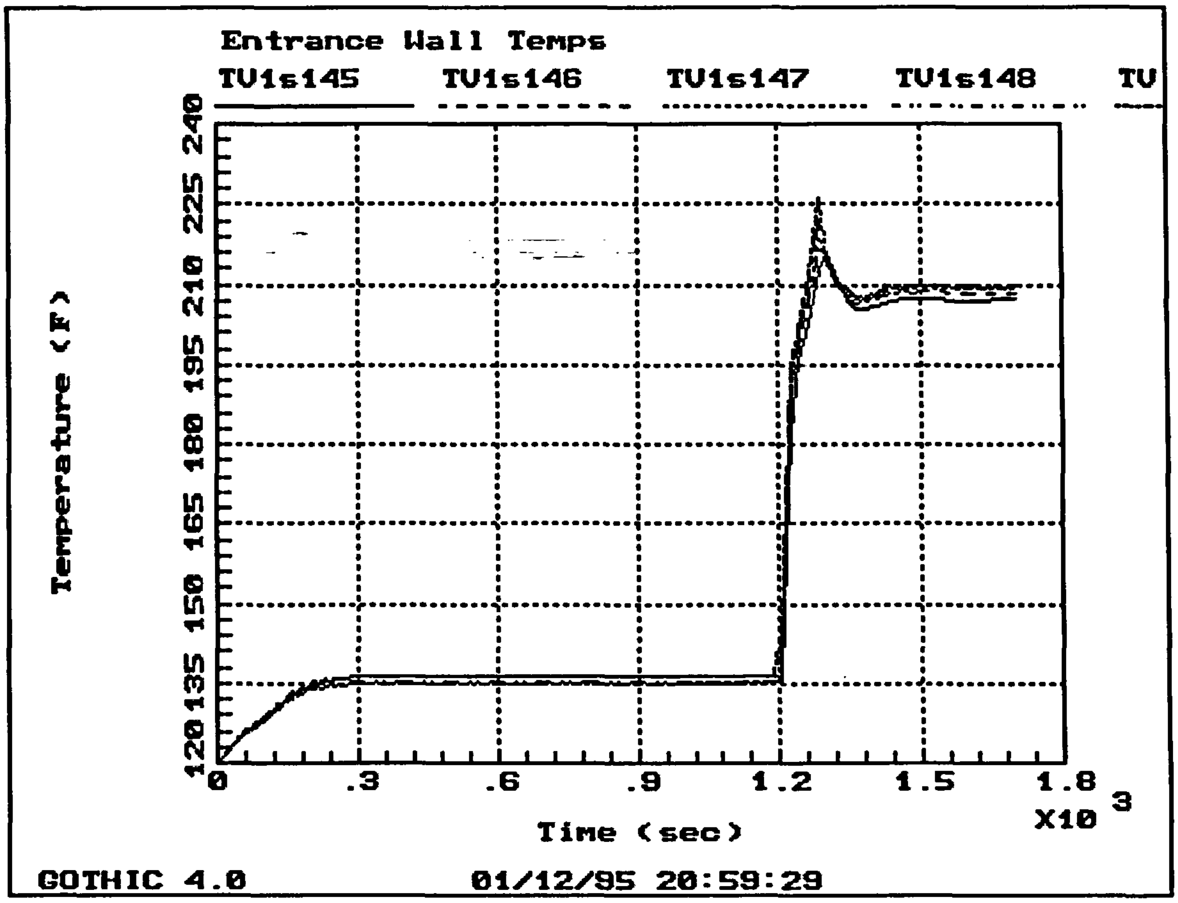
DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
08:13:17 13-JAN-95
GOTHIC Version 4.0 - August 1993



DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
08:14:55 13-JAN-95
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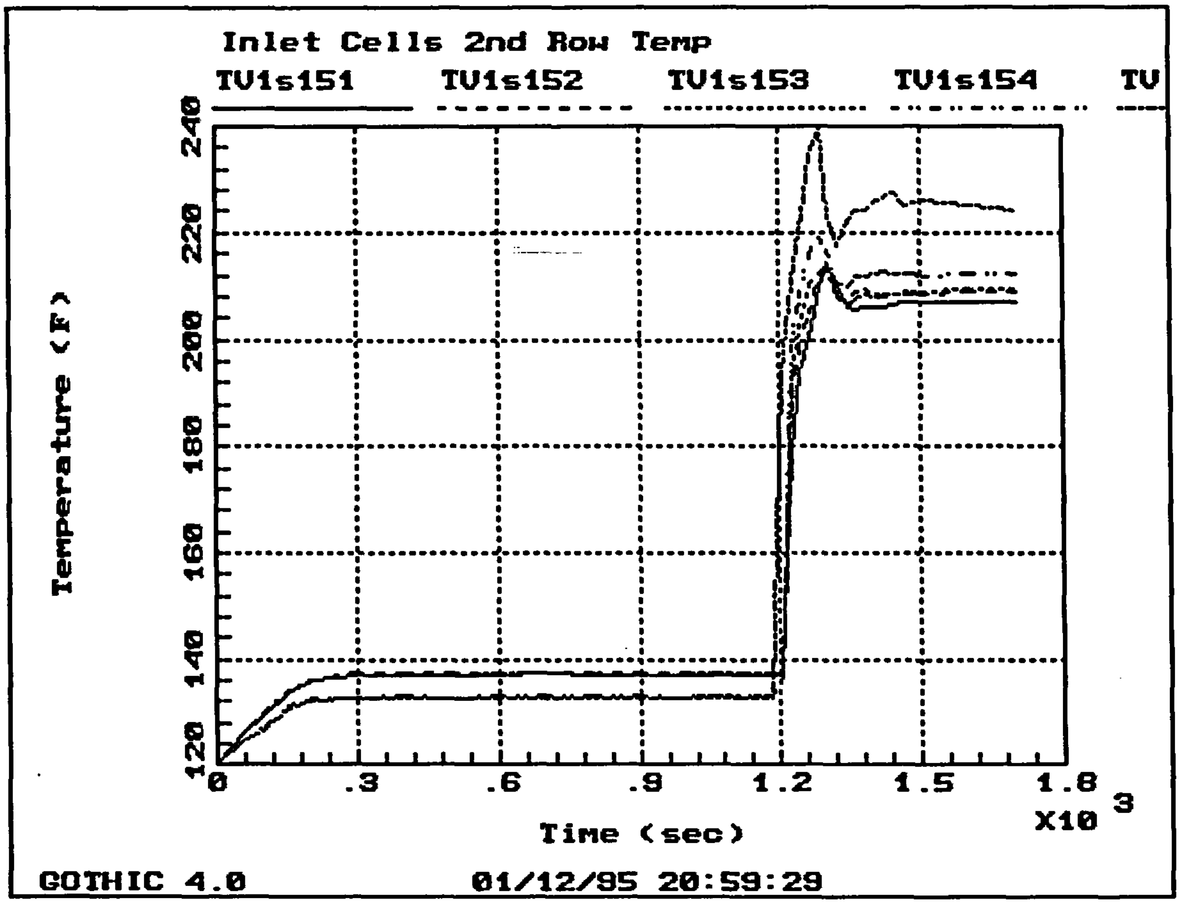

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
08:15:54 13-JAN-95
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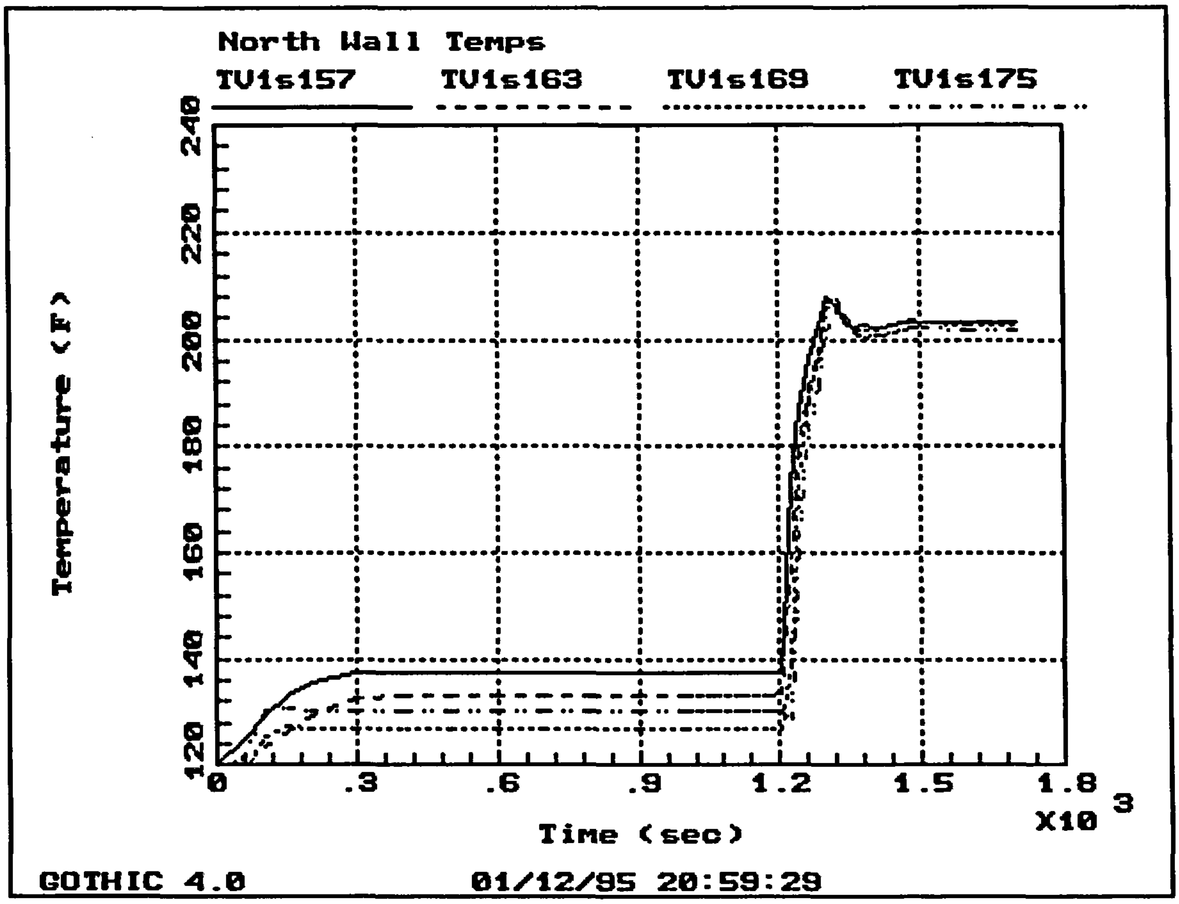

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
08:16:44 13-JAN-95
GOTHIC Version 4.0 - August 1993

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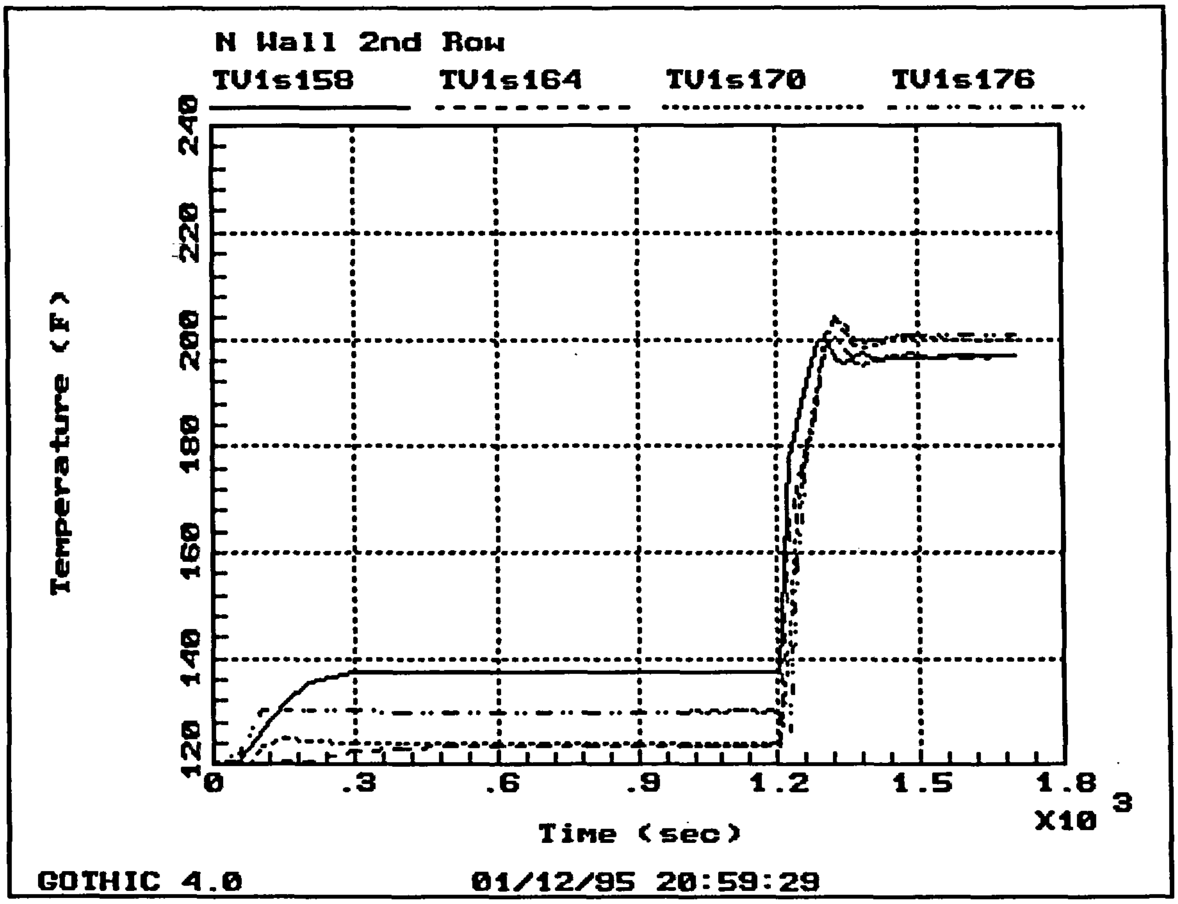

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
08:17:24 13-JAN-95
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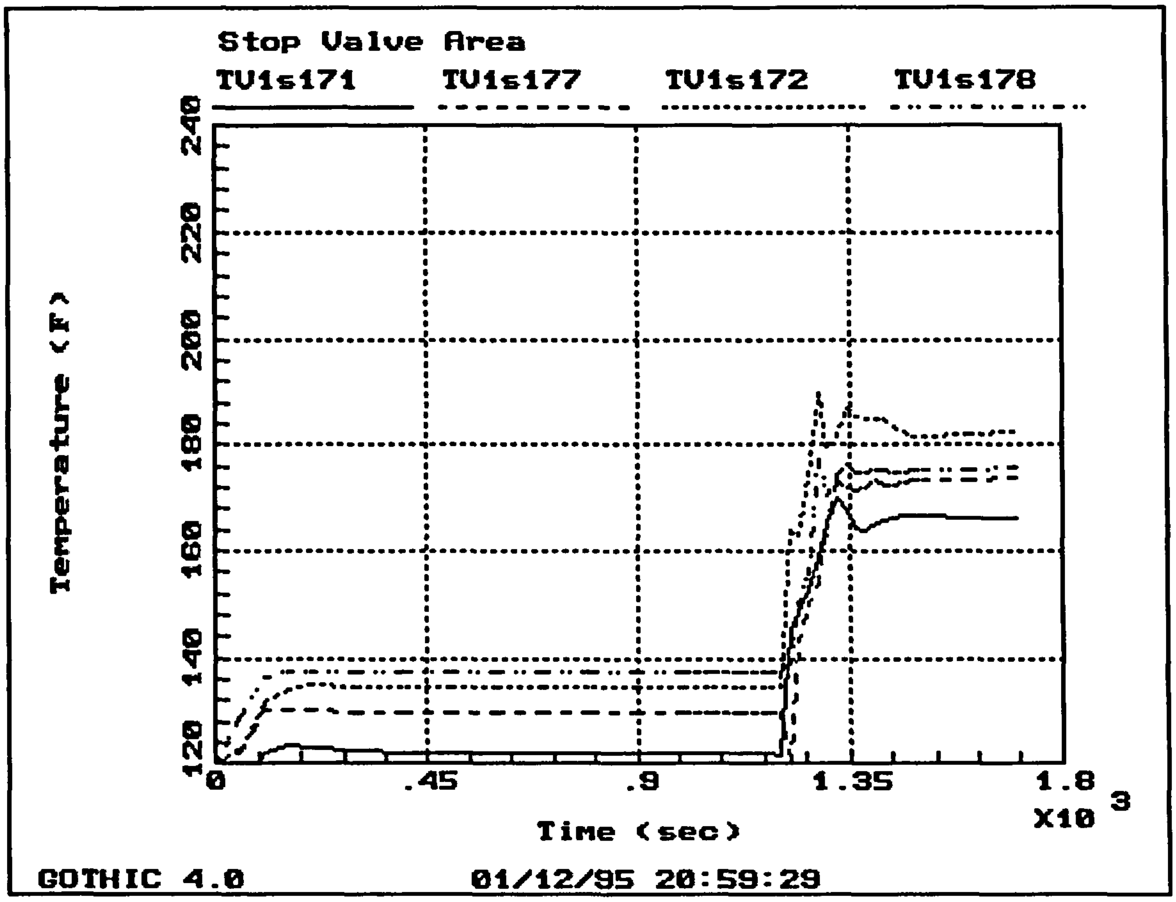

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
08:18:23 13-JAN-95
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Fluid Boundary Conditions - Table 1

BC#	Description	Press. (psia)	FF	Temp. (F)	FF	Flow (lbm/s)	FF	ON Trip	OFF Trip
1F	HVAC out	14.6924		110		-14.0			
2F	HVAC 3000-2	14.6924		110		3			
3F	HVAC 3000-3	14.6924		110		3			
4F	HVAC 2500-1	14.6924		110		2.5			
5F	HVAC 2500-2	14.6924		110		2.5			
6P	el 112-1	14.7		139					
7P	el 112-2	14.7		139					
8P	el 130-1	14.6924		139					
9P	el 130-2	14.6924		139					
10P	el 130-3	14.6924		139					
11P	el 147-1	14.6852		139					
12P	el 147-2	14.6852		139					
13P	el 147-3	14.6852		139					
14P	el 147-4	14.6852		139					
15P	el 151-1	14.6836		139					
16P	el 151-2	14.6836		139					
17P	el 151-3	14.6836		139					
18P	el 151-4	14.6836		139					
19P	el 155-1	14.6819		139					
20P	el 155-2	14.6819		139					
21P	el 155-3	14.6819		139					
22P	el 155-4	14.6819		139					
23P	el 130-4	14.6924		139					
24P	el 130-5	14.6924		139					
25P	el 147-5	14.6852		139					
26P	el 147-6	14.6852		139					
27P	el 151-5	14.6836		139					
28P	el 151-6	14.6836		139					
29P	el 155-5	14.6819		139					
30P	el 155-6	14.6819		139					
31F	Steam Leakage	14.7	0	E1191.4	0	13.9	1	1	
32F	Steam Leakage	14.7	0	E1191.4	0	13.9	1	1	
33F	HVAC 2500	14.7		50		2.5			
34F	HVAC 2500	14.7		50		2.5			
35F	HVAC 2500	14.7		50		2.5			
36F	HVAC 2500	14.7		50		2.5			

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
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Fluid Boundary Conditions - Table 2

BC#	Liq. V Frac.	FF	Stm. P.R.	FF	Drop D (in)	FF	Cpld BC#	Flow Frac.	FF	Heat (Btu/s)	FF
1F	0.		0.1152								
2F	0.		0.1152								
3F	0.		0.1152								
4F	0.		0.1152								
5F	0.		0.1152								
6P	0.		0.1151								
7P	0.		0.1151								
8P	0.		0.1152								
9P	0.		0.1152								
10P	0.		0.1152								
11P	0.		0.1152								
12P	0.		0.1152								
13P	0.		0.1152								
14P	0.		0.1152								
15P	0.		0.1152								
16P	0.		0.1152								
17P	0.		0.1152								
18P	0.		0.1152								
19P	0.		0.1152								
20P	0.		0.1152								
21P	0.		0.1152								
22P	0.		0.1152								
23P	0.		0.1152								
24P	0.		0.1152								
25P	0.		0.1152								
26P	0.		0.1152								
27P	0.		0.1152								
28P	0.		0.1152								
29P	0.		0.1152								
30P	0.		0.1152								
31F	0.		1.		0.01						
32F	0.		1.		0.01						
33F	0.		0.1152								
34F	0.		0.1152								
35F	0.		0.1152								
36F	0.		0.1152								

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
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Fluid Boundary Conditions - Table 3 Gas Pressure Ratios								
BC#	Air	FF	Ar	FF	He	FF	H2	FF
1F	1.							
2F	1.							
3F	1.							
4F	1.							
5F	1.							
6P	1.							
7P	1.							
8P	1.							
9P	1.							
10P	1.							
11P	1.							
12P	1.							
13P	1.							
14P	1.							
15P	1.							
16P	1.							
17P	1.							
18P	1.							
19P	1.							
20P	1.							
21P	1.							
22P	1.							
23P	1.							
24P	1.							
25P	1.							
26P	1.							
27P	1.							
28P	1.							
29P	1.							
30P	1.							
31F	0.							
32F	0.							
33F	1.							
34F	1.							
35F	1.							
36F	1.							

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
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Fluid Boundary Conditions - Table 4 Gas Pressure Ratios								
BC#	Kr	FF	N2	FF	O2	FF	Xe	FF
1F								
2F								
3F								
4F								
5F								
6P								
7P								
8P								
9P								
10P								
11P								
12P								
13P								
14P								
15P								
16P								
17P								
18P								
19P								
20P								
21P								
22P								
23P								
24P								
25P								
26P								
27P								
28P								
29P								
30P								
31F								
32F								
33F								
34F								
35F								
36F								

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
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Flow Paths - Table 1							
F.P. #	Description	Vol A	Elev (ft)	Ht (ft)	Vol B	Elev (ft)	Ht (ft)
1	HVAC Out	1s70	140.	6.	1F	140.	6.
2	HVAC 3000-2	1s53	140.	2.	2F	140.	2.
3	HVAC 3000-3	1s59	140.	2.	3F	140.	2.
4	HVAC 2500-1	1s65	140.	2.	4F	140.	2.
5	HVAC 2500-2	1s71	140.	2.	5F	140.	2.
6	el 112-1	1s30	112.1	17.	6P	112.1	17.
7	el 112-2	1s36	112.1	17.	7P	112.1	17.
8	el 130-1	1s48	130.1	16.	8P	130.1	16.
9	el 130-2	1s66	130.1	16.	9P	130.1	16.
10	el 130-3	1s72	130.1	16.	10P	130.1	16.
11	el 147-1	1s78	147.0	3.9	11P	147.0	3.9
12	el 147-2	1s84	147.0	3.9	12P	147.0	3.9
13	el 147-3	1s102	147.0	3.9	13P	147.0	3.9
14	el 147-4	1s108	147.0	3.9	14P	147.0	3.9
15	el 151-1	1s114	151.0	3.9	15P	151.0	3.9
16	el 151-2	1s120	151.0	3.9	16P	151.0	3.9
17	el 151-3	1s138	151.0	3.9	17P	151.0	3.9
18	el 151-4	1s144	151.0	3.9	18P	151.0	3.9
19	el 155-1	1s150	155.0	3.9	19P	155.0	3.9
20	el 155-2	1s156	155.0	3.9	20P	155.0	3.9
21	el 155-3	1s174	155.0	3.9	21P	155.0	3.9
22	el 155-4	1s180	155.0	3.9	22P	155.0	3.9
23	el 130-5	1s60	130.1	16.	24P	130.1	16.
24	el 130-4	1s54	130.1	16.	23P	130.1	16.
25	el 147-5	1s96	147.	3.9	25P	147.	3.9
26	el 147-6	1s90	147.	3.9	26P	147.	3.9
27	el 151-5	1s126	151.	3.9	27P	151.	3.9
28	el 151-6	1s132	151.	3.9	28P	151.	3.9
29	el 155-5	1s162	155.	3.9	29P	155.	3.9
30	el 155-6	1s168	155.	3.9	30P	155.	3.9
31	Leakage Flow	1s119	151.	3.9	31F	151.	3.9
32	Leakage Flow	1s83	147.	3.9	32F	147.	3.9
33	HVAC 2500	1s159	156.5	1.33	33F	156.5	1.33
34	HVAC 2500	1s165	156.5	1.33	34F	156.5	1.33
35	HVAC 2500	1s171	156.5	1.33	35F	156.5	1.33
36	HVAC 2500	1s177	156.5	1.33	36F	156.5	1.33

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
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Flow Paths - Table 2

Flow Path #	Flow Area (ft2)	Hyd. Diam. (ft)	Inertia Length (ft)	Friction Length (ft)	Critical Flow Model	De-Entrmt Frac.	Mom Trn Opt
1	20.	5.	20.	20.	NO		-
2	20.	5.	20.	20.	NO		-
3	20.	5.	20.	20.	NO		-
4	20.	5.	20.	20.	NO		-
5	20.	5.	20.	20.	NO		-
6	382.	50.	50.	10.	NO		-
7	382.	50.	50.	10.	NO		-
8	98.	8.6	50.	10.	NO		-
9	362.	50.	10.	10.	NO		-
10	362.	50.	50.	10.	NO		-
11	51.2	6.1	10.	10.	NO		-
12	23.	4.7	10.	10.	NO		-
13	85.	20.	50.	10.	NO		-
14	85.	20.	50.	10.	NO		-
15	51.2	6.1	10.	10.	NO		-
16	23.	4.7	10.	10.	NO		-
17	85.	20.	50.	10.	NO		-
18	85.	20.	50.	10.	NO		-
19	51.2	6.1	10.	10.	NO		-
20	23.	4.7	10.	10.	NO		-
21	85.	20.	50.	10.	NO		-
22	85.	20.	50.	10.	NO		-
23	362.	50.	50.	10.	NO		-
24	298.	50.	50.	10.	NO		-
25	85.	20.	50.	10.	NO		-
26	78.	20.	50.	10.	NO		-
27	78.	20.	50.	10.	NO		-
28	85.	20.	50.	10.	NO		-
29	78.	20.	50.	10.	NO		-
30	85.	20.	50.	10.	NO		-
31	150.	10.	1.	1.	NO		-
32	150.	10.	1.	1.	NO		-
33	2.89	2.	1.	1.	NO		-
34	2.89	2.	1.	1.	NO		-
35	2.89	2.	1.	1.	NO		-
36	2.89	2.	1.	1.	NO		-

DB19U1BC: 1% MS119 - 139F - U1 - Small BC Flow
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Flow Paths - Table 3			
Flow Path #	Fwd. Loss Coeff.	Rev. Loss Coeff.	Comp. Opt.
1	0.05	0.05	OFF
2	0.05	0.05	OFF
3	0.05	0.05	OFF
4	0.05	0.05	OFF
5	0.05	0.05	OFF
6	0.05	0.05	OFF
7	0.05	0.05	OFF
8	0.5	0.5	OFF
9	0.05	0.05	OFF
10	0.05	0.05	OFF
11	0.5	0.5	OFF
12	0.5	0.5	OFF
13	0.05	0.05	OFF
14	0.05	0.05	OFF
15	0.5	0.5	OFF
16	0.5	0.5	OFF
17	0.05	0.05	OFF
18	0.05	0.05	OFF
19	0.5	0.5	OFF
20	0.5	0.5	OFF
21	0.05	0.05	OFF
22	0.05	0.05	OFF
23	0.05	0.05	OFF
24	0.05	0.05	OFF
25	0.05	0.05	OFF
26	0.05	0.05	OFF
27	0.05	0.05	OFF
28	0.05	0.05	OFF
29	0.05	0.05	OFF
30	0.05	0.05	OFF
31	0.05	0.05	OFF
32	0.05	0.05	OFF
33	0.05	0.05	OFF
34	0.05	0.05	OFF
35	0.05	0.05	OFF
36	0.05	0.05	OFF

DB13U1BC: 1% MS113 - 139F - U1 - Small BC Flow
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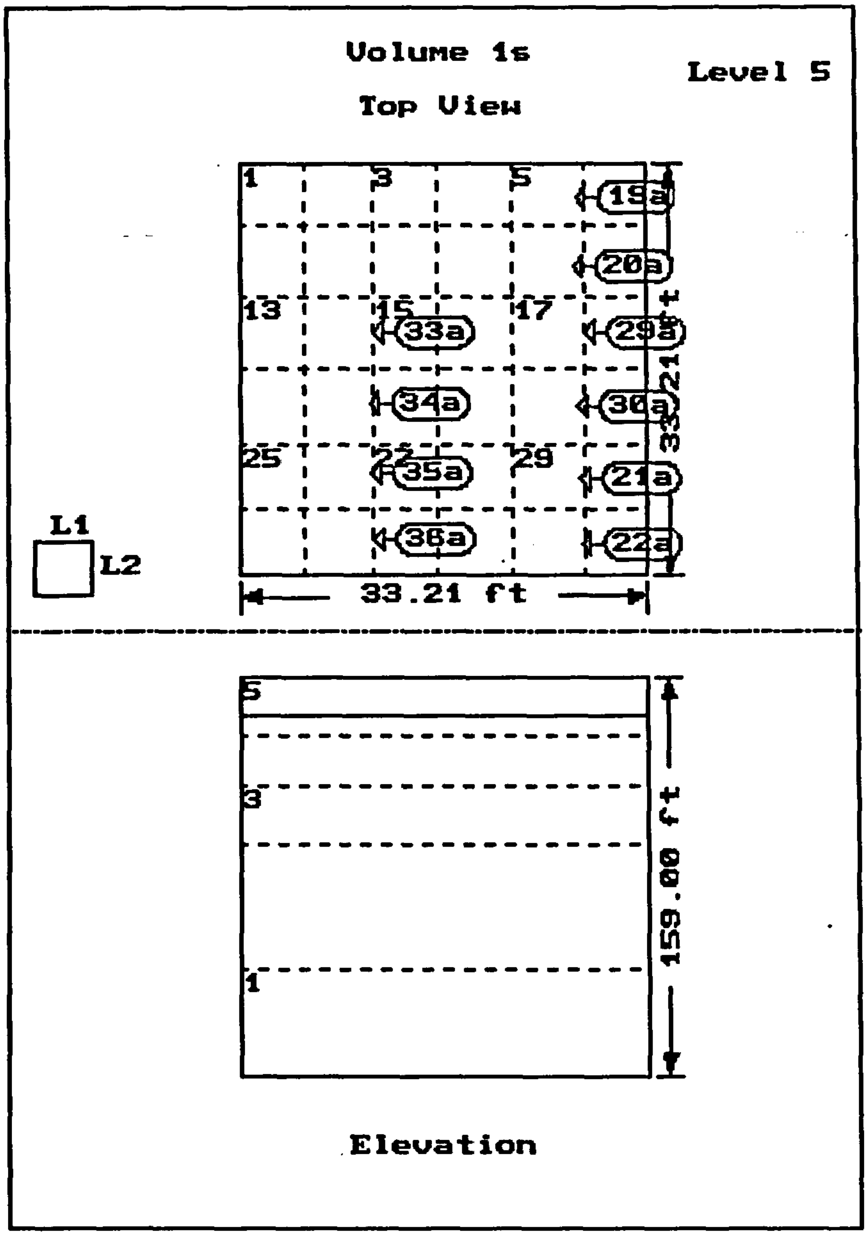
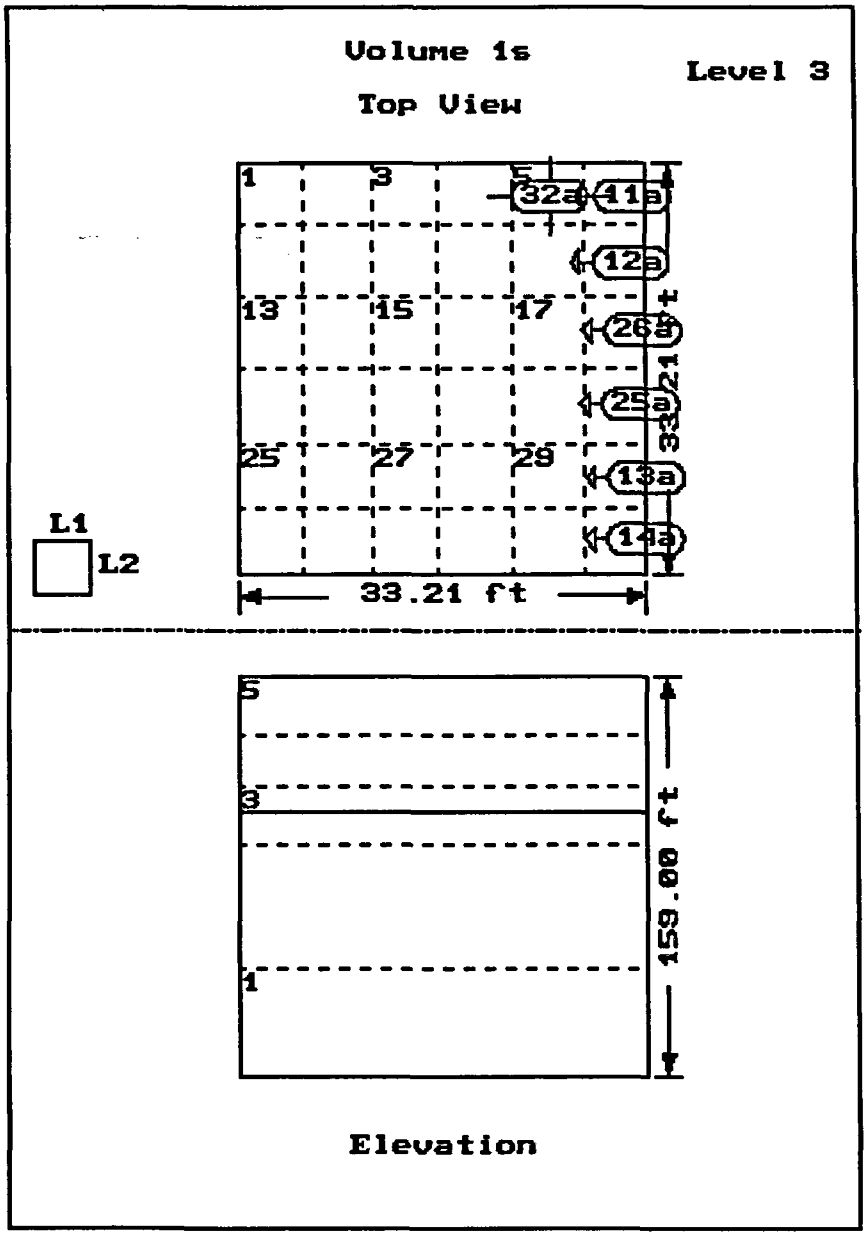


DB13U1BC: 1% MS113 - 139F - U1 - Small BC Flow
07:06:47 13-JAN-95
GOTHIC Version 4.0 - August 1993

SMN#94051

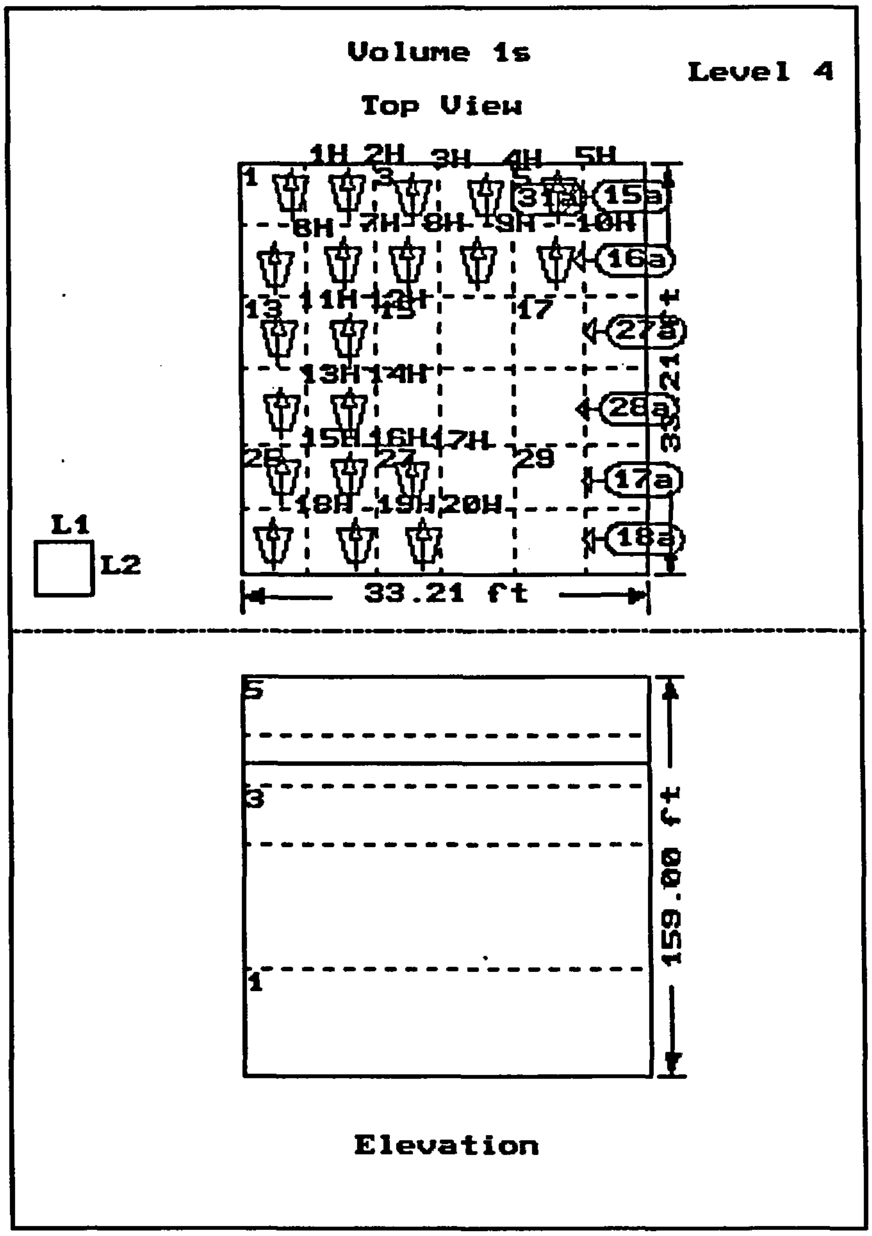
139/145



DB13U1BC: 1% MS113 - 139F - U1 - Small BC Flow
07:06:26 13-JAN-95
GOTHIC Version 4.0 - August 1993

SMNH 94051

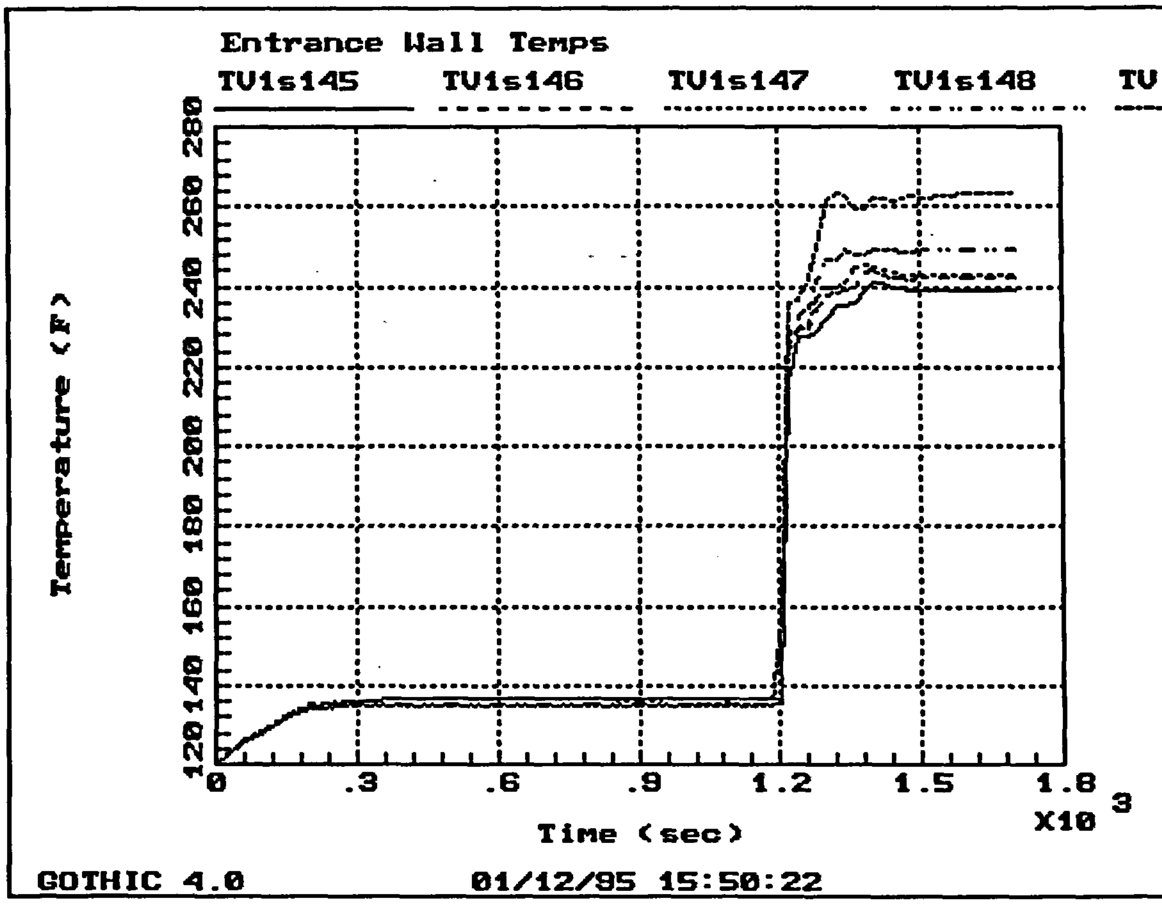
140/145



DB13U1BC: 1% MS113 - 139F - U1 - Small BC Flow
06:59:28 13-JAN-95
GOTHIC Version 4.0 - August 1993

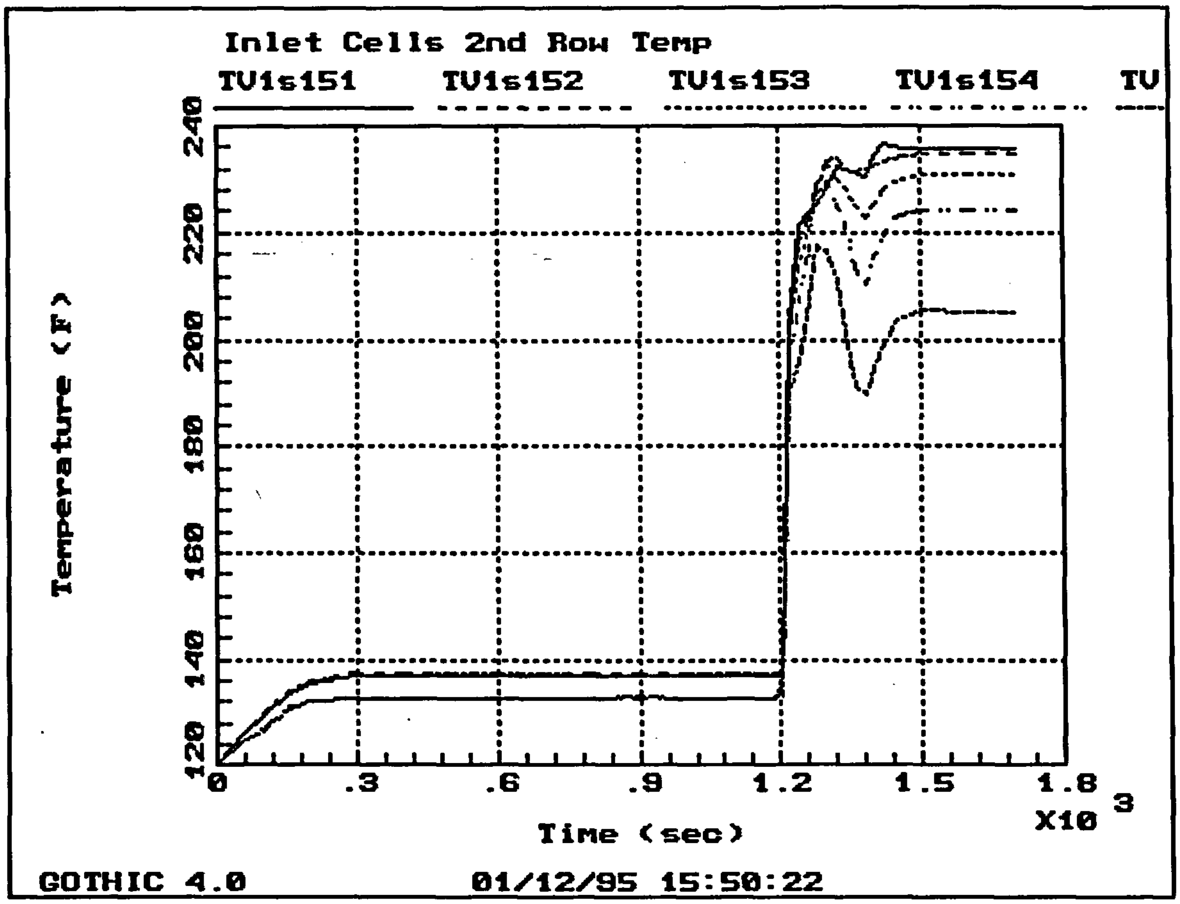
SMN#54051

141/145



DB13U1BC: 1% MS113 - 139F - U1 - Small BC Flow
06:59:36 13-JAN-95
GOTHIC Version 4.0 - August 1993

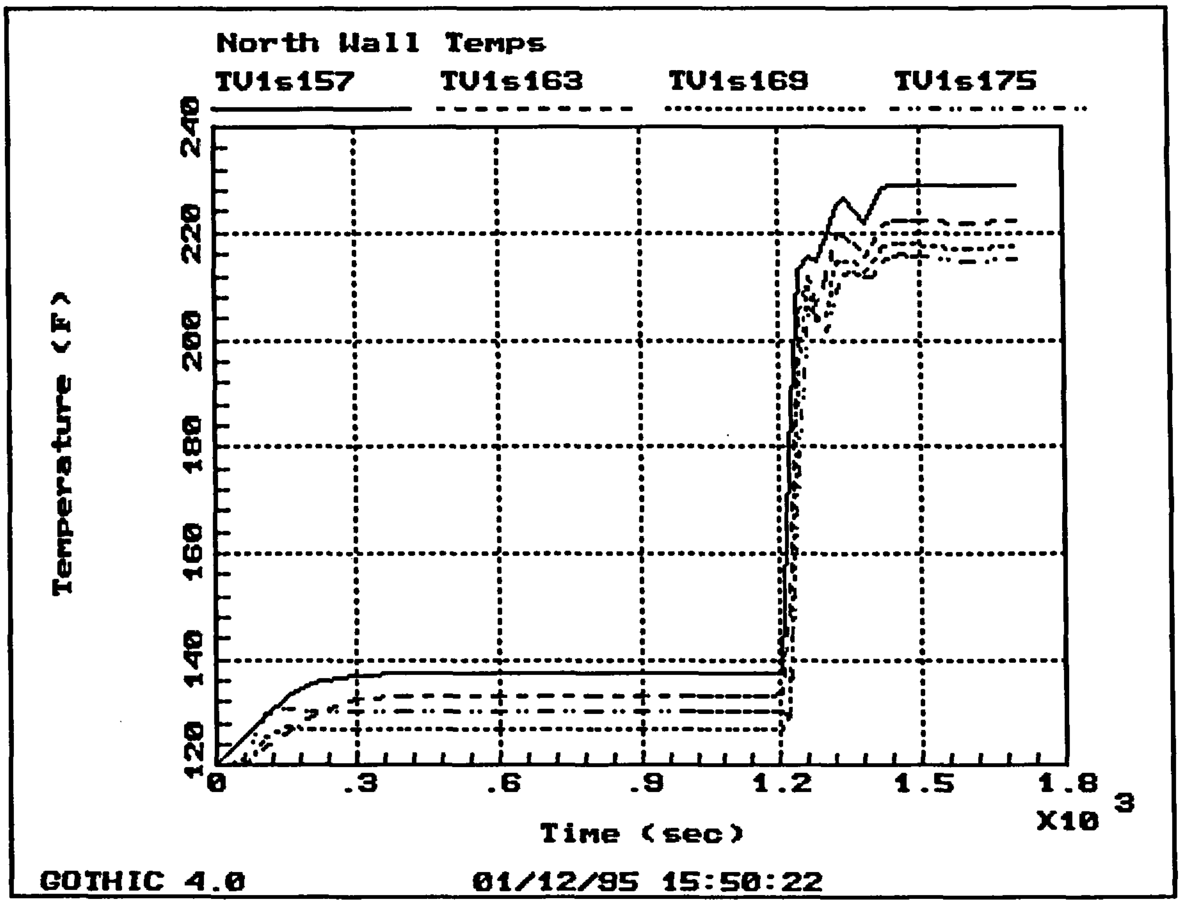
SMNH-94051
142/145



DB13U1BC: 1% MS113 - 139F - U1 - Small BC Flow
07:00:46 13-JAN-95
GOTHIC Version 4.0 - August 1993

SMN#94057

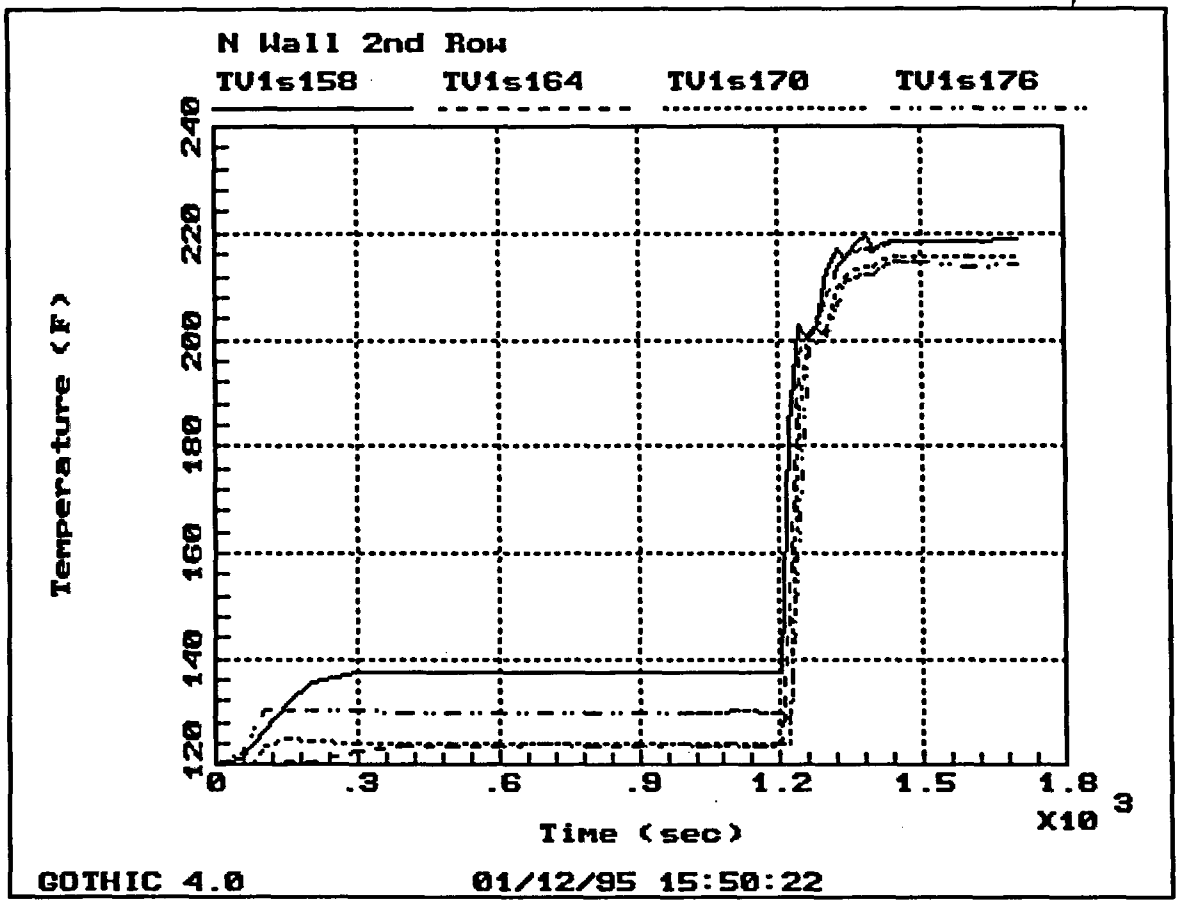
143/145



DB13U1BC: 1% MS113 - 139F - U1 - Small BC Flow
07:00:55 13-JAN-95
GOTHIC Version 4.0 - August 1993

SMNH94051

144/145



DB13U1BC: 1% MS113 - 139F - U1 - Small BC Flow
07:01:03 13-JAN-95
GOTHIC Version 4.0 - August 1993

SMNH94051

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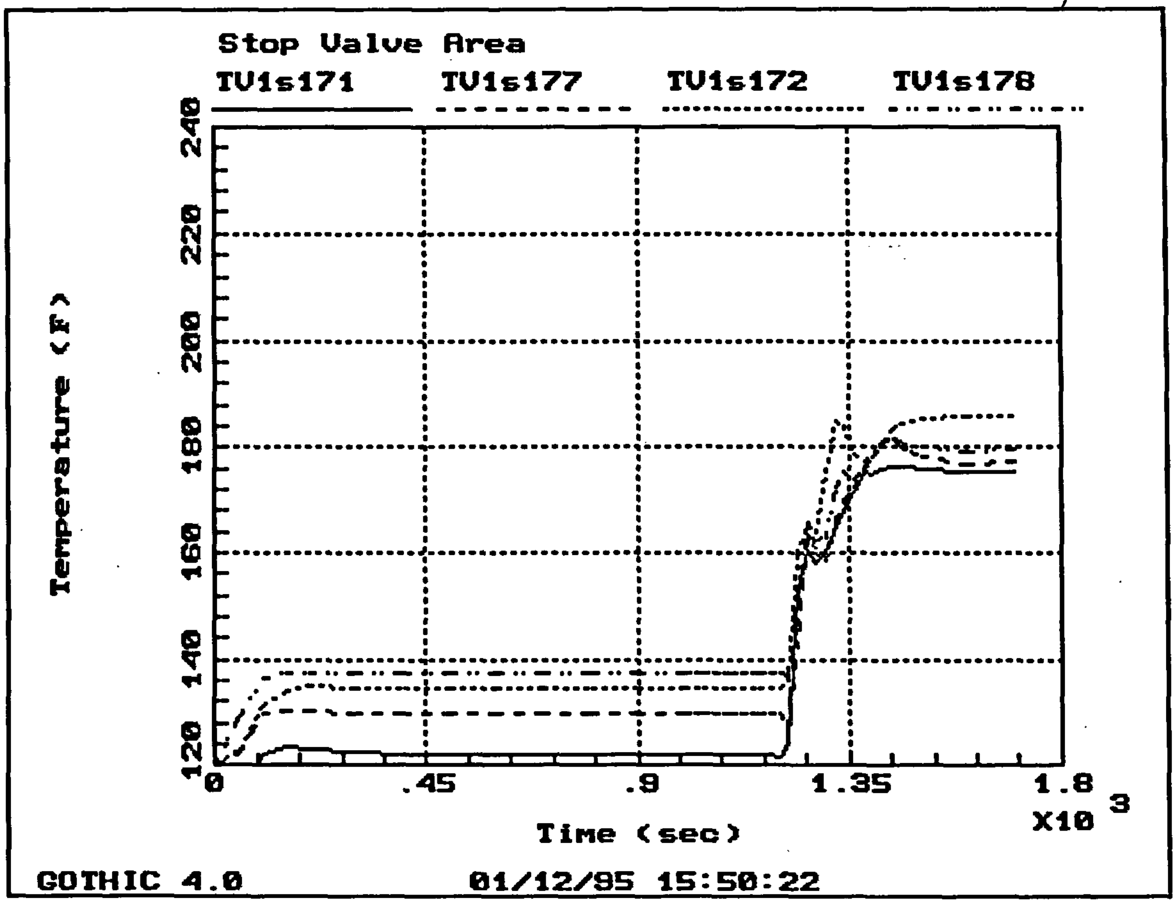

SMNH 94051
Attachment A
Sheet A1 of A3

McLeod, J. N.

From: Ghosh, Deep
To: McLeod, J. N.
Subject: FW: CON BAY TEMP.
Date: Monday, July 18, 1994 2:09PM
Priority: High

Jim: For your information: Deep

From: Britt, Scott A.
To: Ghosh, Deep
Subject: CON BAY TEMP.
Date: Monday, July 18, 1994 2:50PM
Priority: High

<<File Attachment: CONTEMP.WK4>>Jim: Temperature data for benchmarking your calculation: DEEP

SNNH94051
Attachment A
sheet A2 of A3

	A	B	C	D	E	F
1		CONBAY TEMPERATURE READINGS(deg. F)				
2						
3				8-23-93		
4						
5			A	B	C	D
6		N101	161	169	165	166
7		N102	169	168	163	168
8		N103	158	169	168	169
9		N104	166	173	164	160
10		N105	163	170	170	172
11		N106	165	173	166	171
12		N107	168	169	172	173
13		N108	169	170	170	175
14		N109	172	171	168	157
15		N110	175	180	168	171
16		N111	178	178	171	166
17		N112	173	168	168	168
18		N113	169	170	165	162
19		N114	172	170	169	163
20		N115	171	170	164	162
21		N116	168	165	165	167
22						
23				8-27-93		
24						
25			A	B	C	D
26		N101	169	169	167	170
27		N102	170	170	166	173
28		N103	150	171	169	170
29		N104	169	175	166	161
30		N105	169	172	170	172
31		N106	166	178	169	171
32		N107	168	171	170	171
33		N108	170	171	171	176
34		N109	170	177	154	161
35		N110	172	179	150	168
36		N111	177	171	170	168
37		N112	175	169	172	170
38		N113	171	175	171	163
39		N114	172	173	174	167
40		N115	174	173	172	167
41		N116	172	169	169	170
42						
43						

SMNH94051
Attachment A
Sheet A3 of A3

	A	B	C	D	E	F
50						
51		CONBAY TEMPERATURE READINGS(deg. F)				
52						
53				8-30-93		
54						
55			A	B	C	D
56		N101	168	168	167	170
57		N102	165	170	167	173
58		N103	158	171	170	170
59		N104	169	176	167	162
60		N105	170	171	170	173
61		N106	167	177	171	172
62		N107	170	172	171	173
63		N108	172	172	173	178
64		N109	171	179	154	165
65		N110	173	178	163	172
66		N111	176	177	175	171
67		N112	177	171	172	171
68		N113	174	174	173	164
69		N114	175	175	175	168
70		N115	175	174	171	169
71		N116	174	171	169	171
72						
73				7-18-94		
74						
75			A	B	C	D
76		N101	156	162	160	164
77		N102	158	163	161	166
78		N103	151	163	162	165
79		N104	158	167	159	155
80		N105	165	164	163	166
81		N106	159	166	160	164
82		N107	163	161	164	166
83		N108	164	163	163	167
84		N109	168	166	168	162
85		N110	168	173	166	169
86		N111	169	177	164	162
87		N112	177	163	160	161
88		N113	165	163	159	160
89		N114	169	165	157	158
90		N115	165	165	162	158
91		N116	163	162	162	164

SMNH 94051
ATTACHMENT B
sheet B1 of B2
(0384)

0940 12/1/94

	A	B	C	D
2U61-N101(N117)	142	149	149	153
02(N118)	143	150	-024	150
03	137	151	152	154
04	146	149	149	143
05	155	148	154	153
06	149	156	150	154
07	151	150	155	155
08	153	153	157	156
09	157	157	155	153
10	157	161	153	157
11	161	158	153	148
12	160	152	145	150
13	155	149	145	143
14	151	153	147	147
15	155	154	149	146
16(N132)	154	150	149	151

Outside Temp 48°F per U1 SPDS

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To Jim McLeod	From Jim WADE
Co.	Co.
Dept.	Phone #
Fax #	Fax #

SMNH94051
ATTACHMENT B
Sheet B2 of B2

Unit 2 Turbine Building Temperatures

Time 0312 Date 12-2-94

2U61-	A	B	C	D
N101	143	149	148	154
N102	144	150	DC written	150
N103	136	151	153	154
N104	146	149	148	143
N105	155	148	154	154
N106	149	156	156	154
N107	152	150	155	155
N108	153	153	156	156
N109	157	156	156	154
N110	157	161	153	157
N111	161	158	154	148
N112	160	152	150	150
N113	155	149	149	144
N114	152	154	147	147
N115	155	153	149	146
N116	154	150	149	152

Outside Temperature (From SPDS) 45°

FAX TRANSMITTAL MEMO

# of pages ▸ 1	
To J.A. WADE	From STEVE MAYHEW
Co.	Co
Dept	Phone #
Fax # 8-821-7682	Fax #