10.16 HCCALC 12-0025, Rev 3, "Drywell Volume & Torus Air & Water Volumes."

10.17 Specification 10855-M-786 (Q), Rev 11, Technical Specification For HVAC Air Filter Systems, Seismic Category I For The Hope Creek Generating Station.

10.18 Procedure HC.RA-AP.ZZ-0051(Q), Rev. 1, Leakage Reduction Program

10.19 HCCALC GU-0013, Rev. 4, Filtration Recirculation and Ventilation System Exhaust Rate

10.20 Drawing M-76-1, Rev. 18, P&ID Reactor Building Air Flow Diagram

10.21 CR961030231 Act. 0010 Response, Secondary Containment

10.22 NRC Report AEB-98-03, " Assessment of Radiological Consequences For the Perry Pilot Plant Application Using the Revised (NUREG-1465) Source Term.

10.23 MSIV Leakage Iodine Transport Analysis By J.E. Cline & Associates, March 26, 1991, Contract NRC-03-87-029, Task Order 75

10.24 NUREG/CR-2713, Vapor Deposition Velocity Measurements and Correlations for I_2 and CsI, May 1982.

10.25 HCCALC No. H-1-ZZ-MDC-0364, Rev 0, Drywell Temperature After Recirculation Line Break..

10.26 EQE International, Inc., Report No. 200235-R-01, November 12, 1998, Hope Creek Nuclear Plant Main Steam Isolation System Alternate Leakage Treatment Pathway Seismic Evaluation.

10.27 General Arrangement Drawings:

- 10.27.a P-0006-0, Rev 7, Plan EL 153'-0" and 162'-0"
- 10.27.b P-0011-0, Rev 5, Sections C-C & D-D

10.28 Equipment Location Drawings:

- 10.28.a P-0035-0, Rev 10, Service & Radwaste Area Plan EL 137'-0"
- 10.28.b P-0036-0, Rev 16, Service & Radwaste Area Plan EL 153'-0" & 155'-3"
- 10.28.c P-0055-0, Rev 15, Control & D/G Area, Plan EL 137'-0" & EL 146'-0" & EL 150'-0"
- 10.28.d P-0056-0, Rev 16, Control & D/G Area, Plan EL 155'-3" & EL 163'-6"

10.29 Auxiliary Bldg – Control Area Drawings:

- 10.29.a C-1317-0, Rev 22, Floor Plan EL 155'-3" Area 25
- 10.29.b C-1319-0, Rev 12, Floor Plan EL 155'-3" Area 26
- 10.29.c C-1321-0, Rev 5, Roof Plan EL 172-0" Area 25
- 10.29.d C-1323-0, Rev 4, Roof Plan EL 172-0" Area 26

10.30 Auxiliary Bldg – Control Area Drawings:

OUTSTANDING CHANGES MUST BE ATTACHED FOR WORKING COPY
20010717

FORM NC.DE-ZP.ZZ-0002-1

CALCULATION COVER SHEET Page 1 of 24

CALC. NO.: GU-0013 **REVISION** 4

CALC. TITLE: FILTRATION, RECIRCULATION, AND VENTILATION SYSTEM EXHAUST RATE

TS. (CALC) 24 **ATTACHMENTS: #/TOTAL SHTS.:** 5 /171 **TOTAL SHTS.:** 201

CHECK ONE:

☒ FINAL (Supports Installed Condition) ☐ INTERIM (Proposed Plant Change)
☐ FINAL (Future Confirmation Req'd) ☐ VOID

DESCRIPTION OF CALCULATION REVISION (IF APPL.):

The purpose of this calculation is to determine an analytical expression for the reactor building ventilation exhaust rate post-accident for the as-built plant configuration. This is a complete revision; due to the extensiveness of the calculation , revision bars have not been used.

REASON FOR CALCULATION REVISION (IF APPL.):

Revisions 0 through 3 contained design heat load and building data. Revision 4 incorporates the as-built heat loading, as determined in design calculations 11-0066 and 11-0079.

HOPE CREEK ☒ Q ☐ Qs ☐ Qsh ☐ F ☐ R ☐ N/A

Q - LIST (SALEM) ? ☐ YES ☒ NO

IMPORTANT TO SAFETY ? ☒ YES ☐ NO

INTERIM CALC - FUTURE CONFIRMATIONS REQUIRED? ☐ YES ☒ NO ☐ N/A
If YES, list page No(s).

F .L CALC - FUTURE CONFIRMATIONS REQUIRED? ☐ YES ☒ NO ☐ N/A
If YES, list tracking system and tracking No.

OTHER DOCUMENTS AFFECTED? (CBDs, UFSAR, ETC.): See Section 7.0

STATION PROCEDURES IMPACTED? ("N/A" FOR CALCS RELATED TO A DCP)
☐ YES OR UNSURE ☒ NO ☐ N/A

- If "YES OR UNSURE", has System Manager been contacted? ☐ YES ☐ NO
  - If "YES" or "NO", has pertinent descriptive information been transmitted to System Manager/Single Point of Contact? ☒ YES ☐ NO
  (transmittal required if System Manager is not contacted)

ORIGINATOR/COMPANY NAME: [signature] G. Morrison / PSE&G 4/29/99 **Date**

PEER REVIEWER/COMPANY NAME: NA **Date**

VERIFIER/COMPANY NAME: [signature] Vijay Chandra / PSE&G 5/3/99 **Date**

REVIEWED: Contractor Supervisor (as applicable) **Date**

APPROVED: [signature] R.W. DeNight/ PSE&G 5/12/99 **Date**
PSE&G Supervisor (Req'd)

PSEG	CALCULATION CONTINUATION SHEET	SHEET: 2 of 24 CONT'D ON SHEET:

CALC. NO.: GU-0013				REFERENCE: N/A			
ORIGINATOR, DATE	REV:	GAM, 4/29/99	4				
REVIEWER/VERIFIER, DATE		VC, 5/3/99					

REVISION HISTORY

Revision	Issue Date	Revision Description
0	7/2/82	The purpose of this report is to determine the numerical FRVS exhaust flow equation and to compare it to the FRVS exhaust flow equation referenced by PSE&G.
1	1/26/83	Added title block information on pages 19 and 20, added project calc. no. to page 1 and renumbered sheets 21 and 22. Changes were made to respond to QAF AF/AS-2.
2	5/19/83	This calculation confirms the equations developed in GU-10(Q). Also, the equations in GU-10(Q) are bounding and hence more conservative. Therefore GU-10(Q) supercedes GU-13(Q).
3	5/8/84	Perform FRVS long term exhaust rate calculation using updated information.
4	5/12/99	Revision 4 incorporates the as-built heat loading, as determined in design calculations 11-0066 and 11-0079.

PSEG	CALCULATION CONTINUATION SHEET	SHEET: 3 of 24 CONT'D ON SHEET:

CALC. NO.: GU-0013			REFERENCE: N/A			
ORIGINATOR, DATE	REV:	GAM, 4/29/99	4			
REVIEWER/VERIFIER, DATE		VC, 5/3/99				

PAGE REVISION INDEX

PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV
1	4	16	4	Attachment 1	4		
2	4	17	4	Attachment 2	4		
3	4	18	4	Attachment 3	4		
4	4	19	4	Attachment 4	4		
5	4	20	4	Attachment 5	4		
6	4	21	4				
7	4	22	4				
8	4	23	4				
9	4	24	4				
10	4						
11	4						
12	4						
13	4						
14	4						
15	4						

TABLE OF CONTENTS

PSEG	CALCULATION CONTINUATION SHEET	SHEET: 5 of 24 CONT'D ON SHEET:

CALC. NO.: GU-0013				REFERENCE: N/A			
ORIGINATOR, DATE	REV:	GAM, 4/29/99	4				
REVIEWER/VERIFIER, DATE		VC, 5/3/99					

1.0 PURPOSE

The purpose of this calculation is to determine an analytical expression for the reactor building ventilation exhaust rate post-accident for the as-built plant configuration. It incorporates the as-built heat loading, as determined in design calculations 11-0066 and 11-0079.

2.0 SCOPE

This calculation addresses only the FRVS Vent Fan exhaust rate, at the Hope Creek Generating Station (HCGS).

3.0 ASSUMPTIONS / INPUTS / CONDITIONS

3.1 The FRVS Vent fan was selected for purchase on the basis of a desired flow rate of 9000 cfm. The fan has been installed so that at 9000 cfm, 8 in w.g. is the differential pressure, per Reference 4.1.4 (MMIS ICD Card for 1A(B)-V-206). The vent fan's volumetric flow is constant, with vent fan vanes regulated by flow dampers 1GUFD-9426A(B) to maintain 8 in w.g. (References 4.2.1, 4.1.15). Reference 4.3.2, Section 4.6.5.3.1 specifies that the flow rate shall be 9,000 cfm ± 10%. For the exhaust rate calculation, it is assumed that the vent fan volumetric flow is constant at 9900 cfm.

3.2 At steady-state, the vent fan can exhaust no more air than that which enters the reactor building, (if it exhausts more, the pressure decreases, and vice-versa); therefore, the steady-state vent rate is equal to the in-leakage rate—on a pound-mass per second basis. The design basis in-leakage rate for the reactor building is provided in Supplement No. 2 of Reference 4.3.3. The maximum allowable in-leakage rate is specified to be 100% secondary containment volume per day. Reference 4.3.2, Section 4.6.5.1.c.2 specifies that the ventilation system shall maintain "greater than or equal to 0.25 inches vacuum water gauge in the secondary containment at a flow rate not exceeding 3324 cfm." This is the vent rate which corresponds to reactor building in-leakage of 100% total volume per day (2778 cfm) for fixed conditions of 5°F air, expanding to a temperature of 96°F (See Reference 4.1.5), with 4 cfm additional in-leakage assumed from primary containment (See Attachment 15 of Reference 4.1.5).

In this revision, the design basis value of 2778 + 4 cfm is used as the rate of in-leakage, with the volumetric expansion computed in the model. No credit is taken for any out-leakage which may occur during the period of reactor building over-pressure. These values are modeled as a duct from the reactor building to the atmosphere, with the area of the ducting computed on the basis of the temperature of the in-coming air. Out-leakage is prevented by modeling an infinite coefficient of resistance in the outboard direction.

3.3 The spent fuel pool is open to the refuel deck, and as such provides a source of latent heat as well as sensible heat. The latent portion is modeled as a constant mass input rate, with enthalpy assumed to be constant for the maximum spent fuel pool temperature of 170°F, per Attachment 6 of Reference 4.1.11.

3.4 The reactor building pressure is maintained at 0.25 inches vacuum w.g. during the period of FRVS operation by modulating the exhaust air damper, 1GUFD-9425A3(B3), and recirculating air damper, 1GUFD-9425A5(B5) (Reference 4.1.8). That portion of the flow which is not required to maintain the negative reactor building pressure is diverted back into the FRVS recirculation plenum. The instruments which actuate the dampers are indicating controllers 1GUPDIC-9426A(B) of the proportional-integral type (Reference 4.4.4). The set-point for the instruments has been established by Reference 4.1.8 as 0.55 in. w.g. vacuum; however, 0.48 and 0.50 in. w.g. vacuum are required by Reference 4.1.12. The additional .05 in. vacuum was added on the basis of over-all inherent system inaccuracies demonstrated by previous performances of the 18 Month Surveillance Tests (Reference 4.5.2). Because such inherent inaccuracy does not exist in a digital computer, for modeling purposes, 0.5 in. w.g. vacuum is utilized as the set-point. The governing equation for a proportional-integral controller is

$$m(t) = K_p e(t) + \frac{K_p}{T_I}\int_0^t e(t)dt \qquad \text{(Reference 4.1.13)}$$

where: $m(t)$ = controller output: in this case the immediate output is the 4-20 mA control signal to the FRVS vent damper actuators 1GUFD-9425A(B)3 & A(B)5; however, the ultimate output is the pressure of the reactor building.

$e(t)$ = error signal: in this case $(\Delta p - \Delta p_{set}) = (\Delta p-(-0.5)) = (\Delta p+0.5)$ [MMIS ICD Card]

K_p = Gain: in this case 1 [MMIS ICD Card]

T_I = integral time (seconds): The integral time is the reciprocal of the reset rate—recorded in terms of repeats per minute. Through iteration, the ideal reset rate was determined to be 1 repeat per minute. Faster rates yielded a system with excessive overshoot (too underdamped), and slower rates yielded a system which was sluggish (too overdamped).

3.5 The reactor building is modeled for both summer and winter conditions to ascertain the bounding case. All equipment is assumed to be functional. The heat produced from equipment is assumed to be the normal value for 10 seconds after the LOCA, and then assumes the final post-accident values, as determined by Reference 4.1.6. There are two exceptions from the reference.

1) the core spray motors, RHR motors, and FRVS recirculation fan motors are modeled as thermal conductors, which take the form of sources of energy surrounded by heat sinks, so that they do not immediately provide energy to the surrounding air. Instead the energy

created by motor inefficiency first heats the copper and steel of the motor itself, and then heats the air. This phenomenon is found in all motors, turbines, and pumps; however, only these very large motors were so modeled.

2) The suppression pool is modeled, for all model runs, after the Suppression Pool Temperature Response for DBA-LOCA Case C, computed in Reference 4.4.5. [The case is from Section 6.2 of Reference 4.3.1] This is the fastest rising and highest temperature response for a DBA, and is calculated for a SACS temperature of 100°F. The heat load to the Torus Room (model compartment 12) is as modeled in Reference 4.1.6. The over-all heat transfer coefficient used is 0.0003887 Btu/sec-ft^2-°F. The surface area used is 34270 ft^2. The vapor is assumed to be at the same temperature as the liquid. The lighting and equipment load to compartment 12 remains as per Reference 4.1.6.

3.6 The reactor building is assumed to be at environmental equilibrium at the start of the event. The walls and exposed steel surfaces are assumed to absorb energy, in the form of heat sinks; however, heat transfer through the exterior walls is assumed not to occur. The exterior surfaces of the reactor building are modeled as adiabatic. The quantities of concrete and steel modeled are as computed in Reference 4.1.5.

3.7 The reactor building is divided into 25 compartments as in the analysis of Reference 4.1.5. (excerpted in Attachment 5). Those rooms with high heat loading [particularly those on the 54 ft level provided separate coolers of the Equipment Area Cooling System (EACS)] are treated individually or in pairs, while rooms of the upper levels are grouped into larger compartments.

3.8 The initial room temperatures in the reactor building are assumed to be their minimum normal operating temperatures for winter, and maximum normal operating temperatures for summer, as delineated in Reference 4.1.7. In cases where compartments contain multiple rooms, the minimum or maximum temperature, respectively, for the compartment was assumed, with the following exceptions:

Compartment 8,9:	Rooms 4206, 4212 are vestibules—the RHR rooms dominate.
Compartment 10,11:	Rooms 4111 & 4108 are assumed at 102 & 104°F respectively for summer per PIRS 980901199, which identified that the HPCI & RCIC room temperatures are understated in the reference.
Compartment 12:	The torus compartment dominates due to its great volume .
Compartment 15:	Rooms 4207, 4213 are corridors—the RACS pump and HX rooms dominate.
Compartment 18:	Room 4326 & 4333 are contiguous with 4328 and 4322, and have half-compartment height non-insulating partitions. The temperature of the other major spaces, which includes the rooms adjoining 4326 & 4333, is assumed. Rooms 4318 and 4330 are very small; the larger rooms dominate.
Compartment 21:	Room 4513 is a small room with half-walls. Room 4509 is small. The larger

rooms dominate.

Compartment 23: Room 4609 is small. The larger spaces dominate.

Compartment 24: This compartment is made up of a substantial number of large spaces, no one of which can be clearly taken as dominant. For winter, a normal minimum temperature of 50°F is assumed, and for summer a normal maximum temperature of 83°F is assumed.

Compartment 25: This compartment is dominated by the massive refuel floor laydown area (Rm. 4710)

3.9 Zero gauge pressure is assumed at 174 ft, the point of sensor tube wall penetration (See Reference 4.1.12). The initial hydrostatic pressure for each compartment is computed for the midpoint of the height of the compartment. This hydrostatic pressure variation in air is ordinarily ignored; however, since the pressure differences required of the FRVS system are themselves small, this variation cannot be discounted in this calculation.

4.0 REFERENCES

4.1 Engineering Documents:

4.1.1 ASME Steam Tables, 6th Edition
4.1.2 M-786, HVAC Air Filter Systems – Seismic Category I, Revision 11
4.1.3 Calculation GR-0026, Reactor Building FRVS Pressure Losses, Revision 1
4.1.4 Calculation GR-0023, Reactor Building FRVS Vent System Pressure Losses, Revision 0
4.1.5 Calculation 11-0066, HCGS FRVS Drawdown Analysis, Revision 6
4.1.6 Calculation 11-0079, FRVS Drawdown Analysis Heat Loads, Revision 2
4.1.7 Design, Installation, and Test Specification DITS 7.5, Plant Environmental Conditions, Revision 14
4.1.8 Calculation SC-GU-0065-1, Reactor Bldg Atmospheric Differential Pressure Control, Revision 3
4.1.9 Fundamentals of Engineering Thermodynamics, Moran and Shapiro, 3d Edition
4.1.10 M-711, Air Handling Units – Seismic Category I, Revision 14
4.1.11 Calculation GU-0009, Long Term Post-LOCA Reactor Building Temperature, Revision 1
4.1.12 Calculation GU-0030, Reactor Building DP Controller Set-Point, Revision 1
4.1.13 Modern Control Engineering, Ogata, 1st Edition, p. 156
4.1.14 Calculation SC-GR-0024, To Unit Coolers, Revision 1
4.1.15 Calculation GU-0016, Instrument Set-points for FRVS Vent Fan Flow Switches, Revision 1
4.1.16 Calculation 11-0009, Reactor Building Area/Volume, Unit 1 Only, Revision 2

4.2 Drawings:

4.2.1 M-84-1, Sheet 1, P&ID Reactor Bldg Exhaust Control Diagram, Revision 24
4.2.2 M-11-1, Sheet 1, P&ID Safety Auxiliaries Cooling System, Revision 25
4.2.3 M-11-1, Sheet 3, P&ID Safety Auxiliaries Cooling System, Revision 24
4.2.4 M-14-1, Sheet 1, P&ID Turbine Auxiliaries Cooling System, Revision 18
4.2.5 M-14-1, Sheet 2, P&ID Safety Auxiliaries Cooling System, Revision 22

4.2.6 M-15-0, Sheet 5, P&ID Compressed Air (Instrument), Revision 04
4.2.7 M-83-1, Sheet 1, P&ID Reactor Building Supply Control Diagram, Revision 23

4.3 Regulatory Documents:
4.3.1 Hope Creek Generating Station Updated Final Safety Analysis Report (UFSAR), Revision 8
4.3.2 HCGS Technical Specifications
4.3.3 NUREG 1048, Safety Evaluation Report for HCGS, October 1984, with Supplements

4.4 Vendor Documents
4.4.1 PM713Q-0029, Performance Curves, Revision 6
4.4.2 PM711-0010, Cooling Coils, Revision 4
4.4.3 PM069Q-0014, Safety Aux Cooling Sys Heat Exch Performance Data, Revision 1
4.4.4 PM780AQ-0064, Indicating Controller, Revision 1
4.4.5 PSBP 323835, Containment Analysis w/ Increased SACS Temperature, Revision 1
4.4.6 PN1-E11-C002-0006, Outline Induction Motor, Revision 6
4.4.7 PN1-E21-C001-0008, Outline (Nuclear Induction Motor), Revision 8
4.4.8 PM713Q-0054, AC Motor Frames Type T Fan Cooled Outline, Revision 3
4.4.9 M-786 [Appendix F], HVAC Air Filter Systems, Seismic Category 1, Revision 11
4.4.10 PM786Q-0011, Nuclear Containment Cooling Coil, Revision 3
4.4.11 PM786Q-0003, Housing Assy. Filter (FRVS Recirc. Filter Plenum Item 1), Revision 18

4.5 Procedures
4.5.1 HC.OP-SO.GU-0001(Q), Filtration, Recirculation, and Ventilation System Operation, Revision 14
4.5.2 HC.OP-ST.GU-0002, Reactor Building Integrity Functional Test—18 Months, Revision 4

4.6 Software
4.6.1 A-0-ZZ-MCD-0158, Critical Software Document GOTHIC 6.0a, Revision 2

5.0 ANALYSIS

5.1 Methodology

In the reactor building post-accident, the temperature will change as a function of time, pressure will change as a function of time and temperature, mass will change as a function of time, temperature and pressure, heat transfer will occur into heat sinks as a function of time and temperature, heat producing equipment will be stopping and starting, and all of these things will occur simultaneously within a large number of individual compartments. The development of a closed-form expression for the FRVS exhaust rate is not possible; however, the simplifications and assumptions of Section 3.0 permit the exhaust rate to be developed through computer modeling.

Approach

Step 1: Model the reactor building for both winter and summer limiting conditions.
Step 2: Determine an analytical expression for the exhaust rate which bounds the model results.

5.2 In order to generate the FRVS vent exhaust rate, the reactor building will be modeled by computer simulation using GOTHIC transient analysis software. The GOTHIC program is critical software as defined by ND.DE-AP.ZZ-0052(Q), Revision 1, designated GOTHIC, Reference 4.6.1.

5.3 **General Modeling Considerations**

5.3.1 All compartment heat loads are the steady state (final) heat loads as derived in Reference 4.1.6 (excerpted in Attachment 5) with the following exceptions:

5.3.1.2 No equipment failure or LOP is assumed; therefore, the 4th SACS pump is added to the computed heat load from Reference 4.1.6 for Compartment 16, with an additional heat load of 27.075 Btu/sec.

5.3.1.3 As discussed in Section 3.5, the Core Spray, RHR, and FRVS motors are modeled as thermal conductors. The direct heat from these motors is removed from their compartment heat load totals and thermal conductors were added in their place:

Compartment 4:	1B-P-206	36.05 Btu/sec
	1D-P-206	36.05 Btu/sec
Compartment 5:	1A-P-206	36.05 Btu/sec
	1C-P-206	36.05 Btu/sec
Compartment 6:	1D-P-202	77.4 Btu/sec
Compartment 7:	1C-P-202	77.4 Btu/sec
Compartment 8:	1B-P-202	77.4 Btu/sec
Compartment 9:	1A-P-202	77.4 Btu/sec
Compartment 20:	1A(C)-V-213	7.56 Btu/sec (1 motor)
Compartment 24:	1D(E)-V-213	15.12 Btu/sec (2 motors)
	1B(F)-V-213	7.56 Btu/sec (1 motor)

The motor parameters are :

RHR pump motors (Reference 4.4.6):

Weight:	14000 lb		
Diameter:	3.6 ft		
Length:	8.4 ft	Area = 95.0 ft^2	Volume = 85.7 ft^3
Density:	165.0 lbm/ft^3	(Derived from mass/volume)	
Heat Rate:	0.90 Btu/ft^3-sec	(Derived from heat produced/volume)	

Conductivity, k:	3 Btu/hr-ft-F	(Assumed, taking into account insulation)
Specific heat:	0.1 Btu/lbm-F	(Assumed composite of steel and copper)

Core Spray pump motors (Reference 4.4.7):

Weight:	7200 lb	
Diameter:	3 ft	
Length:	6 ft	Area = 56.5 ft^2 Volume = 42.4 ft^3
Density:	165.0 lbm/ft^3	(Derived from mass/volume)
Heat Rate:	0.85 Btu/ft^3-sec	(Derived from heat produced/volume)
Conductivity, k:	3 Btu/hr-ft-F	(Assumed, taking into account insulation)
Specific heat:	0.1 Btu/lbm-F	(Assumed composite of steel and copper)

FRVS Recirculation fan motors (Reference 4.4.8):

Weight:	1950 lb	
Diameter:	2 ft	
Length:	3 ft	Area = 18.85 ft^2 Volume = 9.42 ft^3
Density:	207.0 lbm/ft^3	(Derived from mass/volume)
Heat Rate:	0.803 Btu/ft^3-sec	(Derived from heat produced/volume)
Conductivity, k:	3 Btu/hr-ft-F	(Assumed, taking into account insulation)
Specific heat:	0.1 Btu/lbm-F	(Assumed composite of steel and copper)

It is assumed for these motors that there is an initial surge heating of ten times the steady state rate, which decays parabolically to the steady state rate in four seconds.

5.3.2 The FRVS recirculation unit heat exchangers were modeled precisely using References 4.4.9 – 4.4.11. The benchmarking of the heat exchangers is contained in Appendix 4. Four FRVS exchangers are modeled as operating, which is the normal usage (all six FRVS recirculation units start on a LOCA signal, but two coolers are assumed to be turned off per Reference 4.5.1).

5.3.3 The EACS coolers are modeled as follows. [Heat transfer data for all of the EACS coolers is from Reference 4.4.2. Set-point data is from Reference 4.1.14.] The set point for the RHR, CS, HPCI, and RCIC room coolers to turn on is 115°F, (this is the process limit high, and assumes that the first cooler fails, necessitating the use of the redundant back-up). Reset is 1% of span (225°F), therefore 112.75°F. The set point for the SACS pump room coolers to turn on is 104°F, (this is the process limit high, and assumes that the first cooler fails, necessitating the use of the redundant back-up). Reset is 5° below turn-on, therefore 109°F. Because both the cooling water control valves and the heaters are controlled by the same thermostats [1GRTS-9381A(B) through 9385A(B)] (Reference 4.2.7), both the fan heat to the rooms and the cooling of the rooms are modeled using these set-points.

RHR Pump Room Coolers [1A(B-H)-VH210]:

$$\frac{448500 \text{Btu/hr}}{3600 \text{sec/hr}} = \alpha(115 - 95^{\circ}\text{F})$$

$$\alpha = 6.23 \text{Btu/sec}^{\circ}\text{F}$$

The RHR pump room coolers, used in compartments 6,7,8,9, are modeled as:

$$\dot{Q} = 6.23(T_{room} - T_{SACS})$$

HPCI Room Cooler [1A(B)-VH209]:

$$\frac{311000 \text{Btu/hr}}{3600 \text{sec/hr}} = \alpha(115 - 95^{\circ}\text{F})$$

$$\alpha = 4.32 \text{Btu/sec}^{\circ}\text{F}$$

The HPCI room cooler, used in compartment 10, is modeled as:

$$\dot{Q} = 4.32(T_{room} - T_{SACS})$$

RCIC Room Cooler [1A(B)-VH208]:

$$\frac{137000 \text{Btu/hr}}{3600 \text{sec/hr}} = \alpha(115 - 95^{\circ}\text{F})$$

$$\alpha = 1.90 \text{Btu/sec}^{\circ}\text{F}$$

The RCIC room cooler, used in compartment 11, is modeled as:

$$\dot{Q} = 1.90(T_{room} - T_{SACS})$$

Core Spray Pump Room Coolers [1A(B)-VH211]:

$$\frac{311000 \text{Btu/hr}}{3600 \text{sec/hr}} = \alpha(115 - 95°F)$$

$$\alpha = 4.32 \text{Btu/sec°F}$$

The core spray pump room coolers, used in compartments 4 and 5, are modeled as:

$\dot{Q} = 4.32(T_{room} - T_{SACS})$ (There are two coolers in each of compartments 4 and 5)

SACS Pump Room Coolers [1A(B-D)-VH208] (Note: These coolers use chilled water to provide cooling):

$$\frac{550000 \text{Btu/hr}}{3600 \text{sec/hr}} = \alpha(104 - 50°F)$$

$$\alpha = 2.83 \text{Btu/sec°F}$$

The SACS pump room coolers, used in compartment 16, are modeled as:

$\dot{Q} = 2.83(T_{room} - T_{chilled water})$ (There are two coolers in compartment 16)

5.3.4 Compartment volumes, flow path cross-sectional areas, and concrete and steel heat sink surface areas are taken from Reference 4.1.5. (Excerpted in Attachment 5). The only exception is that in order to maximize the volume of air exhausted, the full geometric volume of the refuel deck (the major volume of Compartment 25) was used per Reference 4.1.16.

5.3.5 The completed model using the parameters listed above is shown in Attachments 1 and 2.

5.4 Determination of the Winter Initial Conditions

5.4.1 P = standard atmospheric pressure – 0.25 inches water [The set-point of 1GRPC-9420, the Reactor Building Ventilation System (RBVS) pressure controller (MMIS ICD Card)]
= 14.696 psia - (0.25 inches water)(14.696 psia/406.92 inches water)
= 14.687 psia
T = 40°F (Assumption based on minimum mode temperature per Reference 4.1.7)
RH = 50%
F.V. = 4,000,000 cuft [free (geometric) volume per Reference 4.3.1, Table 6.2-12]

$P_{vapor} = RH(P_{sat@40}) = 0.50(0.12163) = 0.0608$ psia (Reference 4.1.1)
$P_{dry\ air} = 14.687 - 0.061 = 14.626$ psia

Due to the drywell expansion immediately following a LOCA , air is "squeezed" out of the drywell/concrete gap into the secondary containment. The amount of air which is transferred is equal to 108.35 lbm (Reference 4.1.6, Attachment 6). This will increase the secondary containment pressure. The initial air mass is equal to:

M_{total} = 144 sqin/sqft (14.626 lbf/sqin)(4.0E6 cuft) / [(53.32 ft-lbf/lbm-°R)(40 + 460°R)] +108.35 lbm

M_{total} = 316000.6 + 108.4 = 316109.0 lbm

The total air pressure, corrected for additional air mass from drywell expansion is:

P = 316109.0 lbm (53.32 ft-lbf/lbm-°R) (500°R) / (144 sqin/sqft)(4.0E6 cuft) + P_{vapor}
P = 14.631 + 0.061 = 14.692 psia (Zero gauge pressure is assumed at 174 ft)

The molecular mass of the reactor building air is :

$$M.W. = \frac{(0.0608\,lbf/in^2)(18.02\,lbm/lbmole) + (14.692 - .0608\,lbf/in^2)(28.97\,lbm/lbmole)}{14.692\,lbf/in^2}$$

$$M.W. = 28.924\,lbm/lbmole$$

The density of the reactor building air is:

$$\rho = \frac{P(M.W.)}{R_U T} = \frac{(14.692\,lbf/in^2)(28.924\,lbm/lbmole)(144\,in^2/ft^2)}{(1545.35\,ft\,lbf/lbmole\,R)(500R)} = 0.079\,lbm/ft^3 = .00246\,slug/ft^3$$

PSEG	CALCULATION CONTINUATION SHEET	SHEET: 15 of 24 CONT'D ON SHEET:				
CALC. NO.: GU-0013		REFERENCE: N/A				
ORIGINATOR, DATE	REV:	GAM, 4/29/99	4			
REVIEWER/VERIFIER, DATE		VC, 5/3/99				

The initial compartment pressures, accounting for hydrostatic pressure variation, are:

Elevation 201: median height 250 ft. (Compartment 25)

$$P_o = P_{174} + \rho g h = 14.692\,\text{psia} + \frac{(0.00246\,\text{slug/ft}^3)(32.2\,\text{ft/sec}^2)(174 - 250\,\text{ft})}{144\,\text{in}^2/\text{ft}^2} = 14.650\,\text{psia}$$

Elevation 162: median height 174 ft. (Compartments 23,24). The elevation of pressure sensor tube entry into the reactor building. It is established as the 0 gauge pressure elevation: 14.692 psia.

Elevation 145: median height 152 ft. (Compartments 21,22). [This and following were determined using the method of Elevation 201]

P_o = 14.704 psia

Elevation 132: median height 144 ft. (Compartment 20).

P_o = 14.709 psia

Elevation 132: median height 138 ft. (Compartment 19).

P_o = 14.712 psia

Elevation 102: median height 116 ft. (Compartment 3,16,17,18).

P_o = 14.723 psia

Elevation 77: median height 89 ft. (Compartment 13,14,15).

P_o = 14.738 psia

Elevation 54: median height 77 ft. (Compartment 8,9,12).

P_o = 14.744 psia

Elevation 54: median height 65 ft. (Compartment 4,5,6,7,10,11).

P_o = 14.750 psia

5.4.2 The minimum value of SACS cooling water is T_{SACS} = 32°F (Reference 4.3.1, Table 9.2-3). This value is non-conservative, however, since it provides a maximum of cooling and therefore minimizes thermal expansion. U.S. Coast and Geodetic Survey Temperature data for the years 1991 – 96 (Attachment 3) shows that the greatest mean river water temperature for the months January – February was 5.0°C (41°F). [These months correspond to the time period during which the outdoor temperature may be 5°F.] The STACS heat exchangers 1A1(A2 – B2)E-201 (Reference 4.4.3) yield 110x10^6 Bt/hr, for T_{SSWin} = 85°F, and $T_{SACSout}$ = 95°F. Under winter conditions, the heat loading to the reactor building is much lower than under peak summer conditions; therefore, $T_{SACSout}$ would be reduced further than the 10° indicated above. The SACS heat exchanger temperature control valves [1EGHV-2457A(B) and 1EGTV-2517A(B)] are supplied by instrument air (Reference 4.2.6). Upon either a loss of power or a loss of instrument air, the valves will fail closed (MMIS ICD Card). This analysis does not assume a loss of power; however, on a LOCA signal, service water is isolated from the Turbine Auxiliaries Cooling System (TACS) (References 4.2.2 through 4.2.5). The loss of TACS will cause the loss of instrument air, causing all SACS flow to be sent through the SACS heat exchangers, providing maximized cooling. A winter SACS temperature value of 51°F at the heat exchanger outlet is therefore taken as a conservative and realistic value.

5.5 Determination of the Reactor Building Exhaust Rate During Winter

5.5.1 Heat loading to the compartments is per Reference 4.1.6 except as noted above, and with the following additional exception:

Analysis of Attachment 5 of Reference 4.1.6, shows Q_{solar} to be negative for winter conditions. Q_{solar} is therefore removed from the heat loads provided in Section 6.0 of the reference. The amounts removed are 23.59 Btu/sec from Compartment 16 (Rms 4307, 4309), 15.28 Btu/sec from Compartment 17 (Rms 4301/4310, 4303, 4323), and 40.19 Btu/sec from Compartment 25 (Refuel floor).

5.5.2 The in-leakage is modeled as a duct between the atmosphere and the reactor building at 174 ft elevation. Air is prevented from leaking out during periods when the reactor building is above atmospheric pressure by modeling an infinite loss factor, k, in the outward direction. For the inward direction, the area of the duct is computed as follows:

The pressure loss through a fitting is:

$\Delta P = \frac{1}{2} k \rho V^2$, which, rewritten for volumetric flow rate, is: $\Delta P = \frac{1}{2} k \rho \frac{Q^2}{A^2}$, where $Q^2 = V^2 A^2$

CALC. NO.: GU-0013				REFERENCE: N/A			
ORIGINATOR, DATE	REV:	GAM , 4/29/99	4				
REVIEWER/VERIFIER, DATE		VC, 5/3/99					

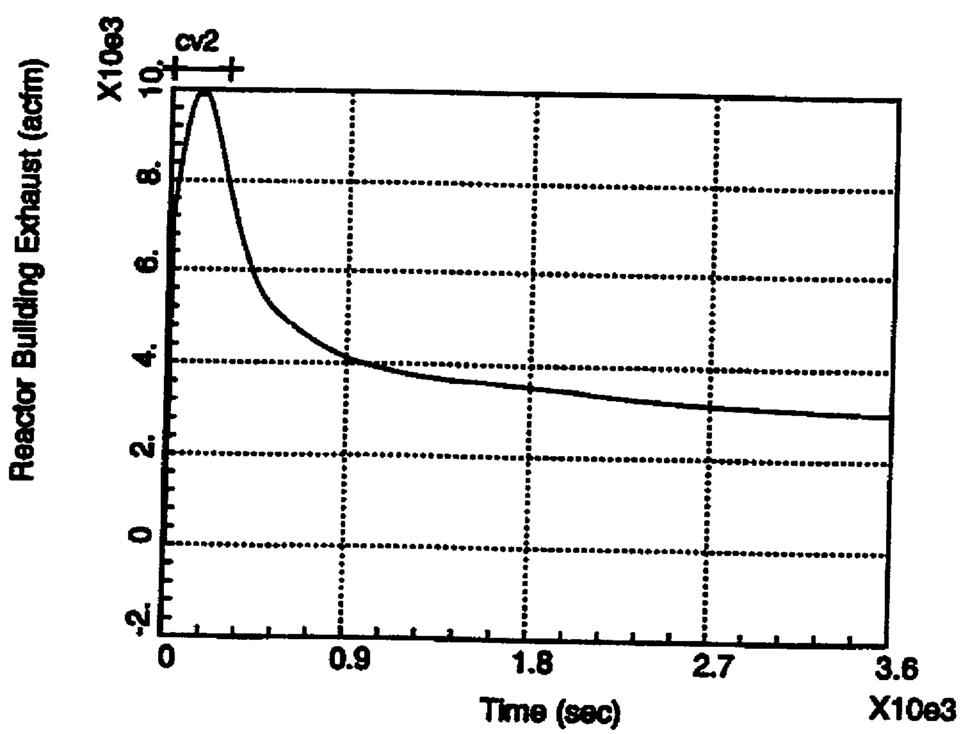
The density of the entering air is: $\rho = \frac{P}{RT} = \frac{14.7\frac{lbf}{in^2}144\frac{in^2}{ft^2}}{53.3\frac{ft\,lbf}{lbm\,R}465R} = 0.085\frac{lbm}{ft^3}$ (winter)

At a steady state in-leakage of 2782 cfm and reactor building pressure of 0.50 in vacuum w.g. at 174 ft. elevation , the cross-sectional area of the pipe is found by assigning a value k=1.0. Then:

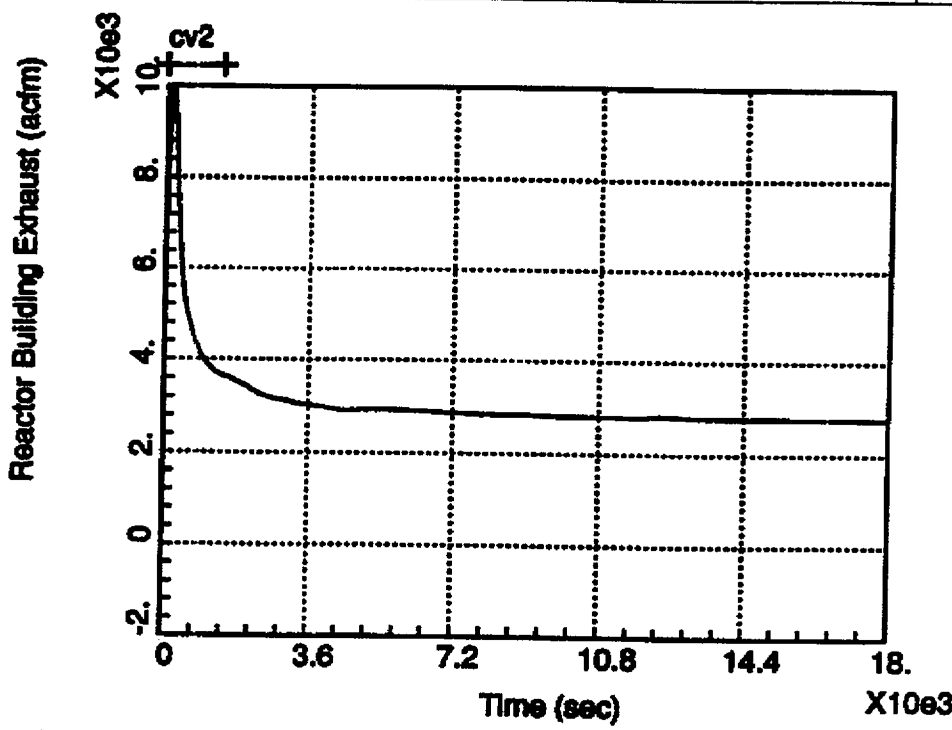
$$\frac{0.5\,in.w.g.}{27.7\,in.w.g./psi}(144\,in^2/ft^2) = \frac{1}{2}\left(0.085\frac{lbm}{ft^3}\right)\frac{(2782\,ft^3/min)^2}{A^2}\left(\frac{1min}{60\,sec}\right)^2\left(\frac{lbf\,sec^2}{32.2\,ft\,lbm}\right)$$

Therefore: $A = 1.046\ ft^2$ (winter)

5.5.3 The winter conditions are modeled in GOTHIC (Reference 4.6.1), (See Attachment 1), with the results presented below.



CALC. NO.: GU-0013				REFERENCE: N/A			
ORIGINATOR, DATE	REV:	GAM , 4/29/99	4				
REVIEWER/VERIFIER, DATE		VC, 5/3/99					



5.6 **Determination of the Summer Initial Conditions**

5.6.1 P = standard atmospheric pressure – 0.25 inches water
= 14.696 psia - (0.25 inches water)(14.696 psia/406.92 inches water)
= 14.687 psia
T = 104°F (Maximum mode temperature per Reference 4.1.7)
RH = 50%
F.V. = 4,000,000 cuft [free (geometric) volume per Reference 4.3.1, Table 6.2-12]

$P_{vapor} = RH(P_{sat@104}) = 0.5(1.0697) = 0.535$ psia (Reference 4.1.1)
$P_{air} = 14.687 - 0.535 = 14.152$ psia

Due to the drywell expansion immediately following a LOCA , air is "squeezed" out of the drywell/concrete gap into the secondary containment. The amount of air which is transferred is equal to 108.35 lbm (Reference 4.1.6, Attachment 6). This will increase the secondary containment pressure. The initial air mass is equal to:

M_{total} = 144 sqin/sqft (14.152 lbf/sqin)(4.0E6 cuft) / [(53.32 ft-lbf/lbm-°R)(104 + 460°R)]
+108.35 lbm

M_{total} = 271063.5 + 108.4 = 271171.9 lbm

PSEG	CALCULATION CONTINUATION SHEET	SHEET: 19 of 24 CONT'D ON SHEET:

CALC. NO.: GU-0013				REFERENCE: N/A		
ORIGINATOR, DATE	REV:	GAM , 4/29/99	4			
REVIEWER/VERIFIER, DATE		VC, 5/3/99				

The total air pressure, corrected for additional air mass from drywell expansion is:

P = 271171.9 lbm (53.32 ft-lbf/lbm-°R) (564°R) / (144 sqin/sqft)(4.0E6 cuft) + P_{vapor}

P = 14.158 + 0.535 = 14.693 psia (Zero gauge pressure is assumed at 174 ft)

The molecular mass of the reactor building air is :

$$M.W. = \frac{(0.535\,lbf/in^2)(18.02\,lbm/lbmole) + (14.693 - 0.535\,lbf/in^2)(28.97\,lbm/lbmole)}{14.693\,lbf/in^2}$$

$$M.W. = 28.571\,lbm/lbmole$$

The density of the reactor building air is:

$$\rho = \frac{P(M.W.)}{R_U T} = \frac{(14.693\,lbf/in^2)(28.571\,lbm/lbmole)(144\,in^2/ft^2)}{(1545.35\,ft\,lbf/lbmole\,R)(564R)} = 0.069\,lbm/ft^3 = .00215\,slug/ft^3$$

Elevation 201: median height 250 ft. (Compartment 25)

$$P_o = P_{174} + \rho gh = 14.693\,psia + \frac{(0.00215\,slug/ft^3)(32.2\,ft/sec^2)(174 - 250\,ft)}{144\,in^2/ft^2} = 14.656\,psia$$

Elevation 162: median height 174 ft. (Compartments 23,24). The elevation of pressure sensor tube entry into the reactor building. It is established as 0 gauge pressure elevation, 14.693 psia.

Elevation 145: median height 152 ft. (Compartments 21,22). [This and following were determined using the method of Elevation 201]

P_o = 14.704 psia

Elevation 132: median height 144 ft. (Compartment 20).

P_o = 14.707 psia

Elevation 132: median height 138 ft. (Compartment 19).

P_o = 14.710 psia

Elevation 102: median height 116 ft. (Compartment 3,16,17,18).

P_o = 14.720 psia

Elevation 77: median height 89 ft. (Compartment 13,14,15).

P_o = 14.733 psia

Elevation 54: median height 77 ft. (Compartment 8,9,12).

P_o = 14.740 psia

Elevation 54: median height 65 ft. (Compartment 4,5,6,7,10,11).

P_o = 14.745 psia

5.6.2 A summer SACS temperature value of 100°F at the heat exchanger outlet is assumed.

5.7 Determination of the Reactor Building Exhaust Rate During Summer

5.7.1 In the manner of Section 5.5.2, the in-leakage duct area during summer is computed:

The density of the entering air is:

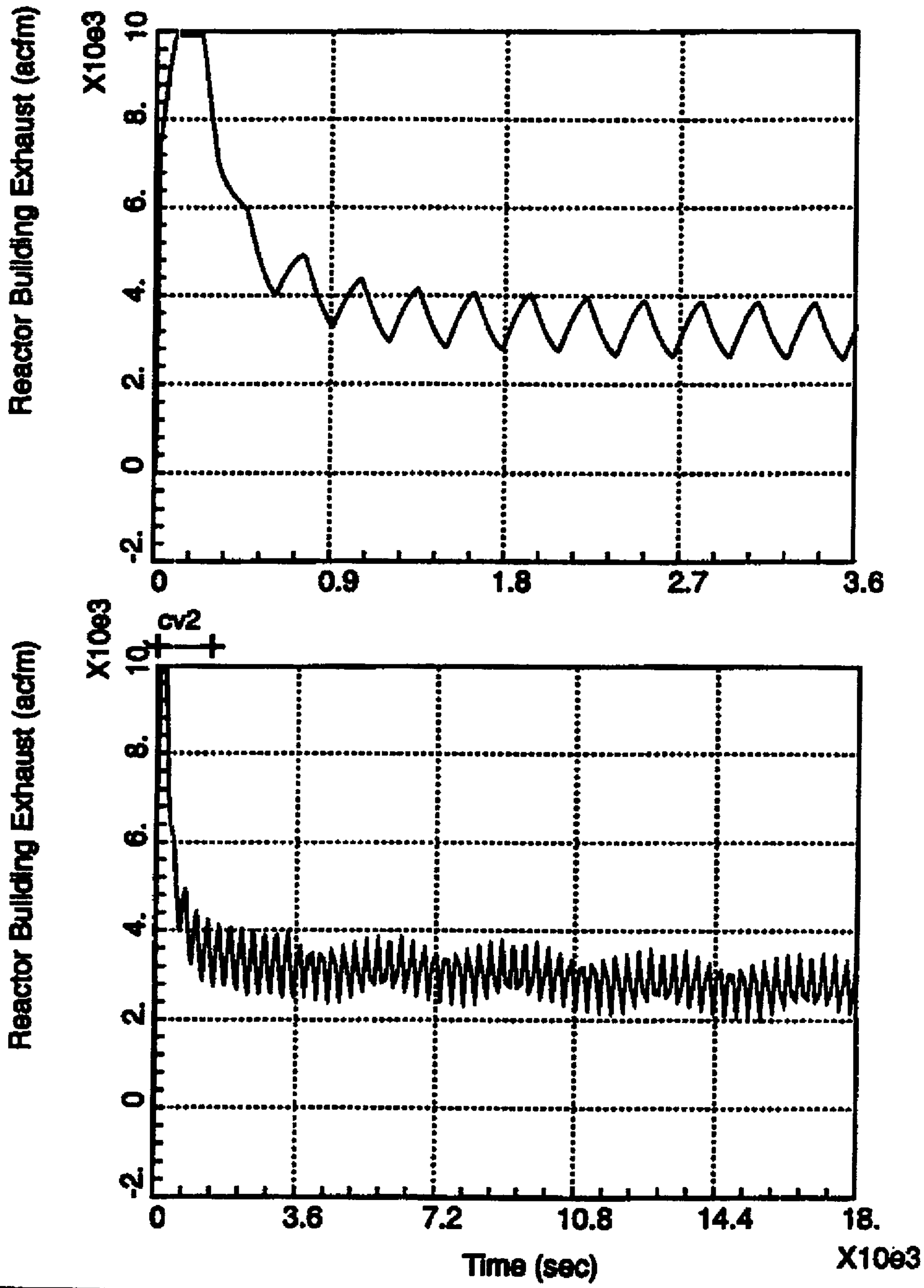
$$\rho = \frac{P}{RT} = \frac{14.7x144}{53.3x554} = 0.072\frac{lbm}{ft^3} \quad \text{(summer)}$$

$$\Delta P = \frac{1}{2}k\rho\frac{Q^2}{A^2}$$

Therefore: $A = 0.958\ ft^2$ (summer)

CALC. NO.: GU-0013			REFERENCE: N/A	
ORIGINATOR, DATE	REV:	GAM, 4/29/99	4	
REVIEWER/VERIFIER, DATE		VC, 5/3/99		

5.7.2 The summer conditions are modeled in GOTHIC (Reference 4.7.1), (See Attachment 2), with the results presented below.



5.8 Discussion of Results and Determination of an Analytical Expression for the Exhaust Flow Rate

The results for the winter analysis are very smooth and are characterized by a sharp rise in the exhaust rate, corresponding to the sharp rise in torus temperature and the start of large amounts of equipment. Then follows a classic exponential decay to the steady-state value, which is seen to level-out below 3324 cfm. The summer results show the same sharp rise, which has a small plateau, corresponding to the limiting flow rate of 9900 cfm. The serrated pattern of the response comes about because of the interaction of the various room coolers, which all behave independently. The steady-state value (the value around which the oscillations occur) is seen to be below 3324 cfm, with the indicator-controller [1GUPDIC-9426A(B)] controlling the reactor building pressure to 0.5 in.w.g. vacuum at the elevation of sensor tube penetration (See Appendix 2, Graph 11).

The analytical expression will be formulated to bound both summer and winter conditions. As seen from the plots of the reactor building exhaust rate, at θ = 0.5 hours (1800 sec), the flow will be below 4000 cfm. At approximately 240 seconds, [for conservatism, θ = 0.1 hours (360 seconds) will be used], the flow will fall below 9900 cfm, the maximum value through the constant flow fan, with duct 1GUFD-9425A(B)3 fully open. The steady state rate, in both cases is seen to be below the Technical Specification value of 3324 cfm. The two equations expressing these selected values are:

$$3324 + xe^{-0.50y} = 4000$$
$$3324 + xe^{-0.10y} = 9900$$

Solving these equations shows y=5.687 and x=11610. An expression for the curve, for time greater than 0.10 hours, is therefore:

$$\dot{V}_{exhaust} = 3324 + 11610e^{-5.687\theta}$$

6.0 CONCLUSIONS

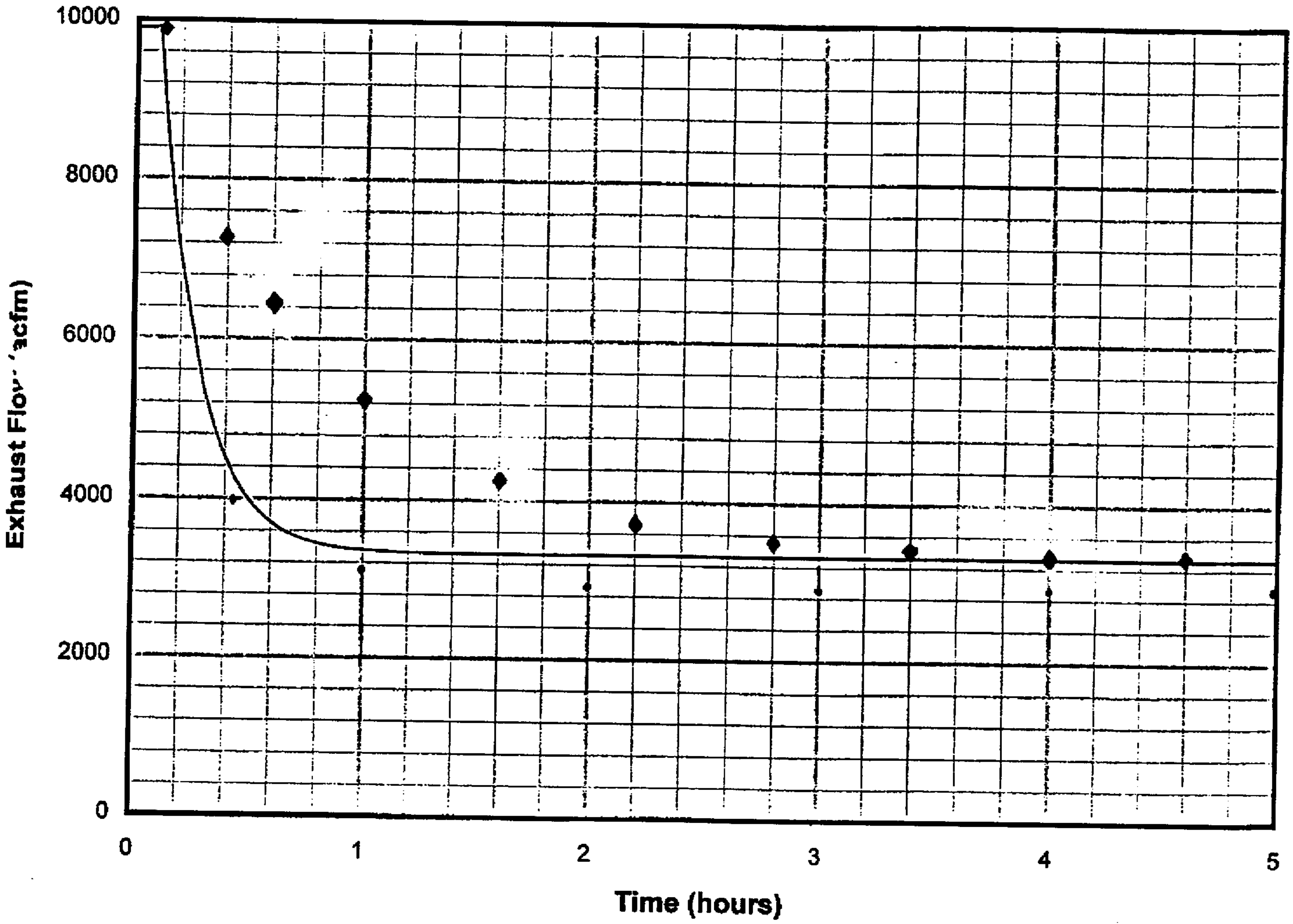
The FRVS vent fan exhaust rate is:

$0<\theta<0.10$ hours	$\dot{V}_{exhaust} = 9900\ \text{cfm}$
$\theta \geq 0.10$ hours	$\dot{V}_{exhaust} = 3324 + 11610e^{-5.687\theta}\ \text{cfm}$

where θ is time in hours from the event. This result is plotted in Figure 1.

PSEG	CALCULATION CONTINUATION SHEET	SHEET: 23 of 24 CONT'D ON SHEET:			
CALC. NO.: GU-0013		REFERENCE: N/A			
ORIGINATOR,DATE	REV:	GAM , 4/29/99	4		
REVIEWER/VERIFIER,DATE		VC, 5/3/99			

Reactor Building Exhaust Flow Rate



• Discrete points from model results
— Analytical expression
♦ Points from UFSAR expression (See Section 7 of this calculation)

Figure 1

7.0 DOCUMENTS AFFECTED

7.1 In order to meet the requirements of Section 3.4, PIRS 990513186 has been opened to revise the reset rate of 1GUPDIC-99426A(B) to one repeat per minute.

7.2 The reactor building vent rate as presented in UFSAR section 15.6.5.5.1.2 is

$$E(t) = 336 + 5637e^{-1.18t}$$

Where t is the time after the building reaches –0.25 inch w.g.

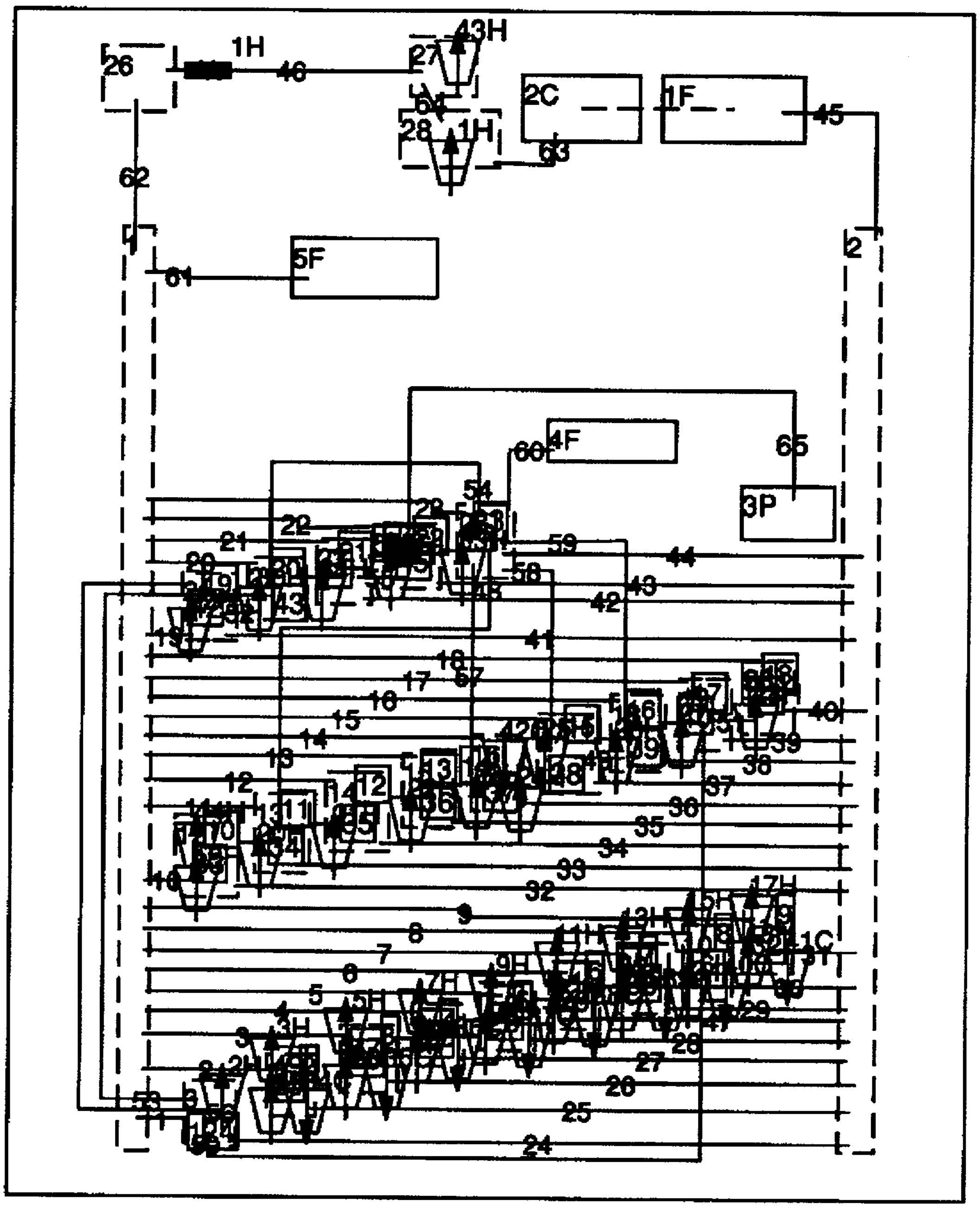
The expression represents an in-leakage rate of 10% per day; however, the exponential portion of the expression is valid for all in-leakage rates. The steady-state portion (336) should have been revised upon receipt of SER Supplement No. 2, dated August 1985, which changed the design basis to an in-leakage rate of 100%. 3324 cfm is the correct steady-state portion of the vent rate expression corresponding to a reactor building in-leakage rate of 100% per day, as calculated in design calculation GU-0013, Revision 3. 3324 cfm is the value used as the acceptance criterion specified in Technical Specification 4.6.5.1.c.2. for 18-month surveillance testing. This correction is being accomplished in UFSAR Change Notice 99-037.

The exponential portion ($5637e^{-1.18t}$) bounds the expression developed in this revision, and is used as an input to the dose rate analysis. Because the UFSAR expression is conservative with respect to the results of this analysis, an UFSAR change is not required, and will not be presented.

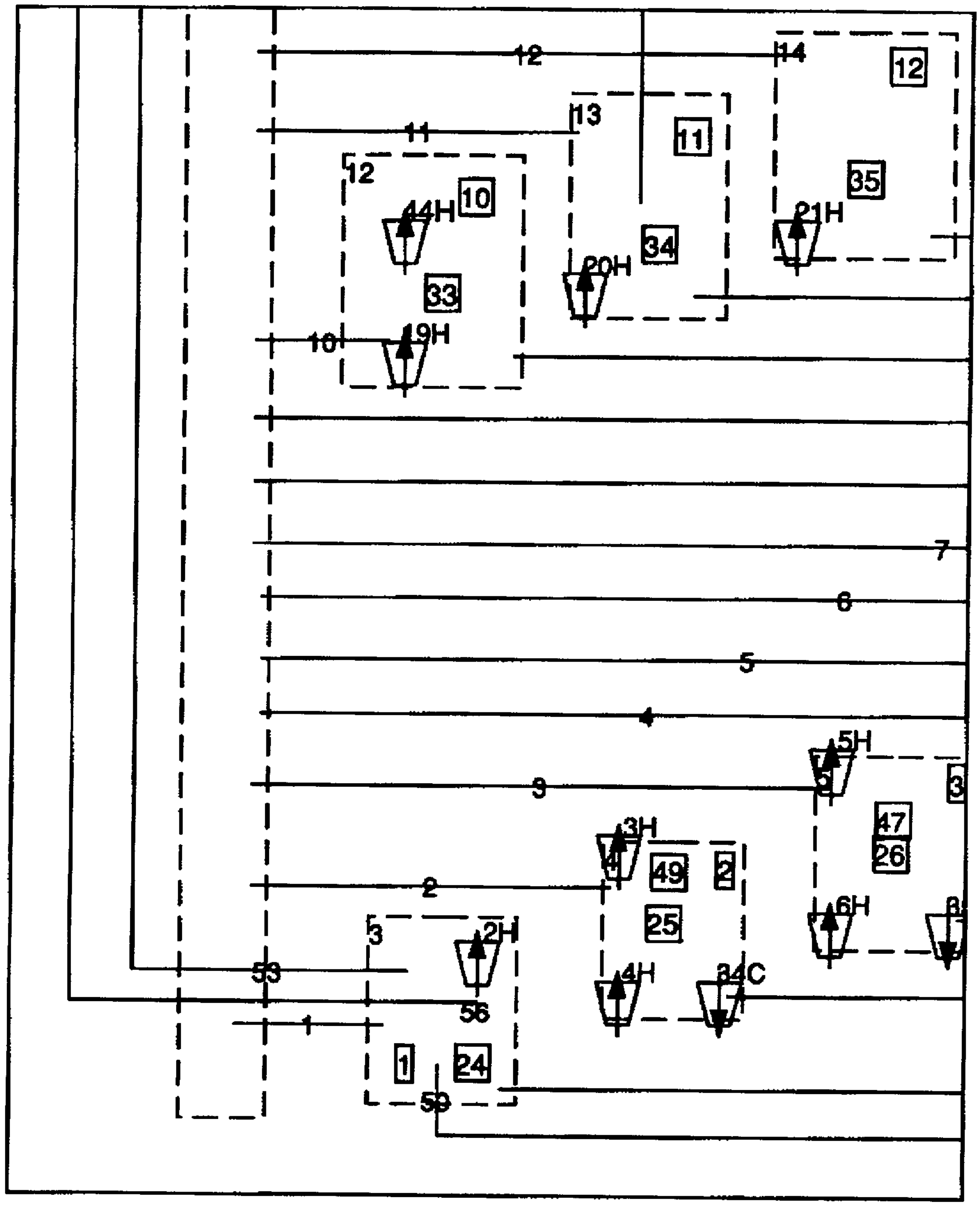
Attachment 1

GOTHIC Winter Condition Model

Reactor Building Exhaust Rate (LOCA Case A - Winter)
Apr/19/1999 11:48:56
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
Apr/19/1999 11:49:47
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
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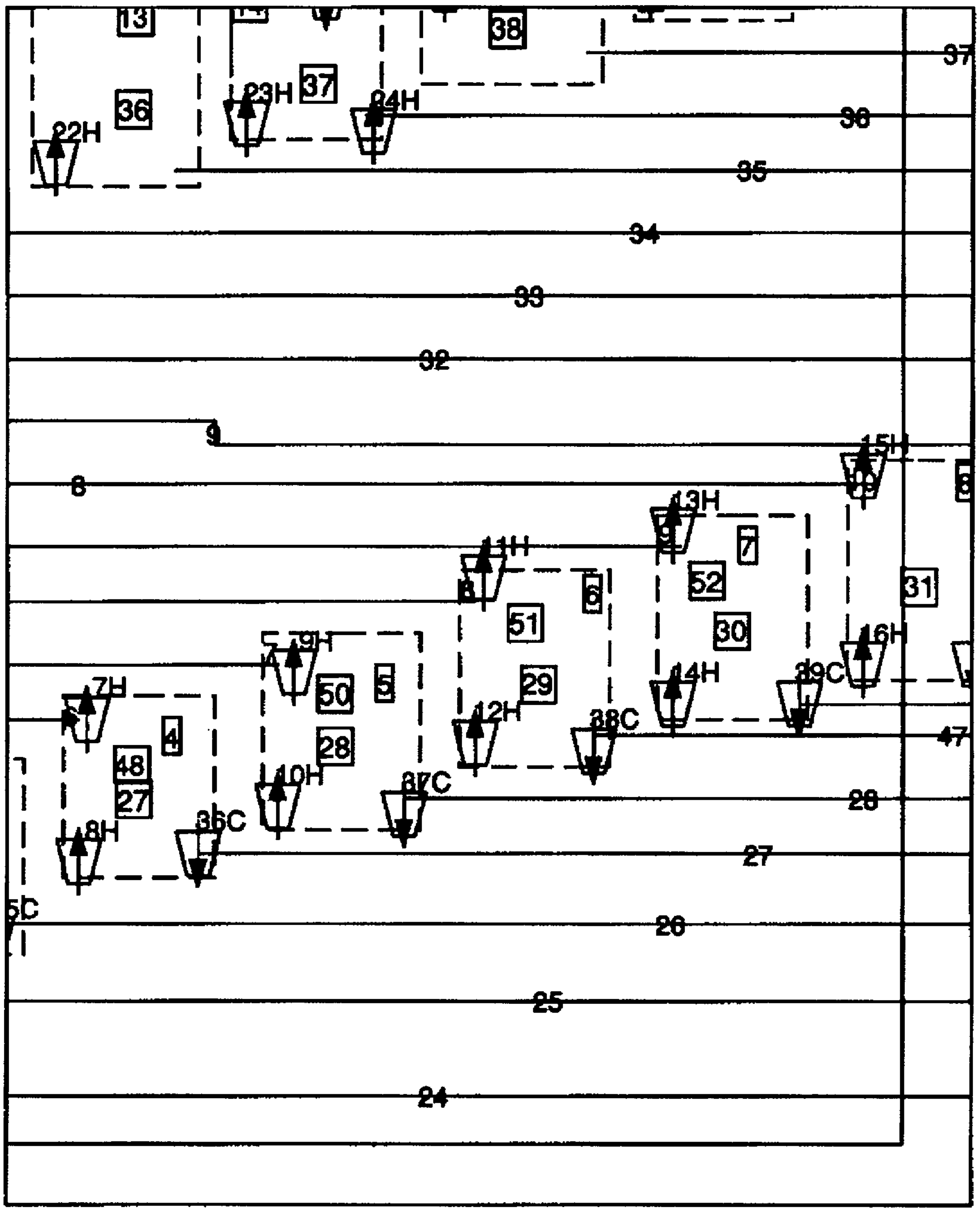
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
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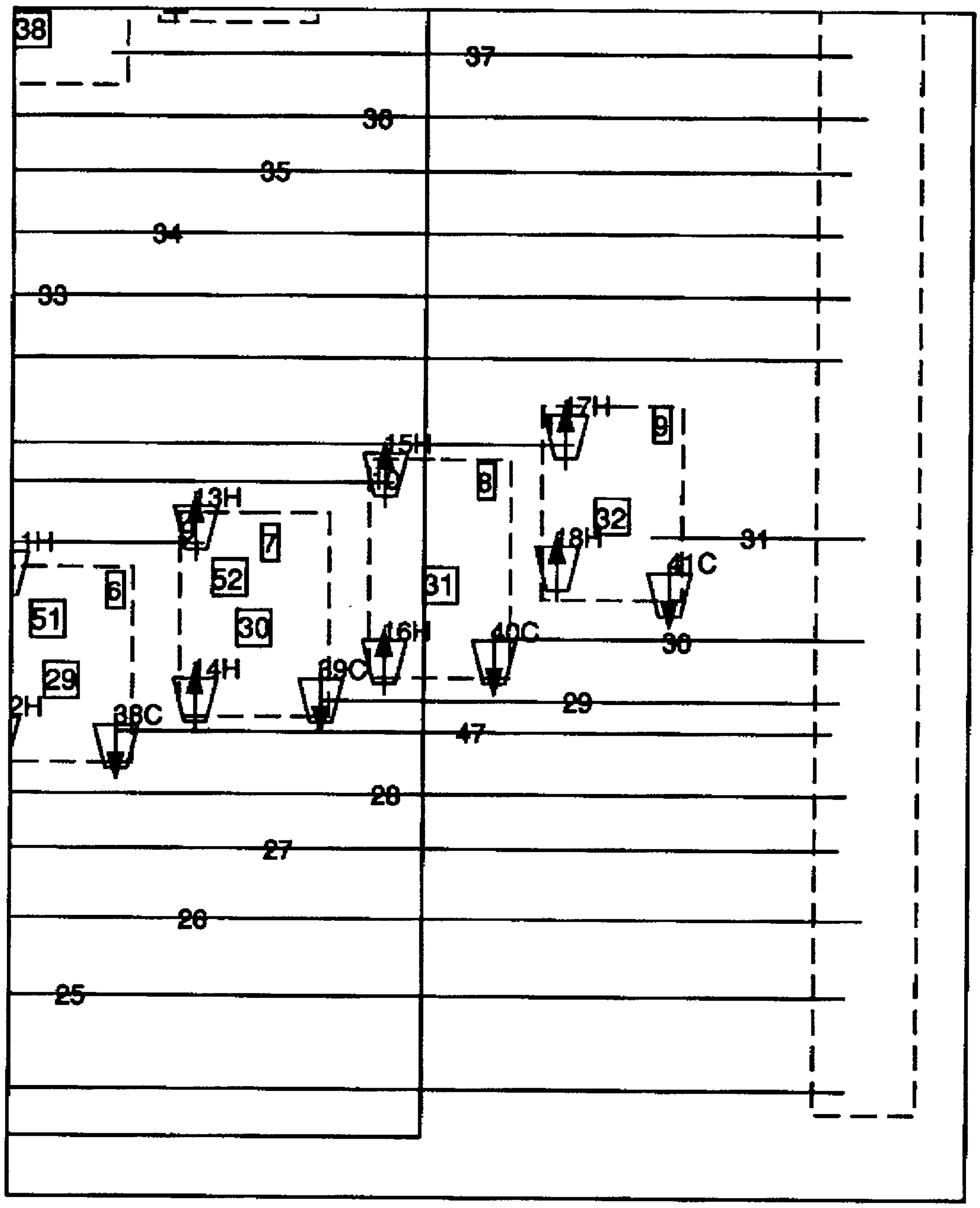
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
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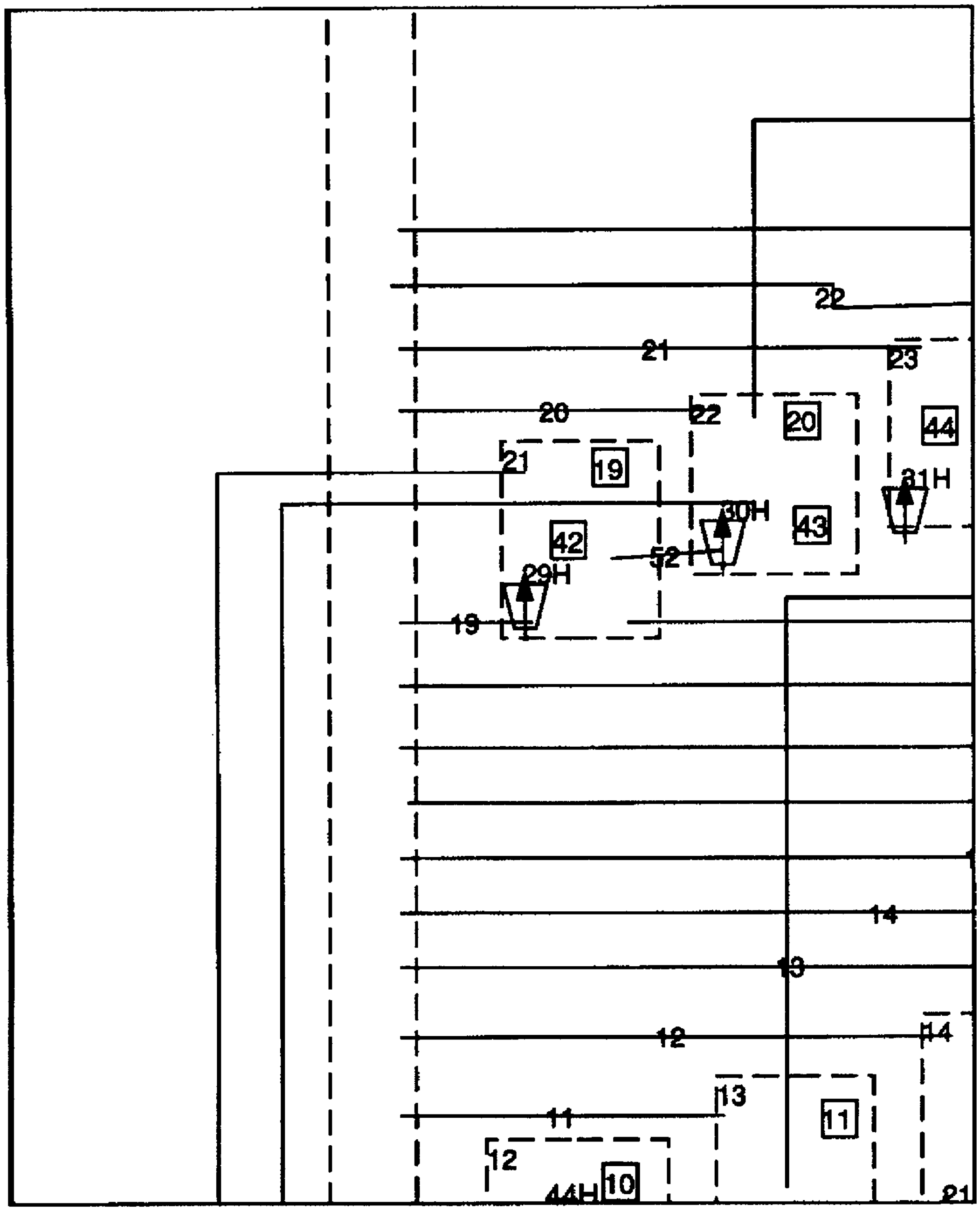
GOTHIC Version 6.0a(QA) - April 1998



OUTSTANDING CHANGES MUST BE ATTACHED FOR WORKING COPY
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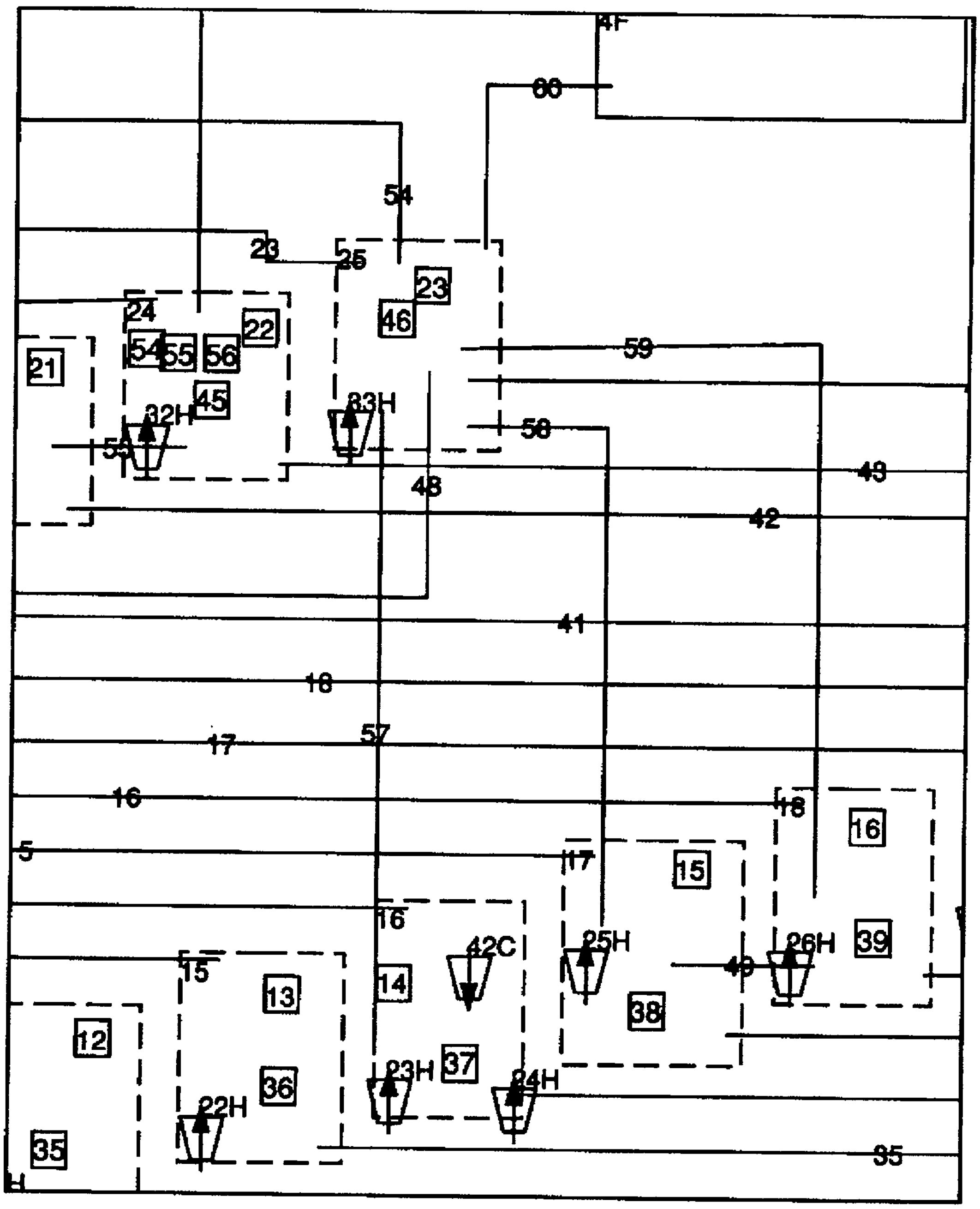
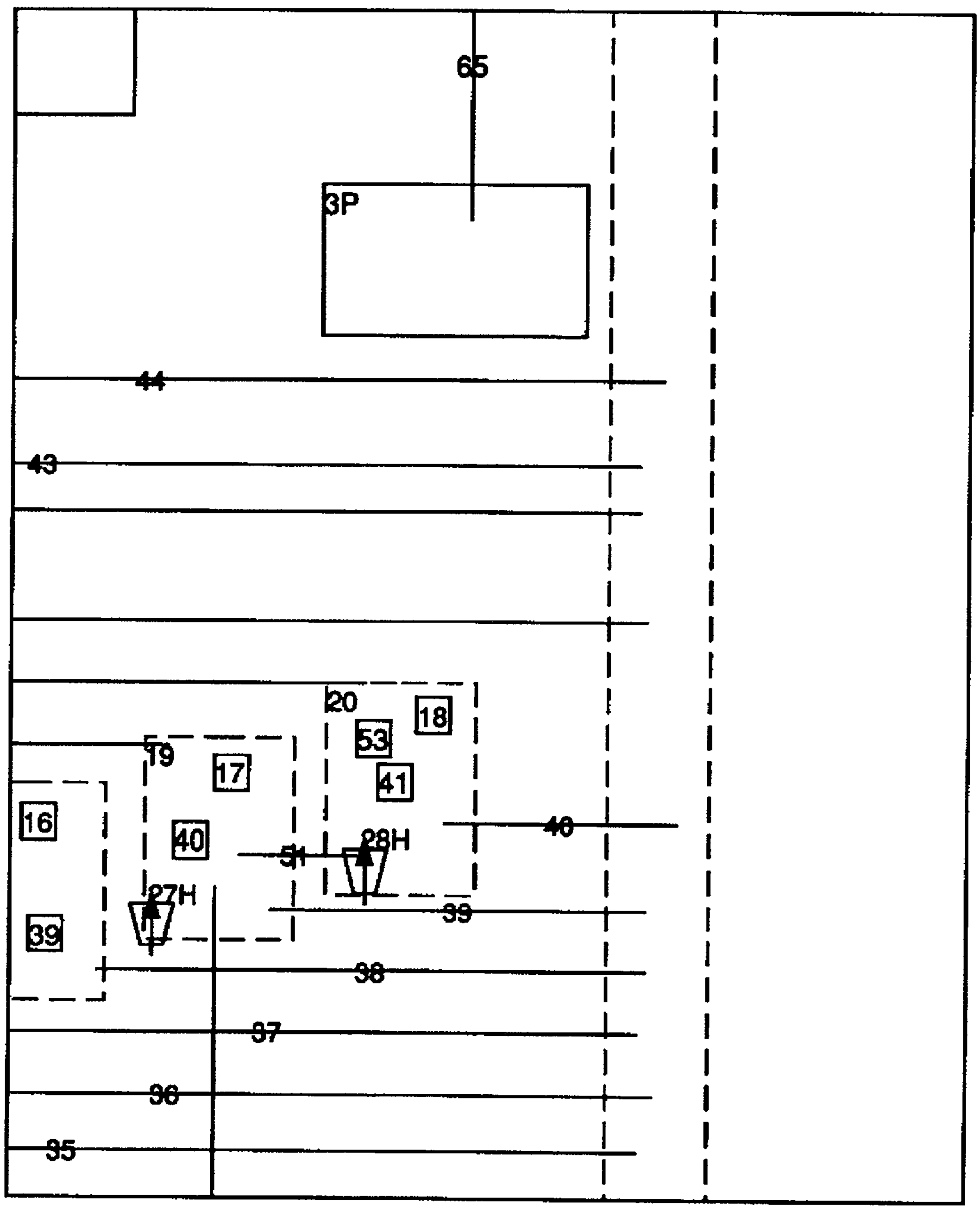
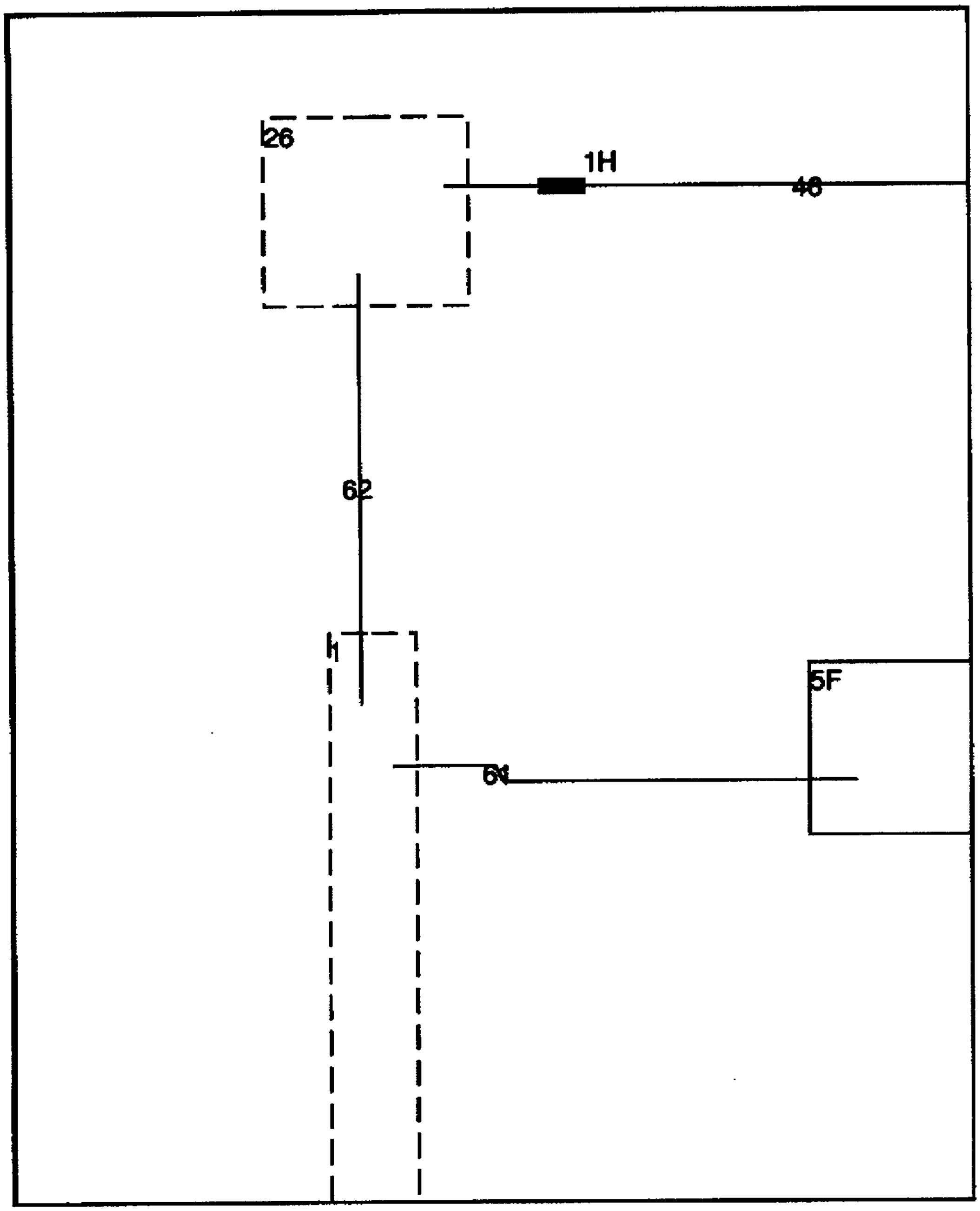
Reactor Building Exhaust Rate (LOCA Case A - Winter)
Apr/19/1999 11:54:56
GOTHIC Version 6.0a(QA) - April 1998



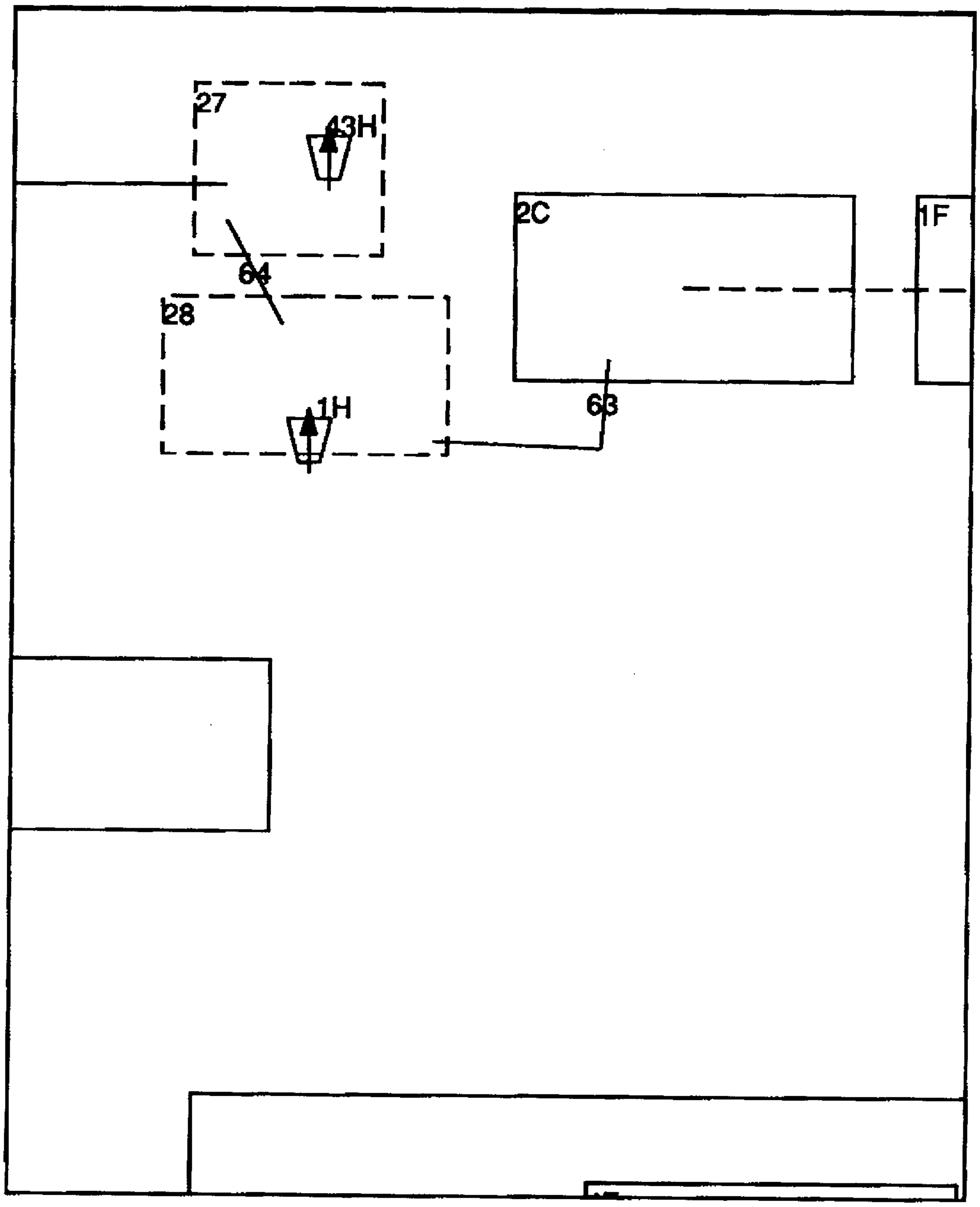
Reactor Building Exhaust Rate (LOCA Case A - Winter)
Apr/19/1999 11:56:03
GOTHIC Version 6.0a(QA) - April 1998



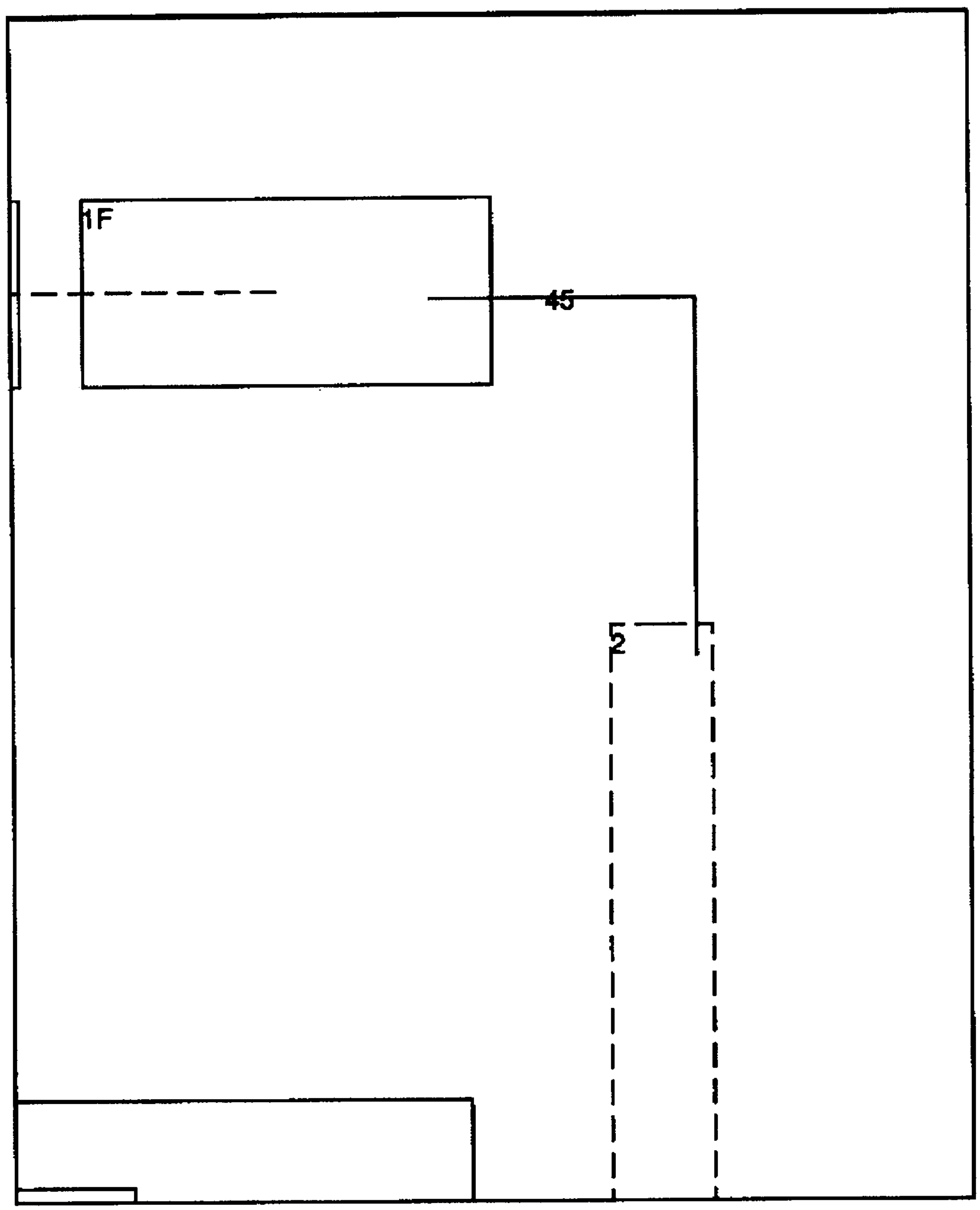
Reactor Building Exhaust Rate (LOCA Case A - Winter)
Apr/19/1999 11:52:28
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
Apr/19/1999 11:52:38
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
Apr/19/1999 11:52:54
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:22
GOTHIC Version 6.0a(QA) - April 1998

Control Volumes

Vol #	Description	Vol (ft3)	Elev (ft)	Ht (ft)	Hyd. D. (ft)	L/V IA (ft2)	Burn Opt
1	SUPPLY HEADER	23137.	54.	246.	20.	DEFAULT	NONE
2	EXHAUST HEADER	27471.	54.	246.	20.	DEFAULT	NONE
3	PIPE CHASES	48651.	102.	28.	20.	DEFAULT	NONE
4	CSP 4104,4105	29461.	54.	21.	20.	DEFAULT	NONE
5	CSP 4116,4118	27996.	54.	21.	20.	DEFAULT	NONE
6	RHR PMP RM 4107	23305.	54.	21.	20.	DEFAULT	NONE
7	RHR PMP RM 4114	23101.	54.	21.	20.	DEFAULT	NONE
8	RHRHX 4109,4208	37045.	54.	46.	20.	DEFAULT	NONE
9	RHRHX 4113,4214	37139.	54.	46.	20.	DEFAULT	NONE
10	HPCI RM EL 54	47223.	54.	21.	20.	DEFAULT	NONE
11	RCIC RM EL 54	32799.	54.	21.	20.	DEFAULT	NONE
12	TORUS & STM VNT	479484.	54.	46.	20.	DEFAULT	NONE
13	MCC AREA EL 77	102084.	77.	23.	20.	DEFAULT	NONE
14	CRD PMP/MCC 77	70013.	77.	23.	20.	DEFAULT	NONE
15	RACS HX, PMP 77	100016.	77.	23.	20.	DEFAULT	NONE
16	SACS HX,PMP 102	233917.	102.	28.	20.	DEFAULT	NONE
17	MCC AREA EL 102	215431.	102.	28.	20.	DEFAULT	NONE
18	CRD AREA EL 102	203129.	102.	28.	20.	DEFAULT	NONE
19	RWCU RMS EL132	10307.	132.	11.	20.	DEFAULT	NONE
20	FRVS,CMP EL 132	195259.	132.	23.	20.	DEFAULT	NONE
21	OP FRVS VNT 145	88701.	145.	15.	20.	DEFAULT	NONE
22	RWCU AREA 145	14958.	145.	15.	20.	DEFAULT	NONE
23	F POOL, SM 162	98388.	162.	24.	20.	DEFAULT	NONE
24	MCC, FRVS 162	248506.	162.	24.	20.	DEFAULT	NONE
25	GENERAL AREAS I	1730000.	201.	99.	20.	DEFAULT	NONE
26	FAN OUTLET	1000.	132.	10.	20.	DEFAULT	NONE
27	frvs heater enc	1000.	132.	10.	20.	DEFAULT	NONE
28	frvs fan heat	1000.	132.	10.	20.	DEFAULT	NONE

Fluid Boundary Conditions - Table 1

BC#	Description	Press. (psia)	FF	Temp. (F)	FF	Flow (lbm/s)	FF	ON Trip	OFF Trip
1F	FRVS FAN INLET	14.7		40		V-550	1	0	
2C	FRVS FAN OUTLET	14.7		40					
3P	INLEAKAGE	14.6959		5					
4F	POOL EVAPORATIO	5.9926		E1134		0.3625			

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Fluid Boundary Conditions - Table 1

BC#	Description	Press. (psia)	FF	Temp. (F)	FF	Flow (lbm/s)	FF	ON Trip	OFF Trip
5F	VENT FAN EXHAUS	14.7		40		v-1	28	23	

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	Outlet Quality	FF
1F	0.		H50		NONE							DEFAULT	
2C	0.		H50		NONE		1F	1.		0.		DEFAULT	
3F	0.		H50		NONE							DEFAULT	
4F	0.		1		NONE							DEFAULT	
5F	0.		H50		NONE							DEFAULT	

Fluid Boundary Conditions - Table 3
Gas Pressure Ratios

BC#	Air Gas 1	FF	Gas 2	FF	Gas 3	FF	Gas 4	FF
1F	1.							
2C	1.							
3F	1.							
4F	1.							
5F	1.							

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

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

Flow Paths - Table 1

F.P. #	Description	Vol A	Elev (ft)	Ht (ft)	Vol B	Elev (ft)	Ht (ft)
1	SUPPLY ROOM 3	1	112.	1.	3	112.	1.
2	SUPPLY ROOM 4	1	64.	1.	4	64.	1.
3	SUPPLY ROOM 5	1	64.	1.	5	64.	1.
4	SUPPLY ROOM 6	1	64.	1.	6	64.	1.
5	SUPPLY ROOM 7	1	64.	1.	7	64.	1.
6	SUPPLY ROOM 8	1	64.	1.	8	64.	1.
7	SUPPLY ROOM 9	1	64.	1.	9	64.	1.
8	SUPPLY ROOM 10	1	64.	1.	10	64.	1.
9	SUPPLY ROOM 11	1	64.	1.	11	64.	1.
10	SUPPLY ROOM 12	1	84.	1.	12	84.	1.
11	SUPPLY ROOM 13	1	87.	1.	13	87.	1.
12	SUPPLY ROOM 14	1	87.	1.	14	87.	1.
13	SUPPLY ROOM 15	1	87.	1.	15	87.	1.
14	SUPPLY ROOO 16	1	122.	1.	16	122.	1.
15	SUPPLY ROOM 17	1	122.	1.	17	122.	1.
16	SUPPLY ROOM 18	1	122.	1.	18	122.	1.
17	SUPPLY ROOM 19	1	140.	1.	19	140.	1.
18	SUPPLY ROOM 20	1	148.	1.	20	148.	1.
19	SUPPLY ROOM 21	1	155.	1.	21	155.	1.
20	SUPPLY ROOM 22	1	155.	1.	22	155.	1.
21	SUPPLY ROOM 23	1	182.	1.	23	182.	1.
22	SUPPLY ROOM 24	1	182.	1.	24	182.	1.
23	SUPPLY ROOM 25	1	205.	1.	25	205.	1.
24	EXHAUST ROOM 3	3	112.	1.	2	112.	1.
25	EXHAUST ROOM 4	4	64.	1.	2	64.	1.
26	EXHAUST ROOM 5	5	64.	1.	2	64.	1.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Flow Paths - Table 1							
F.P. #	Description	Vol A	Elev (ft)	Ht (ft)	Vol B	Elev (ft)	Ht (ft)
27	EXHAUST ROOM 6	6	64.	1.	2	64.	1.
28	EXHAUST ROOM 7	7	64.	1.	2	64.	1.
29	EXHAUST ROOM 9	9	64.	1.	2	64.	1.
30	EXHAST ROOM 10	10	64.	1.	2	64.	1.
31	EXHAUST ROOM 11	11	64.	1.	2	64.	1.
32	EXHAUST ROOM 12	12	84.	1.	2	84.	1.
33	EXHAUST ROOM 13	13	87.	1.	2	87.	1.
34	EXHAUST ROOM 14	14	87.	1.	2	87.	1.
35	EXHAUST ROOM 15	15	87.	1.	2	87.	1.
36	EXHAUST ROOM 16	16	122.	1.	2	122.	1.
37	EXHAUST ROOM 17	17	122.	1.	2	122.	1.
38	EXHAUST ROOM 18	18	122.	1.	2	122.	1.
39	EXHAUST ROOM 19	19	140.	1.	2	140.	1.
40	EXHAUST ROOM 20	20	148.	1.	2	148.	1.
41	EXHAUST ROOM 21	21	155.	1.	2	155.	1.
42	EXHAUST ROOM 23	23	182.	1.	2	182.	1.
43	EXHAUST ROOM 24	24	182.	1.	2	182.	1.
44	EXHAUST ROOM 25	25	205.	1.	2	205.	1.
45	FRVS FAN INLET	2	132.	1.	1F	132.	1.
46	FRVS FAN OUTLET	26	132.	1.	27	132.	1.
47	ROOM 8 EXHAUST	8	64.	1.	2	64.	1.
48	13 TO 25	13	77.	1.	25	205.	1.
49	18 TO 17	18	102.	1.	17	102.	1.
50	19 TO 3	19	132.	1.	3	102.	1.
51	20 TO 19	20	132.	1.	19	132.	1.
52	21 TO 22	21	145.	1.	22	145.	1.
53	22 TO 3	22	145.	1.	3	102.	1.
54	22 TO 25	22	145.	1.	25	205.	1.
55	23 TO 24	23	162.	1.	24	162.	1.
56	21 TO 3	21	145.	1.	3	102.	1.
57	25 TO 16	25	201.	1.	16	102.	1.
58	25 TO 17	25	201.	1.	17	102.	1.
59	25 TO 18	25	201.	1.	18	102.	1.
60	EVAPORATION FLO	25	201.	1.	4F	201.	1.
61	VENT FAN DUCT	1	145.	1.	5F	300.	1.
62	DUCT	26	132.	1.	1	132.	1.
63	DUCT	28	132.	1.	2C	132.	1.
64	duct	28	132.	1.	27	132.	1.
65	INLEAKAGE	24	173.5	1.	3P	173.5	1.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Flow Paths - Table 2							
Flow Path #	Flow Area (ft2)	Hyd. Diam. (ft)	Inertia Length (ft)	Friction Length (ft)	De-Entrmt Frac.	Mom Trn Opt	Strat Flow Opt
1	1.05	1.	10.	1.		-	NONE
2	0.18	1.	10.	1.		-	NONE
3	0.18	1.	10.	1.		-	NONE
4	0.11	1.	10.	1.		-	NONE
5	0.1	1.	10.	1.		-	NONE
6	0.09	1.	10.	1.		-	NONE
7	0.085	1.	10.	1.		-	NONE
8	0.7	1.	10.	1.		-	NONE
9	0.5	1.	10.	1.		-	NONE
10	1.41	1.	10.	1.		-	NONE
11	2.7	1.	10.	1.		-	NONE
12	1.85	1.	10.	1.		-	NONE
13	1.4	1.	10.	1.		-	NONE
14	0.7	1.	10.	1.		-	NONE
15	3.05	1.	10.	1.		-	NONE
16	3.7	1.	10.	1.		-	NONE
17	0.55	1.	10.	1.		-	NONE
18	2.65	1.	10.	1.		-	NONE
19	5.5	1.	10.	1.		-	NONE
20	0.6	1.	10.	1.		-	NONE
21	2.3	1.	10.	1.		-	NONE
22	1.9	1.	10.	1.		-	NONE
23	10.05	1.	10.	1.		-	NONE
24	3.25	1.	10.	1.		-	NONE
25	0.321	1.	10.	1.		-	NONE
26	0.321	1.	10.	1.		-	NONE
27	0.161	1.	10.	1.		-	NONE
28	0.161	1.	10.	1.		-	NONE
29	0.161	1.	10.	1.		-	NONE
30	0.56	1.	10.	1.		-	NONE
31	0.481	1.	10.	1.		-	NONE
32	1.804	1.	10.	1.		-	NONE
33	1.1	1.	10.	1.		-	NONE
34	1.6	1.	10.	1.		-	NONE
35	1.6	1.	10.	1.		-	NONE
36	0.6	1.	10.	1.	0.	-	NONE
37	2.9	1.	10.	1.		-	NONE
38	2.7	1.	10.	1.		-	NONE
39	0.55	1.	10.	1.		-	NONE

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Flow Paths - Table 2							
Flow Path #	Flow Area (ft2)	Hyd. Diam. (ft)	Inertia Length (ft)	Friction Length (ft)	De-Entrmt Frac.	Mom Trn Opt	Strat Flow Opt
40	1.6	1.	10.	1.		-	NONE
41	2.2	1.	10.	1.		-	NONE
42	0.55	1.	10.	1.		-	NONE
43	2.566	1.	10.	1.		-	NONE
44	5.7	1.	10.	1.		-	NONE
45	100.	1.	100.	1.		-	NONE
46	100.	1.	100.	1.		-	NONE
47	0.161	1.	10.	1.		-	NONE
48	1.15	1.	10.	1.		-	NONE
49	0.5	1.	10.	1.		-	NONE
50	2.8	1.	10.	1.		-	NONE
51	1.1	1.	10.	1.		-	NONE
52	1.15	1.	10.	1.		-	NONE
53	0.95	1.	10.	1.		-	NONE
54	0.55	1.	10.	1.		-	NONE
55	1.4	1.	10.	1.		-	NONE
56	0.4	1.	10.	1.		-	NONE
57	0.45	1.	10.	1.		-	NONE
58	0.75	1.	10.	1.		-	NONE
59	1.8	1.	10.	1.		-	NONE
60	1.	1.	10.	1.		-	NONE
61	10.	1.	10.	1.		-	NONE
62	10.	1.	10.	1.		-	NONE
63	10.	1.	10.	1.		-	NONE
64	10.	1.	10.	1.		-	NONE
65	1.05	1.33	10.	1.		-	NONE

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Flow Paths - Table 3					
Flow Path #	Fwd. Loss Coeff.	Rev. Loss Coeff.	Comp. Opt.	Critical Flow Model	Exit Loss Coeff.
1	1.	1.	OFF	OFF	0.
2	1.	1.	OFF	OFF	0.
3	1.	1.	OFF	OFF	0.
4	1.	1.	OFF	OFF	0.
5	1.	1.	OFF	OFF	0.
6	1.	1.	OFF	OFF	0.
7	1.	1.	OFF	OFF	0.
8	1.	1.	OFF	OFF	0.
9	1.	1.	OFF	OFF	0.
10	1.	1.	OFF	OFF	0.
11	1.	1.	OFF	OFF	0.
12	1.	1.	OFF	OFF	0.
13	1.	1.	OFF	OFF	0.
14	1.	1.	OFF	OFF	0.
15	1.	1.	OFF	OFF	0.
16	1.	1.	OFF	OFF	0.
17	1.	1.	OFF	OFF	0.
18	1.	1.	OFF	OFF	0.
19	1.	1.	OFF	OFF	0.
20	1.	1.	OFF	OFF	0.
21	1.	1.	OFF	OFF	0.
22	1.	1.	OFF	OFF	0.
23	1.	1.	OFF	OFF	0.
24	1.	1.	OFF	OFF	0.
25	1.	1.	OFF	OFF	0.
26	1.	1.	OFF	OFF	0.
27	1.	1.	OFF	OFF	0.
28	1.	1.	OFF	OFF	0.
29	1.	1.	OFF	OFF	0.
30	1.	1.	OFF	OFF	0.
31	1.	1.	OFF	OFF	0.
32	1.	1.	OFF	OFF	0.
33	1.	1.	OFF	OFF	0.
34	1.	1.	OFF	OFF	0.
35	1.	1.	OFF	OFF	0.
36	1.	1.	OFF	OFF	0.
37	1.	1.	OFF	OFF	0.
38	1.	1.	OFF	OFF	0.
39	1.	1.	OFF	OFF	0.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Flow Paths - Table 3					
Flow Path #	Fwd. Loss Coeff.	Rev. Loss Coeff.	Comp. Opt.	Critical Flow Model	Exit Loss Coeff.
40	1.	1.	OFF	OFF	0.
41	1.	1.	OFF	OFF	0.
42	1.	1.	OFF	OFF	0.
43	1.	1.	OFF	OFF	0.
44	1.	1.	OFF	OFF	0.
45	1.	1.	OFF	OFF	0.
46	1.	1.	OFF	OFF	0.
47	1.	1.	OFF	OFF	0.
48	1.	1.	OFF	OFF	0.
49	1.	1.	OFF	OFF	0.
50	1.	1.	OFF	OFF	0.
51	1.	1.	OFF	OFF	0.
52	1.	1.	OFF	OFF	0.
53	1.	1.	OFF	OFF	0.
54	1.	1.	OFF	OFF	0.
55	1.	1.	OFF	OFF	0.
56	1.	1.	OFF	OFF	0.
57	1.	1.	OFF	OFF	0.
58	1.	1.	OFF	OFF	0.
59	1.	1.	OFF	OFF	0.
60	1.	1.	OFF	OFF	0.
61	1.	1.	OFF	OFF	0.
62	0.1	0.1	OFF	OFF	0.
63	0.1	0.1	OFF	OFF	0.
64	0.1	0.1	OFF	OFF	0.
65	1e+018	1.	OFF	OFF	0.

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Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Thermal Conductors - Table 1									
Cond #	Description	Vol A	HT Co	Vol B	HT Co	Cond Type	S. A. (ft2)	Init. T. (F)	Or
1	WALL ROOM 3	3	1	3	2	1	18612.	40.	I
2	WALL ROOM 4	4	1	4	2	1	8304.	40.	I
3	WALL ROOM 5	5	1	5	2	1	8146.	40.	I
4	WALL ROOM 6	6	1	6	2	1	6379.	69.	I
5	WALL ROOM 7	7	1	7	2	1	6375.	69.	I
6	WALL ROOM 8	8	1	8	2	1	8056.	65.	I
7	WALL ROOM 9	9	1	9	2	1	8038.	65.	I
8	WALL ROOM 10	10	1	10	2	1	12881.	47.	I
9	WALL ROOM 11	11	1	11	2	1	10343.	47.	I
10	WALL ROOM 12	12	1	12	2	1	43320.	86.	I
11	WALL ROOM 13	13	1	13	2	1	29709.	53.	I
12	WALL ROOM 14	14	1	14	2	1	19254.	61.	I
13	WALL ROOM 15	15	1	15	2	1	26387.	62.	I
14	WALL ROOM 16	16	1	16	2	1	37220.	40.	I
15	WALL ROOM 17	17	1	17	2	1	55356.	43.	I
16	WALL ROOM 18	18	1	18	2	1	55519.	64.	I
17	WALL ROOM 19	19	1	19	2	1	6484.	40.	I
18	WALL ROOM 20	20	1	20	2	1	43611.	40.	I
19	WALL ROOM 21	21	1	21	2	1	32399.	40.	I
20	WALL ROOM 22	22	1	22	2	1	6361.	40.	I
21	WALL ROOM 23	23	1	23	2	1	28952.	40.	I
22	WALL ROOM 24	24	1	24	2	1	61015.	50.	I
23	WALL ROOM 25	25	1	25	2	1	303855.	48.	I
24	Steel Rm 3	3	1	3	1	2	2461.	40.	I
25	Steel Rm 4	4	1	4	1	2	1490.	40.	I
26	Steel Rm 5	5	1	5	1	2	1416.	40.	I
27	Steel Rm 6	6	1	6	1	2	1179.	69.	I
28	Steel Rm 7	7	1	7	1	2	1169.	69.	I
29	Steel Rm 8	8	1	8	1	2	1874.	65.	I
30	Steel Rm 9	9	1	9	1	2	1879.	65.	I
31	Steel Rm 10	10	1	10	1	2	2389.	47.	I
32	Steel Rm 11	11	1	11	1	2	1659.	47.	I
33	Steel Rm 12	12	1	12	1	2	24256.	86.	I
34	Steel Rm 13	13	1	13	1	2	5164.	53.	I
35	Steel Rm 14	14	1	14	1	2	3542.	61.	I
36	Steel Rm 15	15	1	15	1	2	5060.	62.	I
37	Steel Rm 16	16	1	16	1	2	11833.	40.	I
38	Steel Rm 17	17	1	17	1	2	10897.	43.	I
39	Steel Rm 18	18	1	18	1	2	10276.	64.	I
40	Steel Rm 19	19	1	19	1	2	521.	40.	I

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Thermal Conductors - Table 1									
Cond #	Description	Vol A	HT Co	Vol B	HT Co	Cond Type	S. A. (ft2)	Init. T.(F)	Or
41	Steel Rm 20	20	1	20	1	2	9878.	40.	I
42	Steel Rm 21	21	1	21	1	2	4487.	40.	I
43	Steel Rm 22	22	1	22	1	2	757.	40.	I
44	Steel Rm 23	23	1	23	1	2	4977.	40.	I
45	Steel Rm 24	24	1	24	1	2	12571.	50.	I
46	Steel Rm 25	25	1	25	1	2	52263.	48.	I
47	1C-P-206 MOTOR	5	1	5	1	3	56.5	40.	I
48	1D-P-202 MOTOR	6	1	6	1	4	95.	69.	I
49	1B-P-206 MOTOR	4	1	4	1	3	56.5	40.	I
50	1C-P-202 MOTOR	7	1	7	1	4	95.	69.	I
51	1B-P-202 MOTOR	8	1	8	1	4	95.	68.	I
52	1A-P-202 MOTOR	9	1	9	1	4	95.	65.	I
53	1A-V-213 MOTOR	20	1	20	1	5	18.8	40.	I
54	1B-V-213 MOTOR	24	1	24	1	5	18.8	50.	I
55	1D-V-213 MOTOR	24	1	24	1	5	18.8	50.	I
56	1E-V-213 MOTOR	24	1	24	1	5	18.8	50.	I
57	1D-P-206	4	1	4	1	3	56.5	40.	I
58	1A-P-206	5	1	5	1	3	56.5	40.	I

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Thermal Conductors - Table 2				
Cond #	Therm. Rad. Side A	Emiss. Side A	Therm. Rad. Side B	Emiss. Side B
1	No		No	
2	No		No	
3	No		No	
4	No		No	
5	No		No	
6	No		No	
7	No		No	
8	No		No	
9	No		No	
10	No		No	
11	No		No	
12	No		No	
13	No		No	
14	No		No	
15	No		No	
16	No		No	
17	No		No	
18	No		No	
19	No		No	
20	No		No	
21	No		No	
22	No		No	
23	No		No	
24	No		No	
25	No		No	
26	No		No	
27	No		No	
28	No		No	
29	No		No	
30	No		No	
31	No		No	
32	No		No	
33	No		No	
34	No		No	
35	No		No	
36	No		No	
37	No		No	
38	No		No	
39	No		No	
40	No		No	

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Thermal Conductors - Table 2				
Cond #	Therm. Rad. Side A	Emiss. Side A	Therm. Rad. Side B	Emiss. Side B
41	No		No	
42	No		No	
43	No		No	
44	No		No	
45	No		No	
46	No		No	
47	No		No	
48	No		No	
49	No		No	
50	No		No	
51	No		No	
52	No		No	
53	No		No	
54	No		No	
55	No		No	
56	No		No	
57	No		No	
58	No		No	

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Heat Transfer Coefficient Types - Table 1

Type #	Heat Transfer Option	Nominal Value	FF	Cnd/ Cnv Opt	Cnd Opt	Sp Cnv HTC	Nat Cnv Opt	For Cnv Opt	Rad Opt
1	Direct			ADD	UCHI		VERT SURF	PIPE FLOW	ON
2	Sp Heat	0.							

Heat Transfer Coefficient Types - Table 2

Type #	Phase Opt	Min Liq Fract	Max Liq Fract	Convection Bulk Temp Model	Convection FF	Condensation Bulk Temp Model	Condensation FF
1	VAP			Tg-Tf		Tb-Tw	
2							

Heat Transfer Coefficient Types - Table 3

Type #	Char. Length (ft)	Nat Conv Coef FF	Nat Conv Exp FF	For Conv Coef FF	For Conv Exp FF	Nom Vel (ft/s)	Vel FF	Minimum Conv HTC (B/h-f2-F)
1								DEFAULT
2								

HTC Types - Table 4

Type #	Total Heat (Btu)	Peak Time (sec)	Initial Value (B/h-f2-F)	Post-BD Direct FF
1				
2				

Thermal Conductor Types							
Type #	Description	Geom	Thick. (in)	O.D. (in)	Regions	Heat (Btu/ft3-s)	Heat FF
1	1.5 FT THK CONC	WALL	18.	0.	4	0.	
2	3/8 IN STEEL	WALL	0.375	0.	1	0.	
3	CORE SPRAY MOTO	ROD	18.	36.	1	0.85	32
4	RHR PUMP MOTOR	ROD	21.	42.	1	0.9	32
5	FRVS FAN MOTOR	ROD	12.1	24.2	1	0.803	32

Thermal Conductor Type
1
1.5 FT THK CONCRETE

Region	Mat. #	Bdry. (in)	Thick (in)	Sub-regs.	Heat Factor
1	3	0.	1.296	4	0.
2	3	1.296	2.592	4	0.
3	3	3.888	7.056	4	0.
4	3	10.944	7.056	4	0.

Thermal Conductor Type
2
3/8 IN STEEL

Region	Mat. #	Bdry. (in)	Thick (in)	Sub-regs.	Heat Factor
1	4	0.	0.375	2	0.

Thermal Conductor Type
3
CORE SPRAY MOTOR

Region	Mat. #	Bdry. (in)	Thick (in)	Sub-regs.	Heat Factor
1	5	0.	18.	10	1.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Thermal Conductor Type 4 RHR PUMP MOTOR					
Region	Mat. #	Bdry. (in)	Thick (in)	Sub-regs.	Heat Factor
1	5	0.	21.	10	1.

Thermal Conductor Type 5 FRVS FAN MOTOR					
Region	Mat. #	Bdry. (in)	Thick (in)	Sub-regs.	Heat Factor
1	6	0.	12.1	10	1.

Materials	
Type #	Description
1	COPPER FINS
2	STAINLESS STEEL
3	CONCRETE
4	STEEL HEAT SINKS
5	CS/RHR MOTOR COMPOSITE
6	FRVS MOTOR COMPOSITE

Material Type 1 COPPER FINS			
Temp. (F)	Density (lbm/ft3)	Cond. (Btu/hr-ft-F)	Sp. Heat (Btu/lbm-F)
120.	559.	225.	0.108

Material Type 2 STAINLESS STEEL			
Temp. (F)	Density (lbm/ft3)	Cond. (Btu/hr-ft-F)	Sp. Heat (Btu/lbm-F)
120.	490.	9.	0.11

Material Type 3 CONCRETE			
Temp. (F)	Density (lbm/ft3)	Cond. (Btu/hr-ft-F)	Sp. Heat (Btu/lbm-F)
120.	150.	1.04	0.156

Material Type 4 STEEL HEAT SINKS			
Temp. (F)	Density (lbm/ft3)	Cond. (Btu/hr-ft-F)	Sp. Heat (Btu/lbm-F)
120.	490.	18.	0.11

Material Type 5 CS/RHR MOTOR COMPOSITE			
Temp. (F)	Density (lbm/ft3)	Cond. (Btu/hr-ft-F)	Sp. Heat (Btu/lbm-F)
120.	165.	3.	0.1

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Material Type 6 FRVS MOTOR COMPOSITE			
Temp. (F)	Density (lbm/ft3)	Cond. (Btu/hr-ft-F)	Sp. Heat (Btu/lbm-F)
120.	207.	3.	0.1

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	Ctrlr Loc
1H	FRVS FAN HEAT	28					97.63	1	VTI	28
2H	HEAT ROOM 3	3					1.	2	VTI	3
3H	EQP HEAT RM 4	4					1.	3	VTI	4
4H	FAN HEAT RM 4	4	1	14			24.66		VTI	4
5H	EQP HEAT RM 5	5					1.	4	VTI	5
6H	FAN HEAT RM 5	5	2	15			24.66		VTI	5
7H	EQP HEAT RM 6	6					1.	5	VTI	6
8H	FAN HEAT RM 6	6	3	16			16.25		VTI	6
9H	EQP HEAT RM 7	7					1.	6	VTI	7
10H	FAN HEAT RM 7	7	4	17			16.25		VTI	7
11H	EQP HEAT RM 8	8					1.	7	VTI	8
12H	FAN HEAT RM 8	8	5	18			16.25		VTI	8
13H	EQP HEAT RM 9	9					1.	8	VTI	9
14H	FAN HEAT RM 9	9	6	19			16.25		VTI	9
15H	EQP HT. RM 10	10					1.	9	VTI	10
16H	FAN HT. RM 10	10	7	20			12.33		VTI	10
17H	EQP HT. RM 11	11					1.	10	VTI	11
18H	FAN HT. RM 11	11	8	21			4.31		VTI	11
19H	SUPP POOL HT	12	0				1.	29	VTI	12
20H	MCC RM 13 HEA	13					1.	12	VTI	13
21H	RM 14 HEAT	14					1.	13	VTI	14
22H	RM 15 HEAT	15					1.	14	VTI	15
23H	EQP HT. RM 16	16					1.	15	VTI	16
24H	FAN HT. RM 16	16	9	22			12.62		VTI	16
25H	HEAT ROOM 17	17					1.	16	VTI	17
26H	HEAT ROOM 18	18					1.	17	VTI	18
27H	HEAT ROOM 19	19					1.	18	VTI	19
28H	HEAT ROOM 20	20					1.	19	VTI	20

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

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	Ctrlr Loc
29H	HEAT ROOM 21	21					1.	20	VTI	21
30H	HEAT ROOM 22	22					1.	21	VTI	22
31H	HEAT ROOM 23	23					1.	22	VTI	23
32H	HEAT ROOM 24	24					1.	23	VTI	24
33H	HEAT ROOM 25	25					1.	24	VTI	25
34C	RM 4 COOLER	4	1	14			8.64	25	VTE	4
35C	RM 5 COOLER	5	2	15			8.64	25	VTE	5
36C	RM 6 COOLER	6	3	16			6.23	25	VTE	6
37C	RM 7 COOLER	7	4	17			6.23	25	VTE	7
38C	RM 8 COOLER	8	5	18			6.23	25	VTE	8
39C	RM 9 COOLER	9	6	19			6.23	25	VTE	9
40C	RM 10 COOLER	10	7	20			4.32	25	VTE	10
41C	RM 11 COOLER	11	8	21			1.9	25	VTE	11
42C	RM 16 COOLER	16	9	22			5.66	26	VTE	16
43H	frvs heater	27	12	13			379.2		VTI	27
44H	EQP HEAT RM12	12					1.	30	VTI	12

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Heat Exchangers - Table 1

Heat Ex. #	Description	HX Type #	Prim Flow Path	Scnd Flow Path	Cpld HX #
1H	FRVS REC. COOLE	1	46	SPEC	

Heat Exchangers - Table 2

Heat Ex. #	Scndy Flow (lbm/s)	Scndy Flow FF	Scndy Temp (F)	Scndy Temp FF	Ext. Flow (lbm/s)	Ext. Flow FF	Ext. Heat (Btu/s)	Ext. Heat FF
1H	210.6	0	51.					

Heat Exchanger Types - Table 1

HX Type #	Option	Passes or Zones	Tube Mat. #	Thick-ness (in)	Wall Area (ft2)
1	FAN COOLER	9	2	0.035	1095.6

Heat Exchanger Types - Table 2

HX Type #	Side	Fin Type	Flow Area (ft2)	Hyd. Diam. (in)	Tot. S. Area (ft2)	H.T. Coef Curv	H.T. Coef Type	Fouling Resistance (h-f2-F/B)
1	prim	SHEE	58.32	0.625	20301.1	0	BUIL	0.
	SECO	NONE	0.269	0.555	930.	0	BUIL	5e-004

Heat Exchanger Types - Table 3
Fin Parameters

HX Type #	Side	Fin Mat. Type #	Pin Diam. (in)	Length (in)	Thick-ness (in)	Surf. Area (ft2)
1	PRIM	1	0.	0.4375	0.007	19214.
	seco	0	0.	0.	0.	0.

Component Trips

Trip #	Sense Var.	Sensor 1 Loc.	Sensor 2 Loc.	Var. Limit	Set Point	Delay Time	Reset Trip	Cond Trip	Cond Type
1	GAS T	4		UPPER	115.	0.	14		AND
2	GAS T	5		UPPER	115.	0.	15		AND
3	GAS T	6		UPPER	115.	0.	16		AND
4	GAS T	7		UPPER	115.	0.	17		AND
5	GAS T	8		UPPER	115.	0.	18		AND
6	GAS T	9		UPPER	115.	0.	19		AND
7	GAS T	10		UPPER	115.	0.	20		AND
8	GAS T	11		UPPER	115.	0.	21		AND
9	GAS T	16		UPPER	104.	0.	22		AND
10	PRESS	3P	25	UPPER	0.	0.			AND
11	TIME			UPPER	45.	0.			AND
12	CONT	5		UPPER	60.	0.	13		AND
13	CONT	5		LOWER	50.	0.	12		AND
14	GAS T	4		LOWER	112.75	0.	1		AND
15	GAS T	5		LOWER	112.75	0.	2		AND
16	GAS T	6		LOWER	112.75	0.	3		AND
17	GAS T	7		LOWER	112.75	0.	4		AND
18	GAS T	8		LOWER	112.75	0.	5		AND
19	GAS T	9		LOWER	112.75	0.	6		AND
20	GAS T	10		LOWER	112.75	0.	7		AND
21	GAS T	11		LOWER	112.75	0.	8		AND
22	GAS T	16		LOWER	99.	0.	9		AND
23	TIME			UPPER	10.	0.			AND

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:23
GOTHIC Version 6.0a(QA) - April 1998

Functions				
FF#	Description	Ind. Var.	Dep. Var.	Points
0	Constant	-	-	0
1	NO. OF FRVS FAN	TIME (S)	NO. OF FRV	4
2	PIPE CHASE HEAT	TIME (S)	BTU/S	4
3	RM 4 TIME HEAT	TIME (S)	HEAT (BTU/	4
4	RM 5 TIME HEAT	TIME (S)	HEAT (BTU/	4
5	RM 6 TIME HEAT	TIME (S)	HEAT (BTU/	4
6	RM 7 TIME HEAT	TIME (S)	HEAT (BTU/	4
7	RM 8 TIME HEAT	TIME (S)	HEAT (BTU/	4
8	RM 9 TIME HEAT	TIME (S)	HEAT (BTU/	4
9	RM 10 TIME HEAT	TIME (S)	HEAT (BTU/	4
10	RM 11 TIME HEAT	TIME (S)	HEAT (BTU/	4
11	TORUS TEMP	TIME (S)	Torus Temp	22
12	RM 13 TIME HEAT	TIME (S)	HEAT (BTU/	4
13	RM 14 HEAT	TIME (S)	HEAT (BTU/	4
14	RM 15 HEAT	TIME (S)	HEAT (BTU/	4
15	RM 16 TIME HEAT	TIME (S)	HEAT (BTU/	4
16	RM 17 HEAT	TIME (S)	HEAT (BTU/	4
17	RM 18 HEAT	TIME (S)	HEAT (BTU/	4
18	RM 19 HEAT	TIME (S)	HEAT (BTU/	4
19	RM 20 HEAT	TIME (S)	HEAT (BTU/	4
20	RM 21 HEAT	TIME (S)	HEAT (BTU/	4
21	RM 22 HEAT	TIME (S)	HEAT (BTU/	4
22	RM 23 HEAT	TIME (S)	HEAT (BTU/	4
23	RM 24 HEAT	TIME (S)	HEAT (BTU/	4
24	RM 25 HEAT	TIME (S)	HEAT (BTU/	4
25	RM CLR, SACS 51	TEMPERATUR	HEAT TRANS	2
26	RM CLR, CW 51 F	TEMPERATUR	HEAT TRANS	2
27	FRVS HT RATE [N	FAN OUTLET	HEAT TRANS	2
28	exhaust flow	cv8	Exhaust fl	4
29	torus heat (y=x	cv4	torus heat	2
30	TORUS (RM 12) L	Time (sec)	Heat (Btu/	4
31	PDT Output	Reactor Bl	PDT Output	4
32	Motor Heat	TIME (S)	Normalized	8

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function 1 NO. OF FRVS FANS Ind. Var.: TIME (S) Dep. Var.: NO. OF FRVS FANS OPERATING			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0. 17.	0. 4.	10. 1000000.	0. 4.

Function 2 PIPE CHASE HEAT Ind. Var.: TIME (S) Dep. Var.: BTU/S			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0. 10.1	18.27 18.15	10. 1000000.	18.27 18.15

Function 3 RM 4 TIME HEAT Ind. Var.: TIME (S) Dep. Var.: HEAT (BTU/S)			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0. 10.1	1.18 12.92	10. 1000000.	1.18 12.92

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function
4
RM 5 TIME HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	1.24	10.	1.24
10.1	12.78	1000000.	12.78

Function
5
RM 6 TIME HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	1.98	10.	1.98
10.1	3.21	1000000.	3.21

Function
6
RM 7 TIME HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	1.98	10.	1.98
10.1	3.14	1000000.	3.14

Function 7 RM 8 TIME HEAT Ind. Var.: TIME (S) Dep. Var.: HEAT (BTU/S)			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	1.05	10.	1.05
10.1	4.54	1000000.	4.54

Function 8 RM 9 TIME HEAT Ind. Var.: TIME (S) Dep. Var.: HEAT (BTU/S)			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	1.05	10.	1.05
10.1	4.57	1000000.	4.57

Function 9 RM 10 TIME HEAT Ind. Var.: TIME (S) Dep. Var.: HEAT (BTU/S)			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	7.55	10.	7.55
10.1	28.54	1000000.	28.54

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function 10
RM 11 TIME HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	5.41	10.	5.41
10.1	17.05	1000000.	17.05

Function 11
TORUS TEMP
Ind. Var.: TIME (S)
Dep. Var.: Torus Temp F

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	96.	20.	121.
40.	131.	60.	134.
100.	138.	200.	142.
400.	150.	600.	159.
800.	163.	1000.	167.
2000.	181.	3000.	187.
4000.	191.	5000.	194.
7000.	198.	9000.	202.
11000.	204.	13000.	205.
16000.	207.	19000.	209.
22000.	210.	1000000.	210.

Function 12
RM 13 TIME HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	11.08	10.	11.08
10.1	7.3	1000000.	7.3

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function 13
RM 14 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	21.49	10.	21.49
10.1	1.83	1000000.	1.83

Function 14
RM 15 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	22.02	10.	22.02
10.1	2.23	1000000.	2.23

Function 15
RM 16 TIME HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	140.47	10.	140.47
10.1	128.	1000000.	128.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function
16
RM 17 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	30.76	10.	30.76
10.1	13.19	1000000.	13.19

Function
17
RM 18 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	26.85	10.	26.85
10.1	17.98	1000000.	17.98

Function
18
RM 19 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	15.89	10.	15.89
10.1	7.84	1000000.	7.84

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function
19
RM 20 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	58.81	10.	58.81
10.1	23.65	1000000.	23.65

Function
20
RM 21 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	55.2	10.	55.2
10.1	9.12	1000000.	9.12

Function
21
RM 22 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	13.62	10.	13.62
10.1	11.62	1000000.	11.62

Function
22
RM 23 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	38.38	10.	38.38
10.1	25.76	1000000.	25.76

Function
23
RM 24 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	31.44	10.	31.44
10.1	17.15	1000000.	17.15

Function
24
RM 25 HEAT
Ind. Var.: TIME (S)
Dep. Var.: HEAT (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	220.43	10.	220.43
10.1	44.61	1000000.	44.61

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function
25
RM CLR, SACS 51F
Ind. Var.: TEMPERATURE (F)
Dep. Var.: HEAT TRANSFER RATE (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	-51.	151.	100.

Function
26
RM CLR, CW 51 F
Ind. Var.: TEMPERATURE (F)
Dep. Var.: HEAT TRANSFER RATE (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
51.	0.	151.	100.

Function
27
FRVS HT RATE [NOT USED]
Ind. Var.: FAN OUTLET TEMPERATURE (F)
Dep. Var.: HEAT TRANSFER RATE (BTU/S)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	-23.88	200.	23.88

Function
28
exhaust flow
Ind. Var.: Control Variable 8 Output
Dep. Var.: Exhaust flow rate (cfs)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
-1000000.	0.	-1.	0.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function
28
exhaust flow
Ind. Var.: Control Variable 8 Output
Dep. Var.: Exhaust flow rate (cfs)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
1.	165.	1000000.	165.

Function
29
torus heat (y=x)
Ind. Var.: control variable 4
Dep. Var.: torus heat tr rate (Btu/sec)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
-1000000.	-1000000.	1000000.	1000000.

Function
30
TORUS (RM 12) LIGHT AND PIPING HEAT
Ind. Var.: Time (sec)
Dep. Var.: Heat (Btu/sec)

Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	10.25	10.	10.25
10.1	81.41	1000000.	81.41

Function 31 PDT Output Ind. Var.: Reactor Bldg DP (in.w.g.) Dep. Var.: PDT Output (in.w.g.)			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
-1000.	-1.	-1.	-1.
1.	1.	1000.	1.

Function 32 Motor Heat Ind. Var.: TIME (S) Dep. Var.: Normalized Heat Generation Rate			
Ind. Var.	Dep. Var.	Ind. Var.	Dep. Var.
0.	0.	10.	0.
10.1	10.	11.	6.06
12.	3.25	13.	1.56
14.	1.	1000000.	1.

Control Variables

CV #	Description	Func. Form	Initial Value	Coeff. G	Coeff. a0	Min	Max	Upd. Int. Mult.
1	Sensor Tube P	sum	0.	27.7	-14.7	-1e+03	1e+032	0.
2	exh. flow rat	div	0.	60.	0.	-1e+03	1e+032	0.
3	torus temp.	tfunc	96.	1.	0.	-1e+03	1e+032	0.
4	torus ht rate	sum	0.	13.32	0.	-1e+03	1e+032	0.
5	frvs rel. hum	div	50.	100.	0.	-1e+03	1e+032	0.
6	inleakage fl.	sum	0.	60.	0.	-1e+03	1e+032	0.
7	PDTout-setpt	sum	0.	1.	0.5	-1e+03	1e+032	0.
8	PDIC-9426 SUM	proint	0.	1.	1.	-1e+03	1e+032	0.
9	PDT-9426 OUT	tfunc	0.	1.	0.	-1e+03	1e+032	0.
10	MCC Area Pres	sum	0.	27.7	-14.7	-1e+03	1e+032	0.
11	FRVS Vent Rm	sum	0.	27.7	-14.7	-1e+03	1e+032	0.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function Components
Control Variable 1
Sensor Tube Penetration Pressure (177 ft)
sum
Y=G*(a0+a1X1+a2X2+...+anXn)

#	Gothic_s Name	Variable location	Coef. a
1	p	cV24	1.

Function Components
Control Variable 2
exh. flow rate
div
Y=G*(a0+a2X2)/(a1X1)

#	Gothic_s Name	Variable location	Coef. a
1	rvg	cV1	1.
2	wgjnc	cJ61	1.

Function Components
Control Variable 3
torus temp.
tfunc
Y=G*interp(X1,tableX2)

#	Gothic_s Name	Variable location	Coef. a
1	timet	cM	1.
2	-	DC11	1.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Function Components
Control Variable 4
torus ht rate
sum
Y=G* (a0+a1X1+a2X2+...+anXn)

#	Gothic_s Name	Variable location	Coef. a
1	cvval	cv3	1.
2	temv	cV12	-1.

Function Components
Control Variable 5
frvs rel. hum
div
Y=G* (a0+a2X2)/(a1X1)

#	Gothic_s Name	Variable location	Coef. a
1	psatv	cV28	1.
2	psteam	cV29	1.

Function Components
Control Variable 6
inleakage fl.
sum
Y=G* (a0+a1X1+a2X2+...+anXn)

#	Gothic_s Name	Variable location	Coef. a
1	wgjnc	cJ65	14.013

Function Components
Control Variable 7
PDTout-setpt
sum
Y=G*(a0+a1X1+a2X2+...+anXn)

#	Gothic_s Name	Variable location	Coef. a
1	cvval	cv9	1.

Function Components
Control Variable 8
PDIC-9426 SUM
proint
Y=G*(a0X1+a1*integ(X1dt))

#	Gothic_s Name	Variable location	Coef. a
1	cvval	cv7	0.0167

Function Components
Control Variable 9
PDT-9426 OUT
tfunc
Y=G*interp(X1,tableX2)

#	Gothic_s Name	Variable location	Coef. a
1	cvval	cv1	1.
2	-	DC31	1.

Function Components
Control Variable 10
MCC Area Pres
sum
Y=G*(a0+a1X1+a2X2+...+anXn)

#	Gothic_s Name	Variable location	Coef. a
1	p	cV13	1.

Function Components
Control Variable 11
FRVS Vent Rm P
sum
Y=G*(a0+a1X1+a2X2+...+anXn)

#	Gothic_s Name	Variable location	Coef. a
1	p	cV21	1.

Volume Initial Conditions

Vol #	Pressure (psia)	Vapor Temp. (F)	Liquid Temp. F	Relative Humidity (%)	Liquid Volume Fraction	Ice Volume Fract.	Ice Surf.A. (ft2)
def	14.692	40.	40.	50.	0.	0.	0.
1	14.692	40.	40.	50.	0.	0.	0.
2	14.692	40.	40.	50.	0.	0.	0.
3	14.723	40.	40.	50.	0.	0.	0.
4	14.75	40.	40.	50.	0.	0.	0.
5	14.75	40.	40.	50.	0.	0.	0.
6	14.75	69.	69.	50.	0.	0.	0.
7	14.75	69.	69.	50.	0.	0.	0.
8	14.744	65.	65.	50.	0.	0.	0.
9	14.744	65.	65.	50.	0.	0.	0.
10	14.75	47.	47.	50.	0.	0.	0.
11	14.75	47.	47.	50.	0.	0.	0.
12	14.744	86.	86.	50.	0.	0.	0.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Volume Initial Conditions

Vol #	Pressure (psia)	Vapor Temp. (F)	Liquid Temp. F	Relative Humidity (%)	Liquid Volume Fraction	Ice Volume Fract.	Ice Surf.A. (ft2)
13	14.738	53.	53.	50.	0.	0.	0.
14	14.738	61.	61.	50.	0.	0.	0.
15	14.738	62.	62.	50.	0.	0.	0.
16	14.723	40.	40.	50.	0.	0.	0.
17	14.723	43.	43.	50.	0.	0.	0.
18	14.723	64.	64.	50.	0.	0.	0.
19	14.712	40.	40.	50.	0.	0.	0.
20	14.709	40.	40.	50.	0.	0.	0.
21	14.704	40.	40.	50.	0.	0.	0.
22	14.704	40.	40.	50.	0.	0.	0.
23	14.692	40.	40.	50.	0.	0.	0.
24	14.692	50.	50.	50.	0.	0.	0.
25	14.65	48.	48.	50.	0.	0.	0.

Initial Gas Pressure Ratios

Vol #	Air Gas 1	Gas 2	Gas 3	Gas 4	Gas 5	Gas 6	Gas 7	Gas 8
def	1.	0.	0.	0.	0.	0.	0.	0.
1	1.	0.	0.	0.	0.	0.	0.	0.
2	1.	0.	0.	0.	0.	0.	0.	0.
3	1.	0.	0.	0.	0.	0.	0.	0.
4	1.	0.	0.	0.	0.	0.	0.	0.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Initial Gas Pressure Ratios								
Vol #	Air Gas 1	Gas 2	Gas 3	Gas 4	Gas 5	Gas 6	Gas 7	Gas 8
5	1.	0.	0.	0.	0.	0.	0.	0.
6	1.	0.	0.	0.	0.	0.	0.	0.
7	1.	0.	0.	0.	0.	0.	0.	0.
8	1.	0.	0.	0.	0.	0.	0.	0.
9	1.	0.	0.	0.	0.	0.	0.	0.
10	1.	0.	0.	0.	0.	0.	0.	0.
11	1.	0.	0.	0.	0.	0.	0.	0.
12	1.	0.	0.	0.	0.	0.	0.	0.
13	1.	0.	0.	0.	0.	0.	0.	0.
14	1.	0.	0.	0.	0.	0.	0.	0.
15	1.	0.	0.	0.	0.	0.	0.	0.
16	1.	0.	0.	0.	0.	0.	0.	0.
17	1.	0.	0.	0.	0.	0.	0.	0.
18	1.	0.	0.	0.	0.	0.	0.	0.
19	1.	0.	0.	0.	0.	0.	0.	0.
20	1.	0.	0.	0.	0.	0.	0.	0.
21	1.	0.	0.	0.	0.	0.	0.	0.
22	1.	0.	0.	0.	0.	0.	0.	0.
23	1.	0.	0.	0.	0.	0.	0.	0.
24	1.	0.	0.	0.	0.	0.	0.	0.
25	1.	0.	0.	0.	0.	0.	0.	0.

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	1.	1.	3600.	18000.	10.	5000.	0.
2	0.001	2.	1.	18000.	18000.	100.	5000.	0.

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Solution Options						
Time Dom	Solution Method	Imp Conv Limit	Imp Iter Limit	Pres Sol Method	Pres Conv Limit	Pres Iter Limit
1	SEMI-IMP	0.	1	DIRECT	0.	1
2	SEMI-IMP	0.	1	DIRECT	0.	1

Run Options	
Parameter	Value
Restart Time (sec)	0
Restart Time Step #	0
Restart Time Control	NEW
Revaporization Fraction	DEFAULT
Heterogenous Nucleation	INCLUDE
Minimum HT Coeff.	0
Reference Pressure	IGNORE
Forced Ent. Drop Diam.	0.00833
Vapor Phase Head Correction	INCLUDE
Kinetic Energy	IGNORE
Vapor Phase	INCLUDE
Liquid Phase	INCLUDE
Drop Phase	INCLUDE
Force Equilibrium	IGNORE
Drop-Liq. Conversion	INCLUDE
QA Logging	OFF

Ice Condenser Parameters			
Initial Temp. (F)	Bulk Density (lbm/ft3)	Surface Area Multiplier Function	Heat Transfer Option
15.	33.43		UCHIDA

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:01:24
GOTHIC Version 6.0a(QA) - April 1998

Graph #	Title	Mon	Curve Number 1	2	3	4	5
1			TV1	TV2	TV3	TV4	TV5
2			TV6	TV7	TV8	TV9	TV10
3			TV11	TV12	TV13	TV14	TV15
4			TV16	TV17	TV18	TV19	TV20
5			TV21	TV22	TV23	TV24	TV25
6	TEMPERATURES AT		TV26	TV27			
7	RELATIVE HUMIDI		RH26	RH27	RH28		
8	FRVS FAN FLOW R		FV46				
9	RB Exhaust (acf		cv2				
10	Vent Flow to At		FV61				
11	Sensor Tube Pen		cv1				
12	Inleakage Flow		cv6				
13	Pressure Error		cv7				
14	Controller Outp		cv8				
15	PDT Output (in.		cv9				
16	MCC Area Pressu		cv10				
17	FRVS Vent Room		cv11				

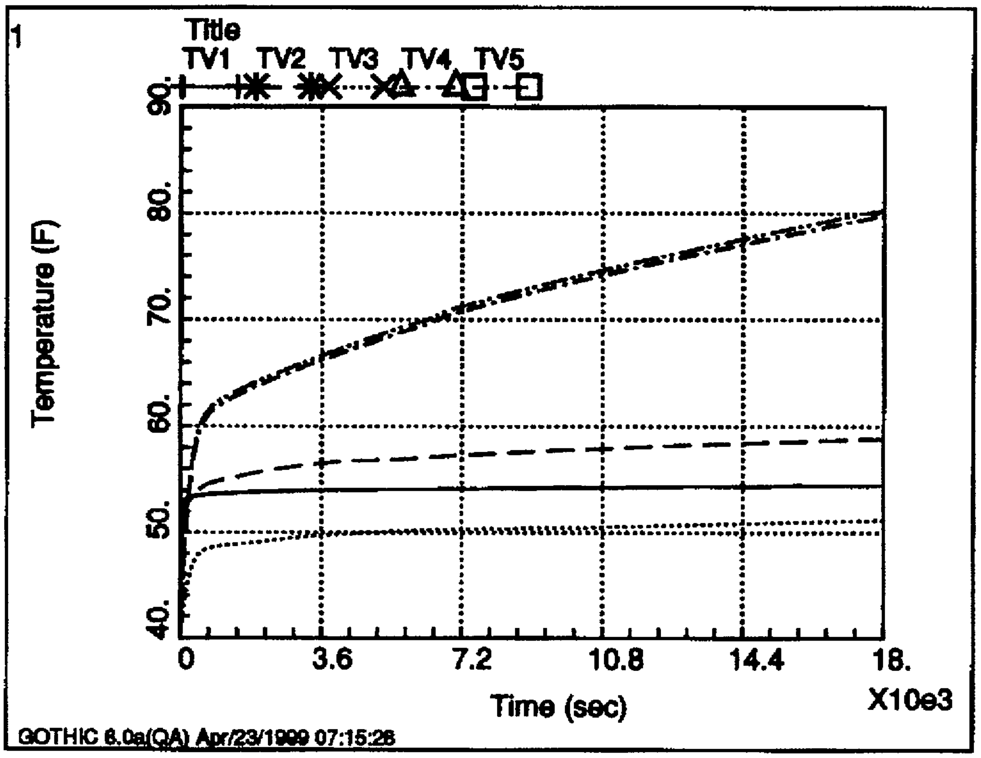
Noncondensing Gases

Gas No.	Description	Symbol	Type	Mol. Weight	Lennard-Jones Diameter (Ang)	Parameters e/K (K)
1	Air	Air	POLY	28.97	3.617	97.

Noncondensing Gases - Cp/Visc. Equations

Gas No.	Cp Tmin (R)	Equation Tmax (R)	(Required) Cp (Btu/lbm-R)	Visc. Tmin (R)	Equation Tmax (R)	(Optional) Viscosity (lbm/ft-hr)
1	360.	2280.	0.238534-6.2006			

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:53
GOTHIC Version 6.0a(QA) - April 1998



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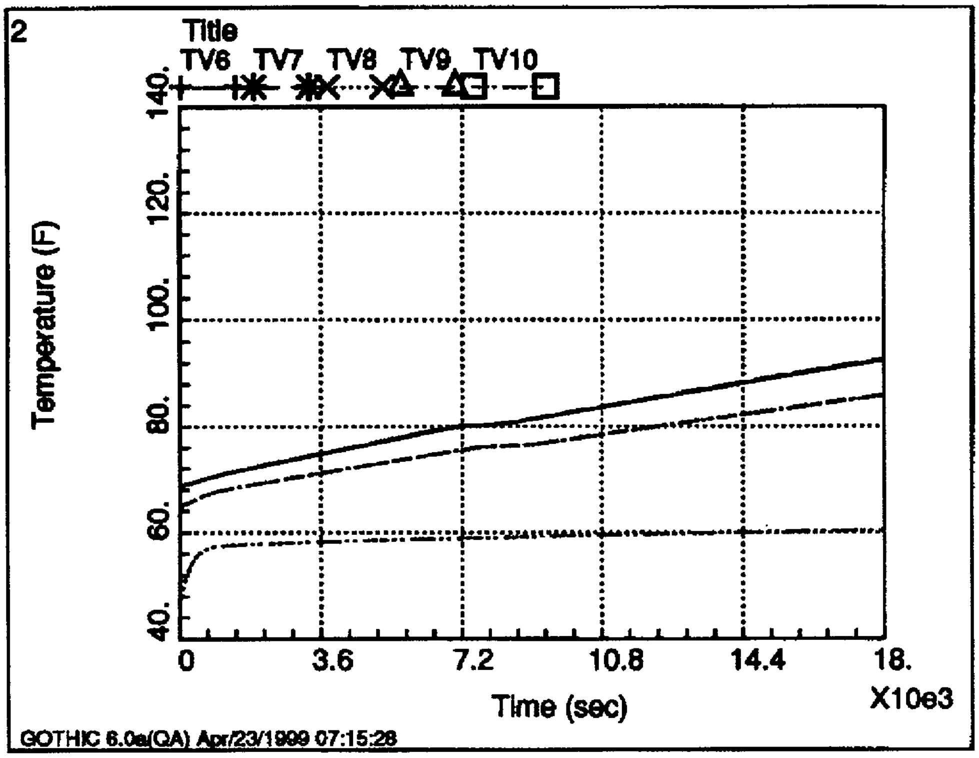
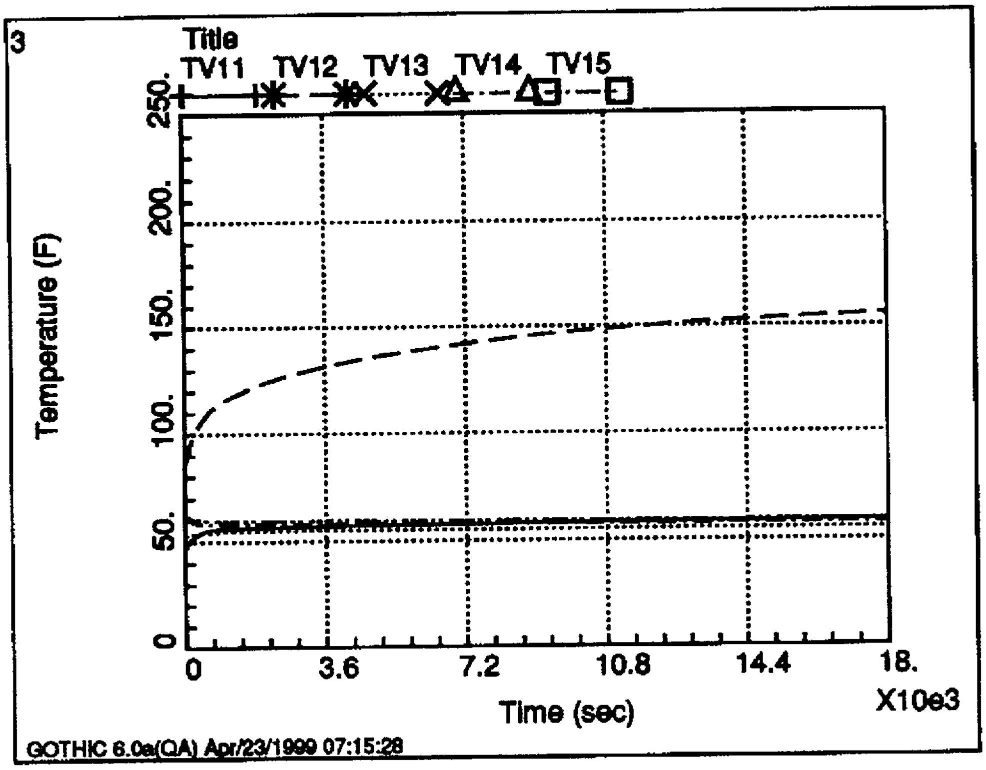
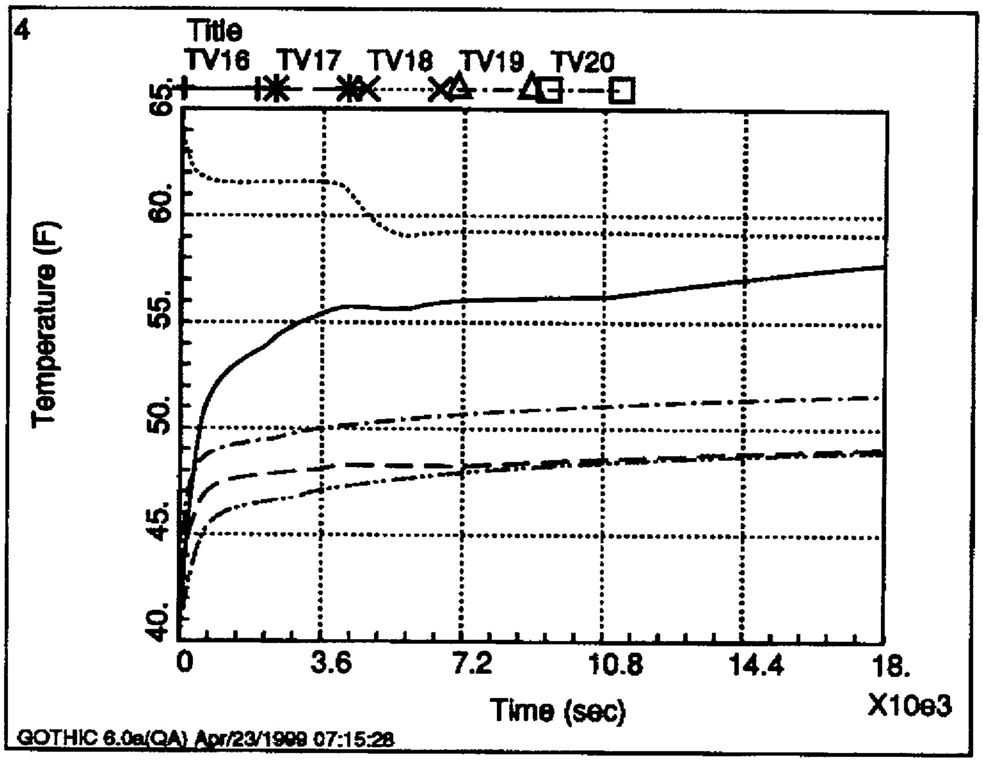
Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:54
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:54
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:55
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
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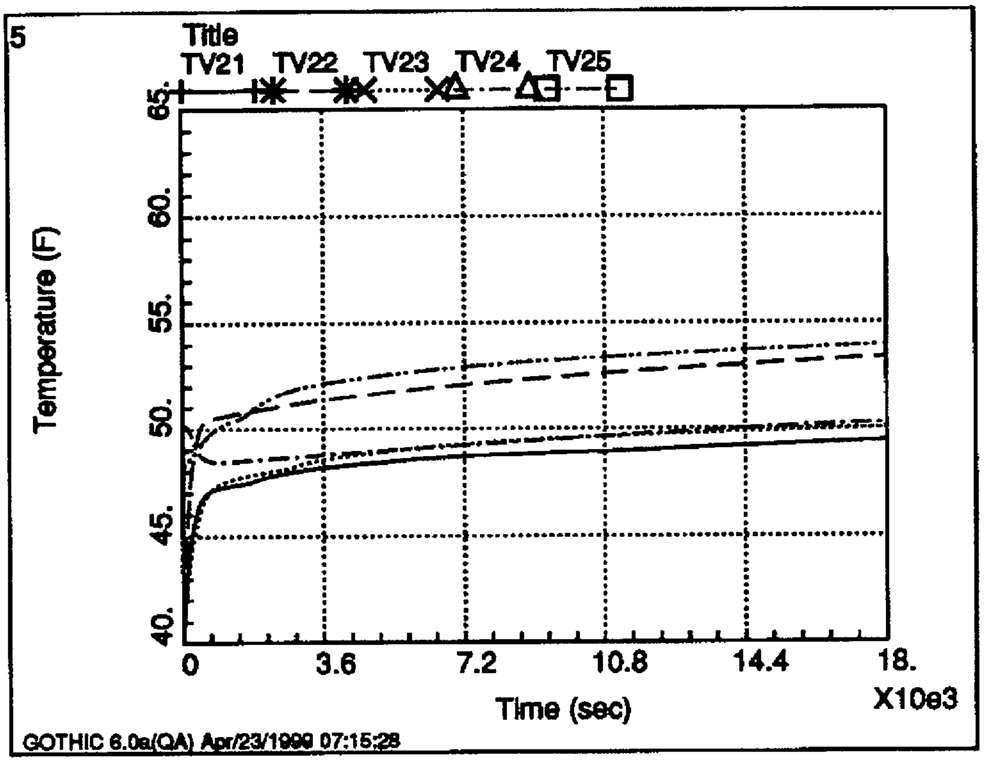
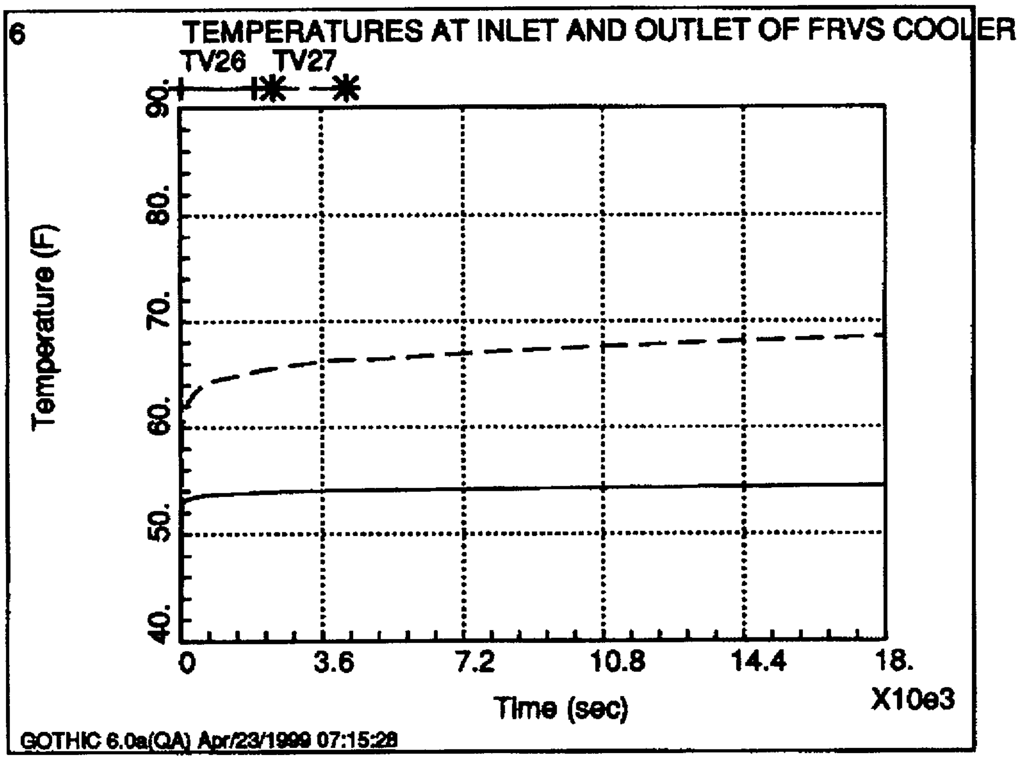


Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:56
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:56
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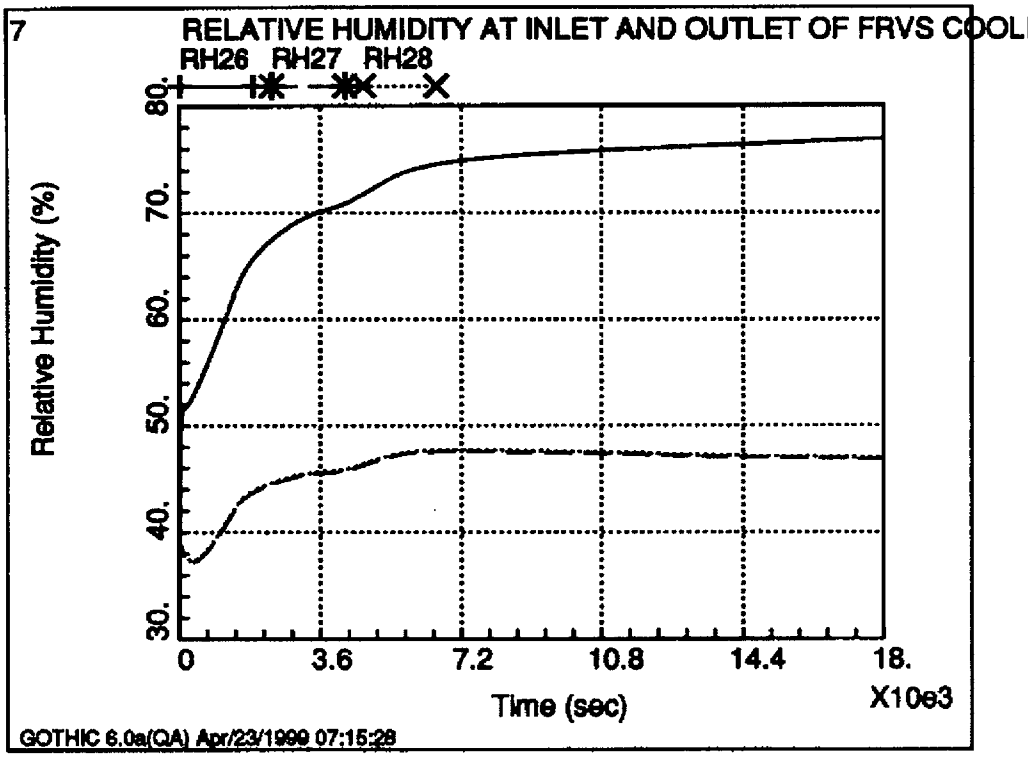

Reactor Building Exhaust Rate (LOCA Case A - Winter)
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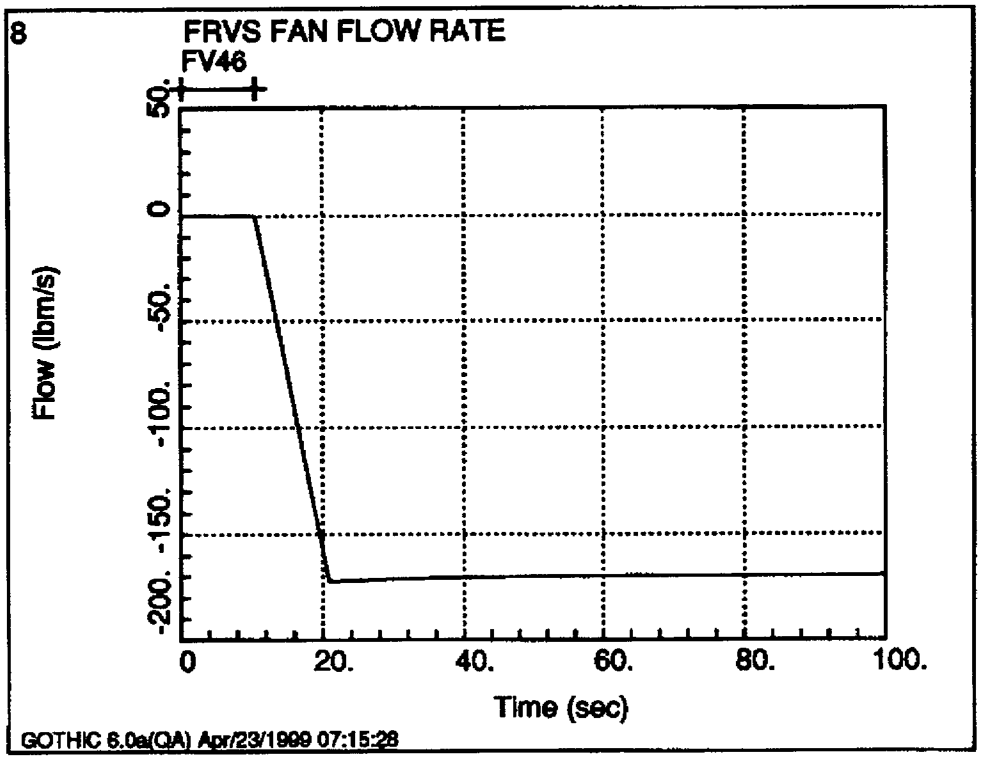
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
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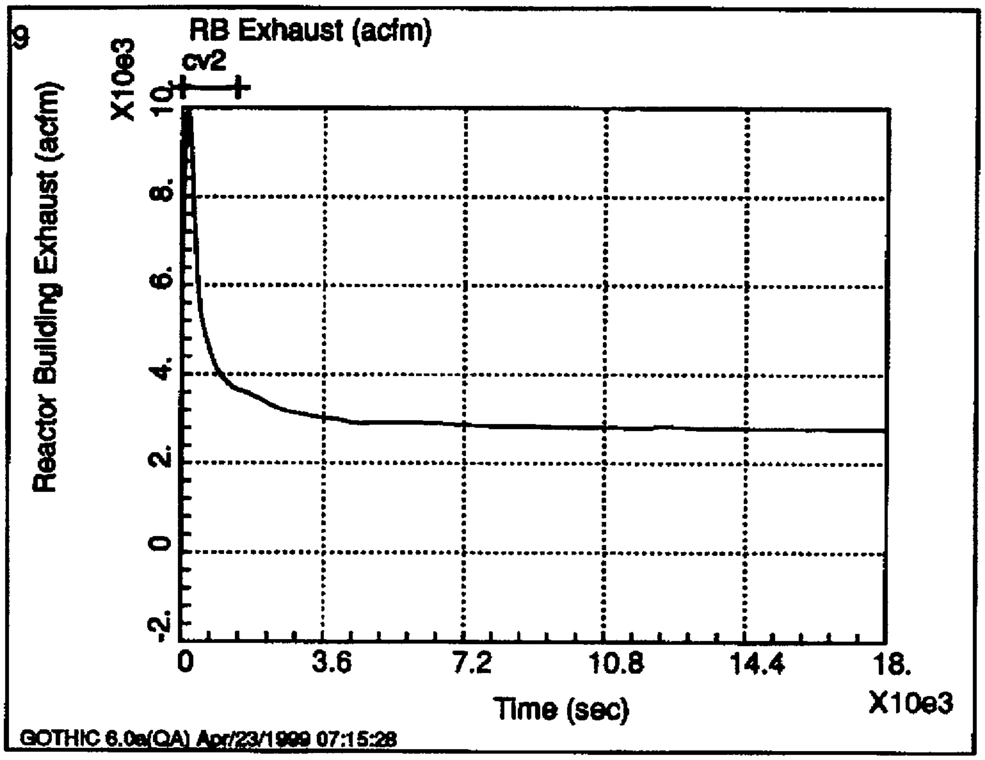

Reactor Building Exhaust Rate (LOCA Case A - Winter)
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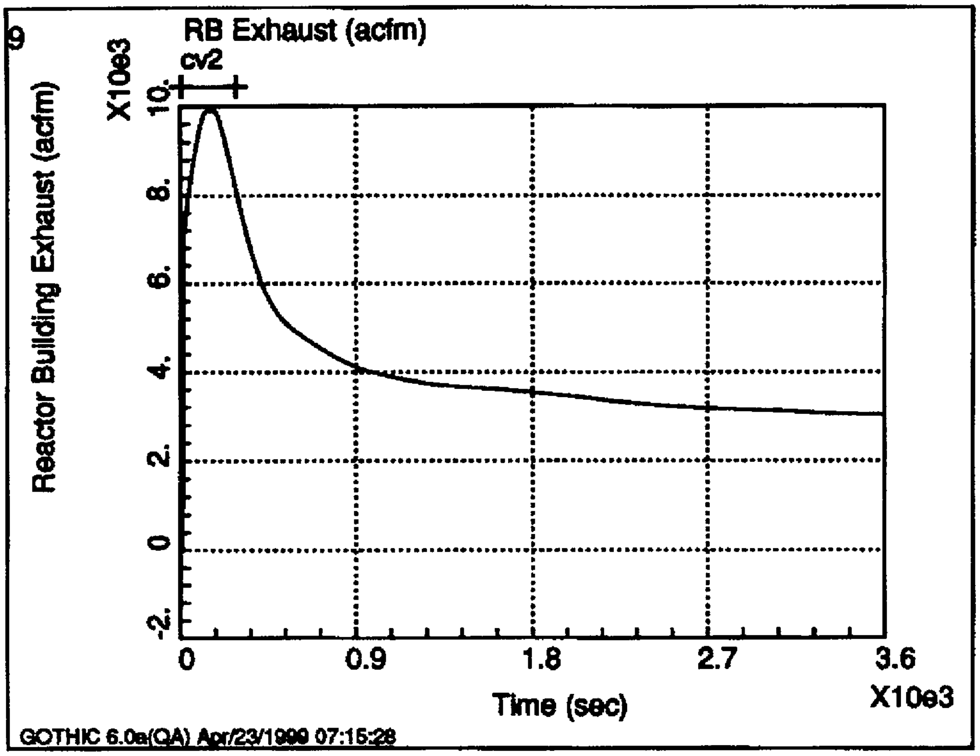

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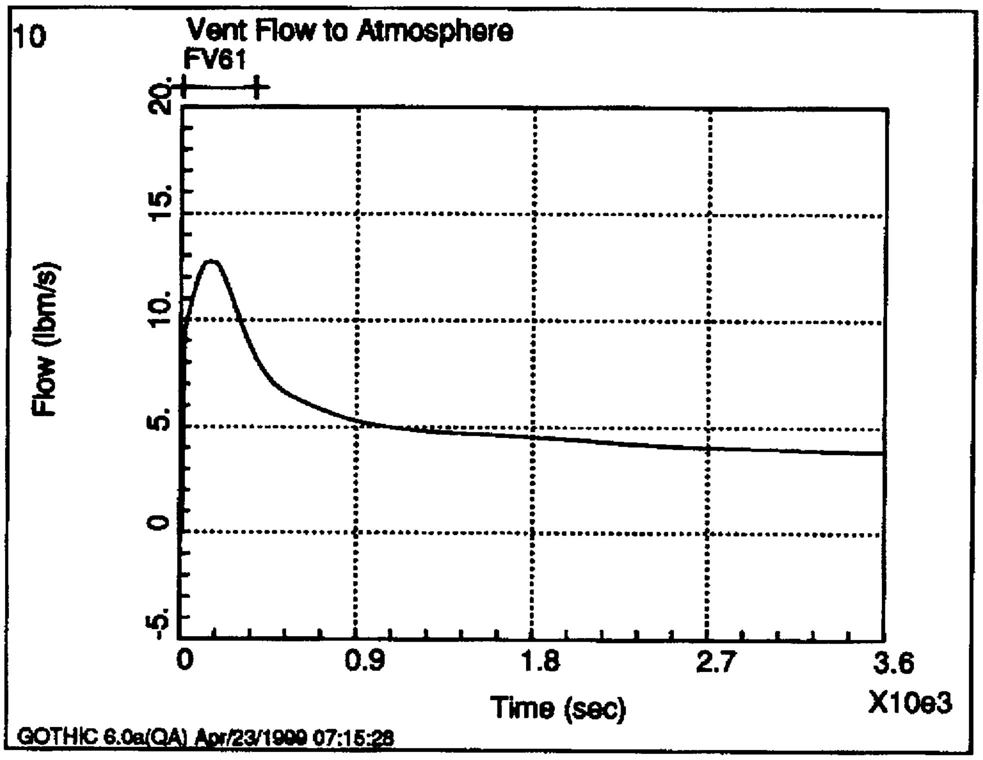
Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:56
GOTHIC Version 6.0a(QA) - April 1998



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Reactor Building Exhaust Rate (LOCA Case A - Winter)
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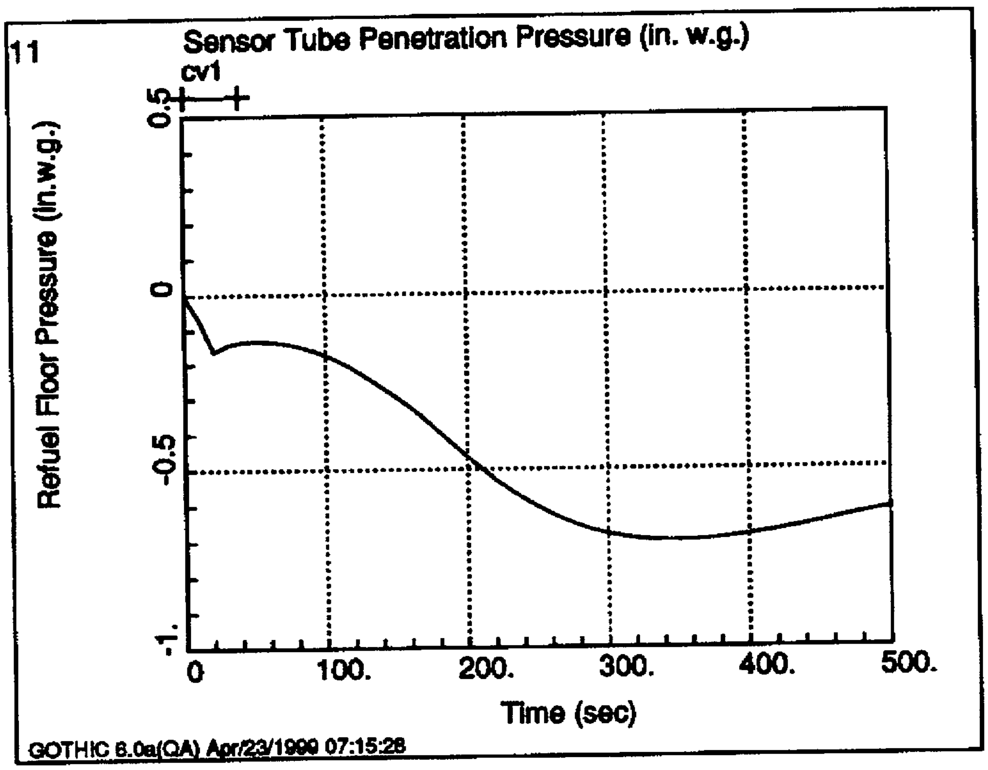
GOTHIC Version 6.0a(QA) - April 1998



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Reactor Building Exhaust Rate (LOCA Case A - Winter)
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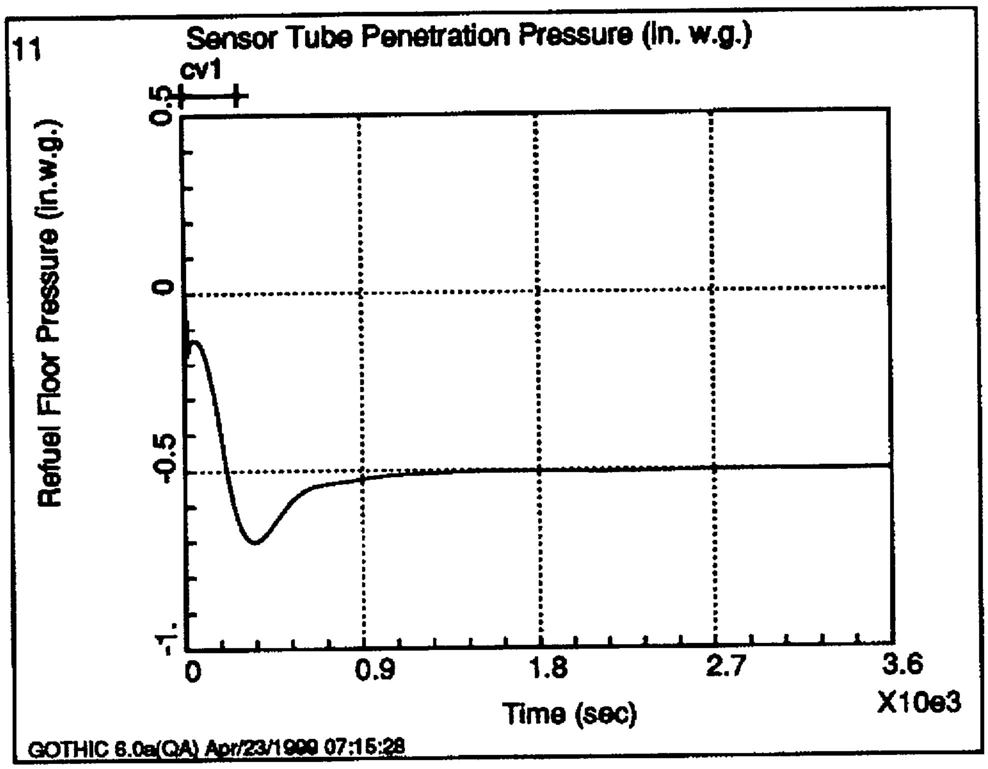

Reactor Building Exhaust Rate (LOCA Case A - Winter)
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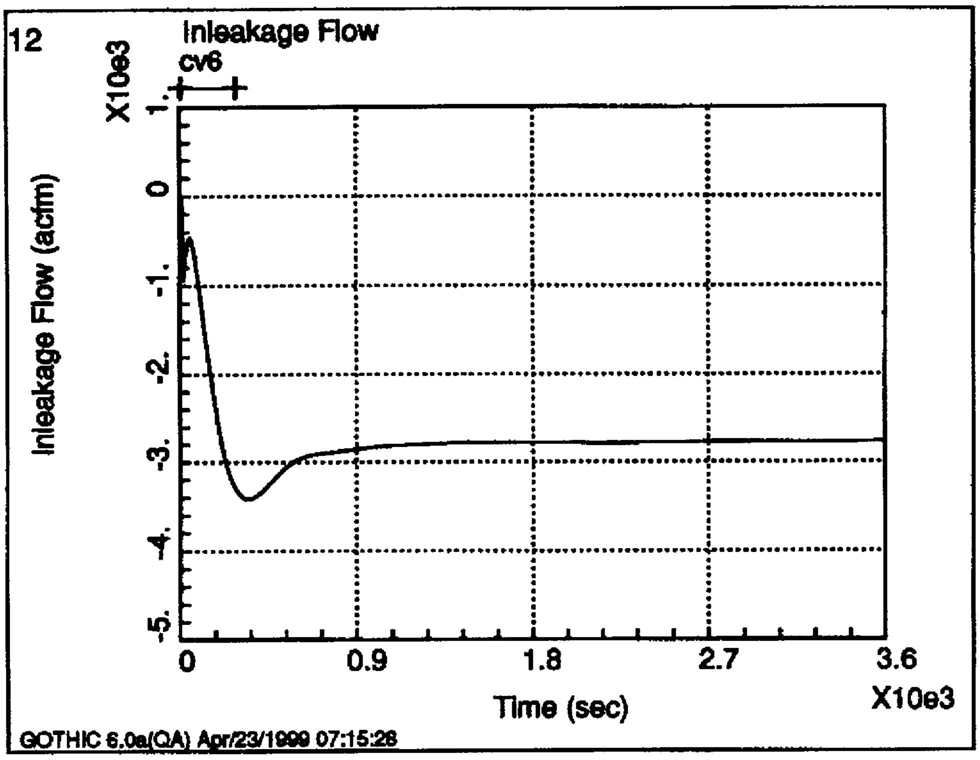
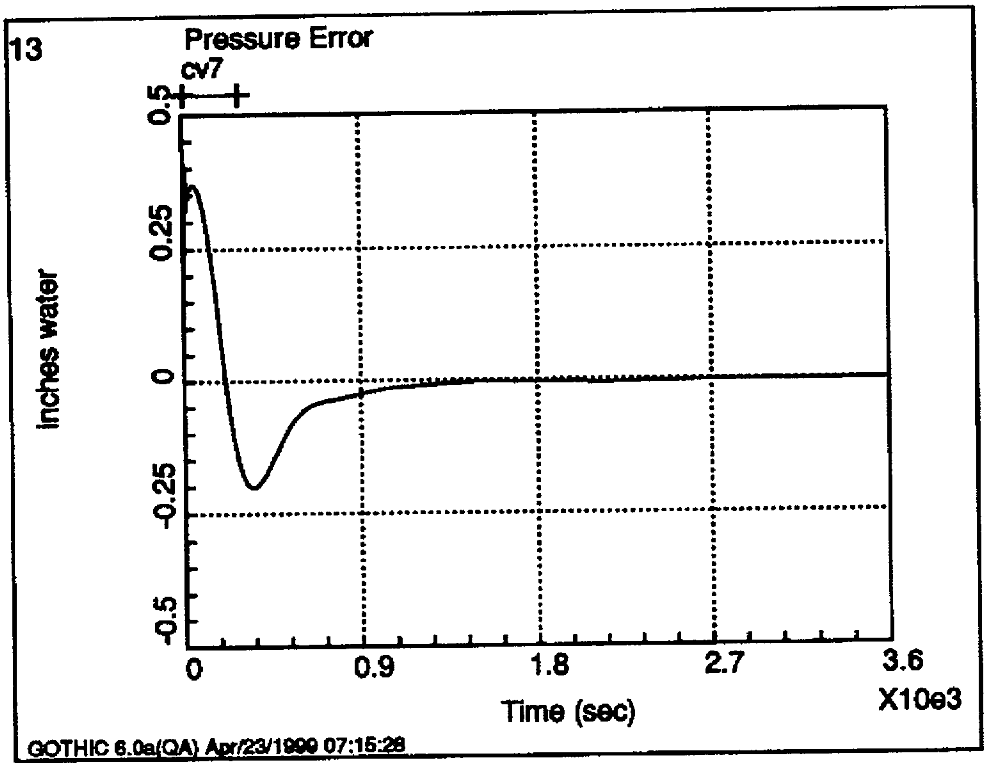
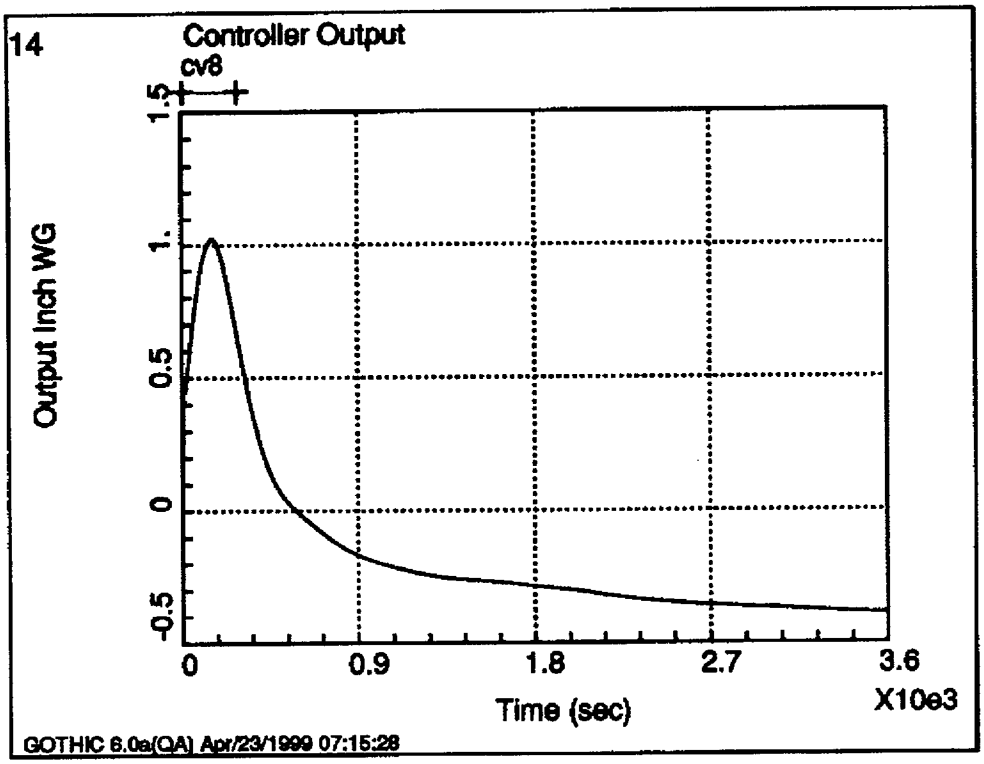
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:57
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:57
GOTHIC Version 6.0a(QA) - April 1998



Reactor Building Exhaust Rate (LOCA Case A - Winter)
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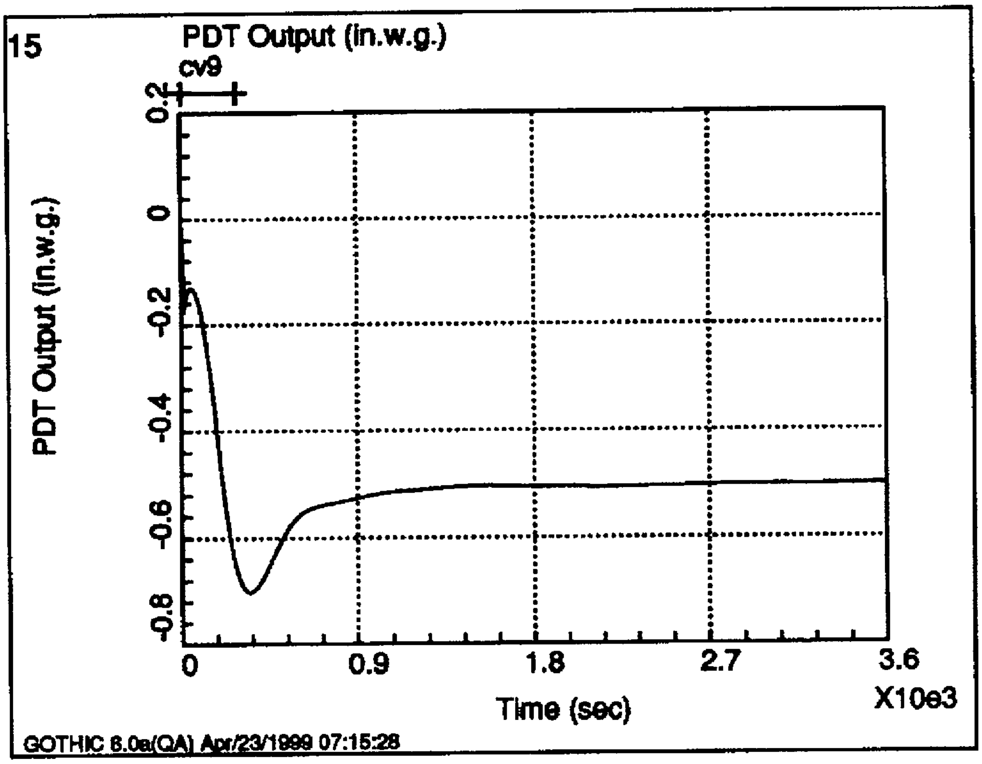

Reactor Building Exhaust Rate (LOCA Case A - Winter)
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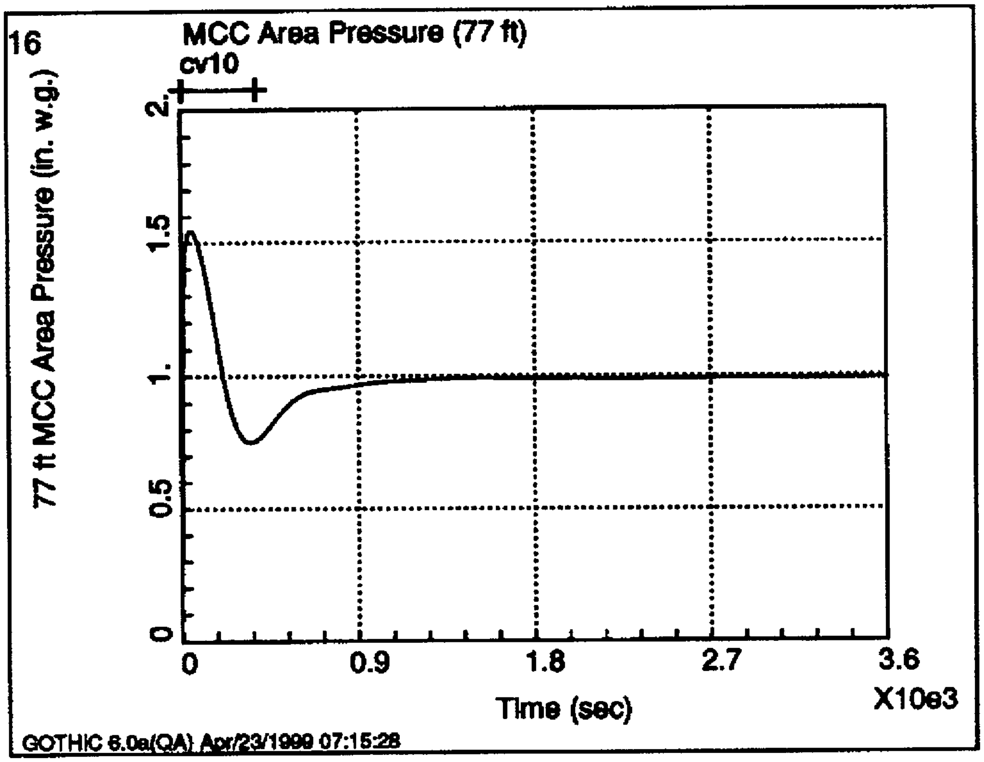

Reactor Building Exhaust Rate (LOCA Case A - Winter)
May/03/1999 13:10:57
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